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EXECUTIVE SUMMARY

Van Cortlandt Park is the fourth largest park in New York City and contains some of the largest remaining tracts of natural area in the region. Among its 1,146 acres are 681 acres of forests with tremendous diversity and a rare, 89-acre urban freshwater wetland. The park has a wealth of vernal pools, streams, and seeps. It is one of the rare urban natural areas with interior forest habitat and natural regeneration of a diversity of native trees, shrubs, and herbs, including several spring ephemerals. It has been designated an Important Bird Area by the National Audubon Society, and its habitats support at least four bird species on the Audubon Watch List.

Van Cortlandt Park is also a critical part of the city’s green infrastructure, providing an array of ecological services and opportunities for recreation. Healthy ecosystems can cool peak summer temperatures, absorb and filter stormwater, purify drinking water, absorb air pollution, release oxygen, store carbon in vegetation and soils, and support biodiversity, as well as allow city residents respite from the stresses of urban living. Unfortunately, land development and population growth have destroyed, fragmented, and degraded our natural areas, making them less resilient and increasing their exposure to ongoing pressures. Meanwhile, those pressures are intensifying as the population of New York City continues to grow. For these reasons, ongoing management is needed to retain the vital services and benefits the city’s natural areas can provide. With proper management, Van Cortlandt Park is a place where the urban forest still has a chance to thrive in New York City.

Insufficient resources from the mid-1960s through the 1980s caused a lapse in park maintenance and management, especially of the natural areas. As a result, human impacts increased, resource quality declined, invasive plants degraded ecosystem integrity, and the park’s ability to provide New Yorkers with critical services diminished.

A management plan for Van Cortlandt Park was produced in 1990 based on vegetation assessments, but its recommended strategies were never fully funded or implemented. In late 2006, due to the conversion of 35 acres of parkland and the resulting removal of some 300 large trees for the construction of a water filtration plant inside the park boundary, funding was provided by the New York City Department of Environmental Protection for the creation of the Croton Forest Management Program. This funding has been vital to both the continuation and expansion of efforts to improve the health and function of the park’s natural areas. The Croton program has also offered an invaluable opportunity to create an updated and comprehensive plan for their management.

As a first step in writing this plan, the entire park was reassessed to obtain information about how its natural areas have changed since the early 1990s. Analysis revealed that the total area of closed forest increased while woodland and herbaceous areas decreased during the 20 years between evaluations, indicating that the forests have matured. However, a number of negative trends also became apparent. For example, the acreage of vineland and the presence and dominance of the invasive Norway maple increased.
throughout the park. Other invasive species, such as garlic mustard and mile-a-minute vine, arrived and have been spreading rapidly.

This plan presents a vision statement for the park’s natural areas. Because a pragmatic strategy is required if Van Cortlandt Park is to emerge from a history of insufficient finances, lack of maintenance, and little public involvement, the plan takes a holistic approach to natural area management based on a three-part bottom line combining ecological, economic, and social sustainability.

More than 50 recommendations covering a diverse range of management functions are included in the plan. Chief among these is the zoning of the park’s natural areas. Another key recommendation is the formation of a dedicated landscape management team to replace the current Croton project-funded staff when the program ends.

The plan provides a bridge from the Croton program into the future. However, funding from the program will not be sufficient for full implementation of the plan’s recommendations throughout the park’s extensive natural acreage. Follow-up funding will be required to complete the task, and for ongoing management.

Van Cortlandt Park is an outstanding feature of the regional landscape, conserving a significant portion of the city’s biodiversity and providing important ecological services that support human life and health. Yet it is confronted with formidable threats that have undermined it in fundamental ways over a period of decades. Only active conservation, careful restoration, and ongoing maintenance and monitoring can preserve this treasure of the Bronx, and ensure that it is available for future generations to enjoy and capable of providing the services the city requires.
List of Recommendations

Zoning:

- To increase efficiency, divide the park into core and intermediate natural areas subdivided into management zones.

Forest Management:

- Undertake a forest inventory and mapping study to obtain a pool of valuable quantitative information to inform planning and management, such as species composition, species distribution, forest stature, woody biomass/volume, and tree condition. Since no quantitative forest inventory has ever been done for the park’s forests, it would provide important baseline information. This information could also be used to make projections into the future, to determine growth and dynamics, and to provide information for fundraising and partnerships. It would supplement the entitation survey and research studies and could be used for mapping and spatial planning. The study could be done as a partnership with local or regional research institutions.
- Manage for multi-age, multi-story (stratified) native forests.
- A full forest restoration regimen should include systematic removal of invasive plants by repeated mechanical removal, slash management, and herbicide treatments, followed by complete replanting with appropriate native herbs, grasses, shrubs, and trees. Planting native flora from local seed sources diversifies forest structure, strengthens ecosystem function, and fortifies genetic health. Planting also supplements or replaces natural regeneration where it is insufficient for the long-term sustainability of the forest, and gives native plant species a leg up on faster-growing invasives. For best results, vegetative management should continue within planted sites for at least two years to fully treat invasive plants re-sprouting from the roots and those emerging from the soil seed bank.
- Monitor regeneration within the forest core to determine the trajectory of forest health.

Meadow Management:

- Adopt a meadow management policy and plan for the park.
- Establish and maintain a wet meadow in the area behind the Van Cortlandt pool, across the path from the existing wet meadow, and an upland meadow along the Shandler Recreation Area road.
- Choose meadow over lawn for open space whenever turf is not necessary. This would also ease demand on limited maintenance resources.
- Consider limiting meadows to sites that volunteer groups are willing and able to regularly maintain, and that have a slope no greater than 15 percent.
- Remove *Phragmites* and replant with appropriate meadow species.
General Vegetation Management:

- Continue the current strategy of planting park natives only but re-evaluate this policy if new knowledge, such as from soil or climate data, indicates a need to shift to differently adapted species. Construction of a general decision-making model would be helpful for guiding overall planting policy. Factors including climate change, soil properties, native status, wildlife value, aesthetic value, occurrence at the site, historic range, and allelopathy should be included in this model.
- Use chemical herbicides as part of a broader integrated pest management (IPM) strategy to control invasive plants to minimize harmful impacts to surrounding native plants, wildlife, and the public. It is agency policy to use only trained and licensed applicators and appropriate protective gear. Impacts are further minimized by New York City law, which holds city agencies to a stricter standard than that prescribed by the New York State Department of Environmental Conservation, the regulatory authority.
- To build upon the results attained under the Croton Forest Management Program, establish a landscape management team that would be responsible for overall natural areas and soil management, including forest restoration. This group would also do storm response work and scientific monitoring.
- Establish close working relationships between the landscape management team and the maintenance and operations unit of the park. Forest restoration and meadow and wetland management are all operations functions, albeit requiring specialized skills. They are operations functions because they maintain areas that supply services to patrons. In the interest of institutional efficiency and effectiveness, these more technical staff should work closely with the park’s operations staff.
- Establish clear lines of communication and close working relationships with the land managers of nearby natural areas, such as Tibbetts Brook Park in Yonkers, and of natural areas within the park that fall under other jurisdictions, such as Department of Environmental Protection (DEP) Tunnel #3 and both golf courses.

Invasive Plants:

- Adopt a concerted, region-wide approach to invasive species management by establishing an interagency group on invasive species management and control. This group should include representatives from Woodlawn Cemetery, the golf course administrations, the New York City Departments of Environmental Protection and Transportation, the citywide and Van Cortlandt Park nurseries, the Natural Resources Group, and the Friends of Van Cortlandt Park.
- Stay current with invasive species management techniques through scientific literature and by attending related conferences.
- Create a corps of trained volunteers who can recognize and manually remove invasive species without direct supervision.
Area Protection:

- Continue long-term efforts to install and place guardrails, bollards, and rock boulders to prevent encroachment in the park, including illegal parking and ATV use and dumping of garbage.
- Conduct surveys to provide a clear demarcation of the boundary with the City Yonkers.
- Continue collaboration with Yonkers authorities on signage, public education, and enforcement and protection along the park’s northern boundary. Involve the DEP in deterrence, surveillance, and enforcement efforts.
- Install signage prohibiting dumping and encroachment along the borders of the natural areas.
- Engage the community to encourage support for protection efforts and for work that has the potential to affect the park’s boundary areas.
- Work with Parks enforcement to increase patrol personnel and frequency in the core natural area and along park borders. Install cameras to enhance surveillance and deterrence.
- Develop an enforcement plan and recruit dedicated enforcement personnel for the park.

Soil:

- Use the information from the New York City soil survey and mapping to determine actions and strategies necessary to manage the soils of Van Cortlandt Park.
- Stabilize soil with cribbing, water bars, and other appropriate methods wherever needed.
- Adopt a policy of facilitating natural nutrient cycling in forests and other natural areas wherever appropriate. Provided it does not create a safety hazard or an overabundance of fuel for fire, allow dead wood, leaves, and other organic matter to accumulate for decomposition and recycling of nutrients.
- In areas with bare soil, apply wood chips or pruned wood strategically whenever feasible to retard erosion and encourage organic soil formation.
- Use site preparation and planting as opportunities to improve soil through the addition of topsoil, compost, and mulch.
- Encourage studies of the biology of the park’s soils.

Wildlife and Biodiversity:

- Provide habitat, food, and cover for desirable wildlife whenever possible.
- Consider potential impacts on wildlife when making decisions about and undertaking work in natural areas. For example, all silvicultural and forest restoration work should consider the impact on wildlife. As much as possible, actions that cause the greatest benefit or least harm to wildlife should be chosen, bearing in mind the need for public safety.
• Consider the impact on wildlife when selecting and planting species in the park.
• Once major infestations of invasive plants are eliminated, reduce the use of herbicides for the mostly routine maintenance work that subsequently will be required in the natural areas.
• Use citizen science as a means of conducting wildlife inventories and increasing public interest in the park’s natural areas.

Public Awareness and Involvement:

• Actively encourage public awareness and participation to increase support for and involvement in natural areas management. A range of involvement should be pursued, including volunteering and donating. In particular, local community groups should be engaged in volunteer forest restoration, trail maintenance, and litter cleanup.
• In addition to community volunteers, develop a corps of trained natural areas stewards to empower concerned citizens to become substantively involved in reclaiming and maintaining the health of the park’s natural areas.
• Create a staff position to coordinate educational and volunteer activities in the park. This person should have a background in environmental education and be skilled in communication.
• Develop a photographic archive that includes images of the natural areas in the different seasons and different stages of succession, and in their pre- and post-restoration states for use in informing and engaging the public. This archive would also be useful to restoration practitioners.

Land Use and Visitation:

• Appoint the Park Administrator and Natural Areas Manager as the decision makers for issues relating to land within and adjacent to the park.
• Encourage a movement towards long-term regional planning as a way to promote benign development around the park.
• Conduct demographic and economic studies of the park’s natural areas to gain information helpful for management and strategic planning. Studies should include users and assess perceptions of the different natural areas of the park as well as willingness-to-pay options.
• Enforce the permit requirement for all picnicking in or adjacent to natural areas. Monitor picnicking in natural areas for impact on habitat, including soil, herbaceous vegetation, and trees. In the long run, discourage picnicking in natural areas.

Aesthetics:

• Consider potential aesthetic impacts when making decisions that could affect the natural areas experience.
Trails and Roads:

- Include nature trails in the core as an integral part of natural areas management.
- Map and measure the length and condition of all park trails using Geographic Information System technology.
- Conduct a feasibility study of the current number and mileage of sanctioned and non-sanctioned trails in the park to determine their appropriateness and whether some trails could be closed to reduce disturbance to the core forest areas.
- Use the study of trails undertaken by the Friends of Van Cortlandt Park in 2009 to help with trail assessment.
- Assess the net impact of three highways running through the park. As part of long-term park planning, evaluate the benefits versus the drawbacks of closing one or both of the sections of the Henry Hudson and Mosholu Parkways that run through and interconnect in Van Cortlandt Park.

Emergency Response:

- Develop a storm preparedness and response strategy for the park that incorporates some of the lessons learned from recent storms.
- Develop a fire prevention and management strategy for the park jointly with the Fire Department that includes development of prevention, detection, and suppression strategies.

Research and Monitoring:

- Establish Permanent Sample Plots (PSPs) in the park and continue plot monitoring to gain information on the history, composition, and dynamics of the park’s forests. Encourage use of the PSPs by third parties and Parks as a resource for measuring long-term vegetation change.
- Convene a symposium on research opportunities to help promote research in Van Cortlandt Park.
- Encourage research on urban forests, human interactions with green infrastructure in large cities, and long-term invasive plant management.
- Promote or conduct research on gap dynamics and regeneration as a key to understanding the forces driving maintenance and regeneration of the forest.
- Encourage efforts to compile data on Lepidoptera (butterflies and moths) that have been collected by members of the New York Butterfly Club, and avian information from the park’s birders, as well as other local experts.
- Cultivate a culture of measurement, monitoring, and assessment to attain a high standard of science-based natural resources management.
VISION, GOAL, AND STRATEGY

This management plan envisions Van Cortlandt Park’s natural areas as a biologically diverse and ecologically functional landscape of native forests, wetlands, and meadows that provide multiple ecosystem services and human amenities on a regional scale.

The goal of the plan is to produce an agenda of policies and actions to guide management, staff, the public, and benefactors towards realizing the vision for this urban landscape.

The overall strategy is a three-part bottom line approach combining:

**Active management**
Urban natural areas exist within a physical, human, and economic environment that constrains their ecological function and ability to provide ecosystem services indefinitely. Ecological functions are the natural processes that maintain a healthy ecosystem; ecological services are the benefits, especially to humans, derived from ecological functions, such as clean air and clean water. Active and regular management intervention is needed to sustain these essential services. Size, fragmentation, disturbance, and biological invasion are major factors constraining sustainable, healthy ecosystems.

Increasing the size of Van Cortlandt Park’s natural areas is virtually impossible at present, but their ecological sustainability can be enhanced. This can be done in part by limiting fragmentation, selecting appropriate land uses for these areas, and conserving their considerable biodiversity. Key to the latter is the removal of the invasive species that threaten the biodiversity of the park’s natural areas and therefore their resilience—their capacity to persist and absorb change. The greater the number of local species and individuals of these species, the greater the chance that some will evolve and persist in the face of change, including climate change, and continue to provide essential ecosystem services.

**Strategic funding**
Sustainability in urban areas requires more than ecological soundness. Sustainable urban natural areas require healthy financial support for their necessary ongoing maintenance. An important corollary is that all management actions must demonstrate a positive return on investment.

To guarantee sustainability, another paradigm shift is also necessary—building sustainability into project plans. Project plans must include a plan for sustainability well into the future.

**Public participation**
Van Cortlandt Park’s users give meaning and expression to its value. Users benefit from the many goods and services provided by the park and its natural areas. At the same
time, their activities have an impact on the park’s natural systems. The long-term goal of the integrity and viability of Van Cortlandt Park and its natural areas requires an aware, involved, and supportive public. Management should inform, involve, and encourage the tangible support of the public in realizing this goal.
OVERVIEW

Park History

Human habitation of Van Cortlandt Park began about 8,000 years ago when the *Wiechquaeskeck*, a group of the Lenape people, settled in the area. Artifacts suggest that they hunted in the wooded areas, fished in Tibbetts Brook and its marshes, farmed on the Parade Ground and Indian Field, and foraged in the park’s forests and meadows for nuts, fruits, and other edible plants.

In 1639, Europeans brought in by the Dutch East India Company settled in the Bronx. The company sold part of what is now Van Cortlandt Park to Dutchman Adriaen Van Der Donck in 1646. The land changed hands several times before English merchant Frederick Philipse purchased it in 1693.

In 1698, Philipse’s daughter married Jacobus Van Cortlandt, who bought an additional 76.5 acres of land encompassing the site where the Van Cortlandt House now stands. At the time, Tibbetts Brook flowed into a vast salt marsh below the slope where the Van Cortlandt House was built. The 16-acre Van Cortlandt Lake, today the largest freshwater body in the Bronx, was formed when Jacobus dammed Tibbetts Brook in 1699 to power two mills, altering the hydrology of the landscape. Over a 38-year period, he systematically purchased the entire land area of the present-day park, developing it into a grain-growing and milling operation. By the 1750s, more than a thousand people were living on the property, farming the land and clearing forests to support the demand for lumber. Jacobus’ son, Frederick Van Cortlandt, inherited his father’s estate, and the family continued farming on the land until donating it to New York City in 1888.

Capital Projects

Civil engineering projects during the 19th century had a major impact on the landscape, including the building of a water conduit, railroad lines, highways, and golf courses. Construction of the 41-mile, gravity-fed Croton Aqueduct commenced in 1837. The aqueduct opened in 1842, bringing clean water from the upstate Croton Reservoir through Westchester County and Van Cortlandt Park to the city’s growing population of 330,000. It was replaced by the New Croton Aqueduct, which began service in 1890. The Old Croton Aqueduct was added to the National Register of Historic Places in 1974 and today is a 1.1-mile walking trail that provides access to nature and history in the Croton Woods.

The Putnam Railroad was completed in 1880. A northwest spur of this line to Getty Square in Yonkers ran through the park. Passenger service on the line ceased in 1958, but it carried occasional freight until 1981. Today, the abandoned railroad is a 1.5-mile trail through the park used for walking, jogging, and biking. It runs along the western edge of the Croton Woods and the eastern edge of Tibbetts Brook and continues through Yonkers as an asphalt bike path. The trail serves as a wildlife corridor from Westchester south to the Van Cortlandt Golf Course.
Other construction projects had a major impact on the forest. The Van Cortlandt Golf Course, the nation’s earliest municipal course, was completed in 1895, replacing a large section of what was once mesic hardwood forest, and in the 1950s nearly 7 acres of marshland were filled to reconstruct part of the course lost to the Major Deegan Expressway route. A second golf course, the Moshulu, opened in 1914.

The most significant impacts on the park’s ecosystems, however, resulted from the construction of the Moshulu Parkway and the Major Deegan Expressway, which transformed forest and wetland into asphalt and fragmented the surrounding natural areas. The highways also disrupted the hydrology of these areas, degraded wildlife habitat, and facilitated the dumping of solid wastes in the park. The Moshulu Parkway, which interchanges in the park with the Major Deegan Expressway and the Henry Hudson-Saw Mill River Parkway, was constructed from 1935 to 1937. Jurisdiction over these highways is shared between the New York City Department of Transportation (DOT) and New York City Parks & Recreation. According to the New York State DOT, the 3-mile-long Moshulu Parkway carries approximately 35,000 vehicles per day.

**Park Planning and Land Use Change**

In the late 19th century, newspaperman John Mullaly helped form the New York Park Association, which advocated for more parkland in the Bronx. In 1892, a Bronx parks system was created as part of a “Mullaly plan.” It added 4,000 acres of parkland at Van Cortlandt, Pelham Bay, Claremont, and Crotona Parks, and land was purchased for the Moshulu and Pelham Parkways.

The city subsequently developed sections of Van Cortlandt Park, and formalized a trail system to increase access to wild areas. The Parade Ground was not accessible to the public until much later, as it was used as a training ground for a National Guard squadron. The nationally renowned Cross Country Trail that courses through the woodlands and around part of the Parade Ground was created in the 1910s and reconstructed in 1997.

**Fiscal Crisis and Focus on Natural Areas and Administration**

The New York City fiscal crisis of the 1970s was a major setback for the park, as maintenance was slashed. The following decade saw some positive system-wide improvements, however. In the 1980s the city became the first in the country to outsource by opening programs and concessions to competitive bidding, which brought in much-needed revenue. The Van Cortlandt Lake system, from the lower basin north to the city line, was classified a Class I State Protected Wetland by the New York State Department of Environmental Conservation (NYS DEC) in 1980. In 1983, a joint Administrator's Office to oversee all aspects of the operations and management of Van Cortlandt and Pelham Bay Parks was established. In 1984, the Natural Resources Group (NRG) was created to address the need for a more comprehensive approach to natural resource management citywide, elevating the profile of natural areas and highlighting the need to manage them.
The now-defunct Urban Forest and Education Program was launched in Van Cortlandt Park in 1992 to promote forest management and environmental education. The same year, the Friends of Van Cortlandt Park was founded to promote youth and public participation in the park and raise funds for environmental education, renovation projects, and special programs, including trail maintenance and forest restoration.

The Forever Wild Program was created in 2001 to draw attention to the city’s ecosystems. The program designates areas of significant ecological value within a formal preserve network. More than half of Van Cortlandt Park is designated a Forever Wild preserve.

A Henry Hudson Parkway Scenic Byway Task Force was formed in 2001 with the aim of promoting the designation of the Henry Hudson Parkway, from its origin in Van Cortlandt Park to Manhattan, as a Scenic Byway. In 2004, the New York Metropolitan Transportation Council agreed to fund and oversee the development of a comprehensive corridor management plan for the parkway. Designation as a Scenic Byway would allow for federal and other sources of funding to maintain the corridor.

In 2006, the first administrator and staff dedicated solely to Van Cortlandt Park were appointed.

Croton Water Filtration Plant and Launch of the Conservancy
In 1993, the New York State Department of Health and the U.S. Environmental Protection Agency ordered the City of New York to filter the water from the Croton Reservoir, one of the city’s three water sources. In 2005 the city’s Department of Environmental Protection (DEP) began constructing a water treatment plant under the Mosholu Golf Course. As mitigation for this disturbance and loss of parkland, the DEP provided $243 million for park improvements in the Bronx, including $13 million for a forest management program and institutional support for native plant propagation. Called the Croton Forest Management Program, it commenced in 2006.

A major evolution in the institutional structure of the park occurred in 2009 with the launch of the not-for-profit Van Cortlandt Park Conservancy, with an independent board of directors. The Conservancy was founded to assist NYC Parks & Recreation with promoting the park’s events and features, and to advance public awareness of the park.

Previous Planning Initiatives
Prior to this document, two management plans covering natural areas were developed for Van Cortlandt Park. The first was the 1990 Natural Areas Management Plan developed by the NRG. The second, the Management Plan for the Croton Woods, was developed in 1996 in part to evaluate an initial proposal to locate the Croton water filtration plant in the Croton Woods.

Drawing significantly from the results of a 1989 natural areas survey, the 1990 management plan provides a fairly comprehensive inventory and diagnosis of the state of the park’s natural areas. It includes extensive mapping, and contains a number of recommendations, many of which are still important today. A list of these
recommendations is in Appendix F. The analyses and recommendations in this document are based in part on the 1990 plan.

The 1996 Management Plan for the Croton Woods was based on field studies and rapid assessments made by a student group from the Yale School of Forestry and Environmental Studies. It includes a number of tables containing data collected from these field studies and identifies five goals and specific recommended actions for each. A list of these recommendations can be found in Appendix G.

Other planning initiatives for the park, such as a master plan and a number of operationally focused plans, will likely be developed over time. It is expected that these plans will complement each other in appropriate ways. Although the park master plan will be overarching, ideally it will incorporate many of the suggestions offered here.

**Natural History**

Van Cortlandt Park’s 1,146 acres consist of rocky ridges, plains, and valleys. The park supports three ecosystem types: meadow, freshwater wetland, and forest, the latter of which covers more than half the landscape, in addition to the underlying soil ecosystem. A diverse array of plants and animals inhabit the park, including many that are rare citywide. Native plant species include 50 trees, 37 shrubs, more than 12 vines, 167 herbs, 37 grasses and sedges, and 16 non-flowering plants. Forty-nine species of fungi have been recorded. Van Cortlandt Park is also an important habitat for resident and migratory wildlife, which are described below. A summary of the park’s soil types also follows. The park’s vegetation types are covered in detail in the Recommendations section.

**Geology**  
(by Sidney Horenstein of the American Museum of Natural History and the Bronx County Historical Society)

Van Cortlandt Park is located in the New England Upland physiographic province, part of the Appalachian Highlands region. Three of New York City’s rock formations are found in Van Cortlandt Park: the Fordham Gneiss, Yonkers Gneiss, and Inwood Marble.

The Fordham Gneiss is the most widespread rock formation in the park. Formed from layers of sediment and several lava flows, it is over a billion years old, making it the oldest of New York City’s bedrock types. Although found in other parts of the city, it is best exposed in Van Cortlandt Park, along the Cass Gallagher Trail in the Northwest Forest and at Vault Hill. It is also a component of the Fordham ridge, the eastern ridge adjacent to Tibbetts Brook valley in the Croton Woods.

The Yonkers Gneiss is located in the northeast part of the park along the axis of the Major Deegan Expressway. Although its exact age and origin are still uncertain, it is believed to have originated from lava that erupted out of fractures on the sea floor about 560 million years ago.
The Inwood Marble is found below the Tibbetts Brook wetland and the Van Cortlandt House. It formed as limestone in a shallow sea on the edge of ancestral North America, but later was deeply buried and transformed into marble by heat and pressure as a result of continental collision.

Many light-colored intrusions of pegmatite and granite invaded the bedrock as molten material. A good place to observe one is at the base of the western side of Vault Hill. Fractures (cracks that have not moved) can be seen in some sections of the Northwest Forest. Most faults (fractures that have movement) in the park are small, but the large Mosholou Fault, one of the largest in the city, enters Van Cortlandt Park on the southeast, cuts across Tibbetts Brook valley, forms part of the Parade Ground, and runs northwestward, forming the lower terrain between Broadway and the Northwest Forest. The structure of the rocks and their distribution give the park its north-south orientation, which is also reflected to some degree in the highways that run through it.

Glaciers played a big role in shaping the topography of New York City. Little is known about the earlier glaciations, but about 21,500 years ago the last ice sheet reached the park and profoundly modified the terrain. When the ice thawed, the receding glacier and its melting floodwaters tore into the land, fashioning today’s landscape. Glacial deposits of sand and gravel are common in the valley of Tibbetts Brook and some of the hilltops and slopes of the northwestern part of the park. Here and there are rocks and boulders left by the glaciers. Some of the boulders are either very local or from Westchester, but the dark gray or brown boulders without banding are Palisades diabase, a tough rock that withstood long-distance dragging by the ice.

Studies of adjacent areas show that when the glacier receded, the predominant vegetation was tundra. As the climate warmed, this was replaced by boreal-type coniferous forests, which were in turn succeeded by the current deciduous forest about 6,500 years ago.

**Topography and Hydrology**

Van Cortlandt Park has an overall rolling topography with two drainage inclines. There is an overall north-south drainage incline, except where interrupted by highways, and there is also sloping towards the course of Tibbetts Brook. The highest elevation, 246 feet, is in the northeast part of the park, and some slopes are as much as 30 percent. The lowest point, approximately 10 feet below mean sea level, is in the marshy area behind the Van Cortlandt House.

Tibbetts Brook, with a total course of more than 3 miles, originates in northern Yonkers and flows south along the Sawmill River Parkway and into Van Cortlandt Park, where it becomes the lake formed by damming years ago. The lake flows underground, feeding into the municipal sewer system. In 1877 the lake had a total surface water area of approximately 38 acres. Today, as a result of sedimentation, it covers 15 acres, and the rest of the original lake basin has become a freshwater wetland. A recommended plan for restoration of the lake was submitted in 1986 but never implemented.
Other threats to the freshwater stream and wetland include agrochemical pollution from the golf courses and polluted runoff from the highways. The highways have also had other disruptive effects on the hydrology of the watershed. Construction of the Henry Hudson Parkway in the 1930s and the Major Deegan Expressway in the 1950s contributed in a large way to the siltation and loss of wetlands associated with the lake. Stormwater runoff from the southern portion of the Major Deegan Expressway, the Mosholu Parkway Extension, and part of the Van Cortlandt Golf Course drain into Van Cortlandt Lake through three direct pipe outfalls and one indirect outlet into a tributary stream. Activity well outside the park also has an impact: Only 38 percent of the present 2,293-acre watershed is entirely in Van Cortlandt Park, while 62 percent is in Yonkers—an indication of how critical cooperation across political boundaries is.

**Climate**

Van Cortlandt Park has a temperate climate, with warm, humid summers and frequent thunderstorms, and mild winters. The nearest weather station is 4 kilometers northeast of the park, at Beech Hill, Scarsdale. The nearest weather station in New York City is in Central Park. The weather at Van Cortlandt Park is assumed to be somewhere between those of the two stations.

The coldest period is from December to February, with average daily temperatures of 31.2° Fahrenheit (F) (Scarsdale) and 34.9° F (Central Park). The average minimum daily temperature is 24.1° F (Scarsdale) and 30.2° F (Central Park). The lowest temperature recorded at these two stations was -14° F and -15° F, respectively, both in February. The warmest period is from June to August, with daily averages of 71.9° F (Scarsdale) and 74.7° F (Central Park). The highest temperature recorded was 104° F (Central Park) and 102° F (Scarsdale), both in July.

Average annual precipitation is 45.3 inches (Scarsdale) and 49.51 inches (Central Park). In Scarsdale, the wettest months are March to May, November, and January (with an average of 4.0 inches); in Central Park, March to May, July to September, November, and January (average 4.3 inches). The highest daily rainfall recorded was 5.2 inches in Scarsdale in August, and 8.3 inches in Central Park in September.

The driest non-freezing months are June and October in Scarsdale, with 0.2 inch and 0.1 inch of precipitation, respectively. Thunderstorms occur on average 15 days per year, mostly in July. The average annual snowfall is 30.2 inches in Scarsdale, and 22.2 inches in Central Park.

Average relative humidity is 66 percent, ranging from 55 percent in mid-afternoon to 72 percent at dawn in Central Park. Annual possible sunshine is 58 percent, peaking at 64.3 percent during June to August, and lowest at 50.6 percent during November to January in Central Park. The prevailing wind is from the west, averaging 9.3 miles per hour. Winds are strongest during December to April (10.6 miles per hour), and peak in March at 11 miles per hour in Central Park.
**Demography**

The economically and culturally diverse population residing in the nine communities bordering Van Cortlandt Park is comprised of mostly Latinos, Caucasians, and African Americans, in that order. The west side includes the upper-middle-class residential neighborhoods of Riverdale and Moshulu and the middle-class neighborhoods of Kingsbridge and Norwood. To the south are the lower-middle-class neighborhoods of Van Cortlandt Village and Norwood. To the east are Woodlawn Cemetery and the middle-class neighborhoods of Woodlawn and Williamsbridge. To the northwest is the economically depressed section of southwest Yonkers.

Data from the 2010 census indicates that the Bronx had an overall population of 1,385,308, and Yonkers City, 195,976. The 2010 census data was not available by zip code at the time this document was written, but the 2000 census indicates that over 650,000 people lived in the neighborhoods surrounding the park—473,855 in the nine Bronx communities and 176,600 in the five Yonkers communities. These are not as affluent as many other communities in New York City or Westchester County, with an average median household income of $36,323 for the former and $44,319 for the latter. Highest average household income exceeded $50,000 in the communities of Riverdale ($56,488), Yonkers zip code 10710 ($55,323), and Yonkers zip code 10704 ($54,602). Lowest average household incomes, below $30,000, were along Moshulu Parkway ($22,072), in Bedford Park ($26,852), and in Norwood ($29,044), all south of the park in the Bronx.

Ethnically, the Yonkers communities are 53 percent white, 25 percent Latino, 15 percent black, and 6 percent Asian, while the Bronx communities are mainly Latino of any race (34 percent), white (33 percent), black (28 percent), or Asian (5 percent).

A 1986-87 user survey by the City University of New York showed that Van Cortlandt Park was the fourth most popular Bronx park (after Pelham Bay Park, the Bronx Zoo, and The New York Botanical Garden) and that one-third of Bronx adults had visited the park at least once during the previous year. Most traveled to the park by car (55 percent), on foot (20 percent), via subway (11 percent), by bus (8 percent), or by taxi (3 percent). The high number of drivers was skewed by the many golf course patrons, but also included other park users.

The survey showed that while there was wide variation in the age of users in different areas of the park, overall most (30 percent) were older adults (55 or older), while 18 percent were young adults (under 25). This is surprising for a park that has such a large Parade Ground, the Cross Country Trail, and sporting facilities and suggests that there is an opportunity to attract more young people. A remarkable 25 to 30 percent of users had college degrees, a large group of potential advocates for the park’s natural areas.

Pool users had the lowest and Indian Field visitors the highest incomes. Finally, on the day of the interview “relax” (68 percent) and “walk in the park” (38 percent) were the most common visitor activities. Although the study did not look specifically at natural
area-related activities, it is reasonable to assume that some of those visitors are also potential users of these areas.

**Soils**
(by Richard Shaw of the U.S. Department of Agriculture Natural Resources Conservation Service)

Soil is defined as the unconsolidated material at the surface of the Earth, composed of mineral (from rocks) and organic (from animals, plants, and microbes) material that serves as a growth medium for plants. Through infiltration of runoff, soil also plays an important role in the management of stormwater and non-point source pollutants, particularly in areas without sewers. Soils adsorb and filter contaminants, and store and cycle carbon and nutrients.

Soil consists of a series of layers formed from soil-forming processes over time. Each of these layers, or horizons, has particular physical and chemical properties that influence what type of vegetation can grow there, and the soil’s ability to absorb stormwater and reduce runoff.

Glaciers had a profound influence on not only New York City’s landforms but also its soils. The material they deposited has served as the basis for soil formation. Glacial deposits vary in type: Glacial till is the unsorted and unstratified (not deposited in layers) material dropped by the ice, and glacial outwash refers to the sorted and stratified meltwater deposits. In some areas till deposits can be tens of feet thick. In places where the bedrock is a more resistant rock type, they can be quite thin.

Because the ice sheet receded from the city about 18,000 years ago, there has been relatively little time for soil formation. The processes of soil formation have altered a 2- to 3-foot-thick zone of soil, or solum. Addition of decaying plant material at the surface has resulted in a dark, organic-enriched topsoil mineral layer, or A horizon, with good granular aggregation, or structure. In some areas enough material has accumulated for a thin organic layer, or O horizon, above the A. In the subsoil, or B horizon, iron oxides from the decomposition of hornblende and magnetite impart a bright brown to yellowish brown color. Subangular blocky aggregation is common in the subsoil, and the process of clay movement into the B horizon from the zone above is just beginning. The substratum layer, or C horizon, the zone below the realm of the soil-forming processes, is a paler brown color and can be sandier in texture. It lacks the development of any color or aggregation.

The U.S. Department of Agriculture’s Natural Resource Conservation Service (USDA NRCS) conducted a citywide soil survey at a scale of 1:12000, and updated an earlier soil map for Van Cortlandt Park (see Figure 1 and Appendix D). Soils that formed in human-transported materials, or fill, are differentiated from those formed in naturally deposited materials such as glacial till, outwash, alluvium, and organic matter. Most soils were mapped to the series level, the lowest (most specific) category or level of classification in soil taxonomy.
Figure 1. Soil Map of Van Cortlandt Park. For descriptions of the soil units, see Appendix D.
Soils within a series have a similar sequence of horizons, are formed in the same parent material by a comparable climate, and support similar vegetation.

Almost 50 percent of Van Cortlandt Park is covered in glacial till. The western ridge and Northwest Forest have a shallow mantle of till where outcrops of the Fordham Gneiss bedrock are common. Three soil series, differentiated by depth to bedrock, are found in the upland areas of the western ridge: Charlton, Chatfield, and Hollis. Because extensive surveying by the USDA with ground-penetrating radar indicated that great variability in depth to bedrock is common over small distances, these soils were generally mapped together in a complex. Below is an overview of the park’s soils. For more information, see Appendix D.

Deep-to-bedrock Charlton soils (coarse-loamy, mixed, active, mesic Typic Dystrudepts) are generally sandy loam or loam textural class: A typical particle size distribution, or texture, for the park’s soils is 55 percent sand, 35 percent silt, and 10 percent clay. Coarse fragments, from gravel to boulder size, can range to almost 40 percent of the volume in Charlton soils, and surface stoniness can be common. The soil is generally nutrient poor, with pH values that can range from extremely to strongly acid (from 3.5 to 5.5). The substratum generally lacks the firm and dense consistency that can be found in many other till soils.

Chatfield (20 to 40 inch to bedrock; coarse-loamy, mixed, superactive, mesic Typic Dystrudepts) and Hollis (10 to 20 inch to bedrock; loamy, mixed, active, mesic Lithic Dystrudepts) are the shallower analogues of Charlton. They have much the same properties, only with a layer of hard bedrock visible in the profile. In general, areas with steeper slopes (greater than 35 percent) and higher amounts of bedrock outcrop have shallower soils.

The eastern ridge of the park (including the Croton Woods and Northeast Forest) generally has a deeper mantle of till over the bedrock. Some Paxton (coarse-loamy, mixed, active, mesic Oxyaquic Dystrudepts) soils are found in addition to Charlton on the eastern ridge. Paxton is a deep till soil similar to Charlton except the substratum is firm, dense lodgment or basal till. A perched water table above the substratum is common in late winter and early spring, and following periods of extended rainfall.

Wet soils are found in the small depressions along drainage ways in the till. Generally, these lower areas have slightly finer textures than the well drained, due to the re-deposition and accumulation of eroded silt- and, to a lesser extent, clay-sized particles. A silt loam textural class (more than 50 percent silt) is common, especially in the wetter locations. Prolonged saturation during the growing season results in the depletion of oxygen by plants and microorganisms in these soils. This lack of oxygen hinders the decomposition of vegetative matter, and results in the transformation of several elements, including iron, from the oxidized to the reduced chemical forms. Iron is one of the most important coloring agents in soil. Oxidized, or ferric (Fe+3), iron compounds are responsible for the brown, yellow, and red colors in soil. When iron is reduced to the ferrous (Fe+2) form, it becomes mobile, and can be removed from certain areas of the
soil, leaving a gray color. Upon aeration, reduced iron can be re-oxidized and re-deposited, sometimes in the same horizon, resulting in a variegated or mottled color pattern. These soil color patterns are used to indicate the duration of the anaerobic state and the depth to the seasonal high water table. Wet soils in the till areas include Woodbridge (coarse-loamy, mixed, active, mesic Aquic Dystrudepts), the moderately well drained associate of Paxton, which also has a firm substratum. The depth to the high water table in these soils is between 18 to 36 inches during the growing season. The siltier (and wetter) soils include the somewhat poorly drained Tonawanda (coarse-silty, mixed, active, nonacid, mesic Aeric Endoaquepts), with gray coloration and a high water table at 6 to 18 inches, and the poorly drained Siwanoy (coarse-silty, mixed, active, mesic Humic Endoaquepts), with gray coloration and a high water table at 0 to 6 inches. The latter is a hydric soil. In general, the wetter soils are not as acid as the better drained ones, with pH values ranging from very strongly to slightly acid (4.5 to 6.5).

Glacial outwash deposits are found in the outer portion of the Tibbetts Brook Valley. The well drained Riverhead soils (coarse-loamy, mixed, active, mesic Typic Dystrudepts) and the moderately well drained and somewhat poorly drained Pompton soils have sandy loam textures and generally coarser stratified material at depth. The well drained Flatbush soils are found where a thin layer (less than 40 inches) of fill has been placed over the outwash.

The inner portion of the valley is comprised of more recent alluvial deposits. Due to the variability in particle size distribution and drainage class, these soils are mapped to the higher (less specific) level of classification. Fluventic Hapludolls are moderately well drained alluvial soils with a thick, dark surface. Fluvaquentic Endoaquolls are poorly drained alluvial soils with a thick, dark surface. Both can range from sandy to silty. The wettest areas, classified as very poorly drained, have a water table at or above the soil surface (ponded) for a significant amount of time during the growing season. Under these conditions, organic materials accumulate to a significant thickness. Natchaug (loamy, mixed, euic, mesic Terric Haplosaprists) soils contain 16 to 51 inches of highly decomposed organic materials (muck) over a loamy substratum; Catden soils contain greater than 51 inches. The pH values of the organic materials generally fall in the strongly acid to slightly acid range (5.1 to 6.5).

Moderately well drained coal ash soils, currently unnamed, are found in two locations in the park: the west side of the Northwest Forest and the central portion of the Northeast Forest. This excessively coarse material generally has a low water-holding capacity, which can be problematic for re-vegetation efforts once the water table drops in the summer. Initial trace element analyses have indicated high levels of copper, nickel, lead, and zinc at some locations.

Although the forests of Van Cortlandt Park are among the most mature in the city and the soils show little evidence of disturbance, some anthropogenic effects are still evident. Non-native earthworm species have caused organic materials at the surface of upland soils to decompose rapidly. Air pollutants, including some metals, PAHs (polycyclic aromatic hydrocarbons), and black carbon (soot and other combustion by-products)
from industrial, transportation, and municipal solid waste incineration emissions are predominantly adsorbed and immobilized in the organic-rich surface horizons. USDA NRCS lab data on two Northwest Forest sites from 1999 and 2000 show slightly elevated amounts of cadmium, copper, lead, mercury, and zinc in the surface horizons. According to the New York State Department of Environmental Conservation (NYS DEC) Soil Cleanup Objectives for Protection of Ecological Resources, lead levels might be the most problematic, but they are still below the levels established for the protection of public health.

**Fauna**

The size of its natural areas, its proximity to the Hudson River flyway, and its habitat diversity and quality make Van Cortlandt Park a unique and important resource for wildlife. The park’s forests provide important habitat for nesting and migratory birds, mammals, and a range of arthropods. The Tibbetts Brook wetland is an important habitat for fish, amphibians, songbirds, and waterfowl, and the park’s meadows are habitat for a range of insects and other arthropods and an array of open-area bird species.

In 1990, using a variety of methods including wildlife sightings by NRG technicians, Urban Park Rangers, NYS DEC, and local bird watchers, the NRG compiled a list of wildlife species for the park. It includes 169 species total: 140 birds, 12 mammals, 11 fish, six amphibians, and three reptiles (see Appendix E). Other reports compiled at different times have indicated different numbers, due possibly to different research methods and possibly to change, indicating the need to repeat measurements to determine change over time.

**Birds**

Van Cortlandt Park is one of the two Bronx and nine New York City sites identified as Important Bird Areas by the National Audubon Society. Nearly every non-aquatic species in the region has been recorded in the Croton Woods alone. The park’s relatively large size, quality forest and wetland habitats, and position as an “island” amid an extensive urbanized landscape make it one of the last regional sites supporting breeding bird species. The multi-layered structure of some of the forests provides valuable cover for neotropical migrant and forest interior songbirds. In the words of New York City Audubon, Van Cortlandt Park “supports an exceptional diversity of migrant songbirds and is thought to be an important migratory stopover for landbirds.”

Since it is not possible to manage the park for all avian species at once, target species must be chosen. For example, Van Cortlandt’s forests attract forest interior birds such as the Scarlet Tanager and Red-eyed Vireo that are uncommon in urban environments. Because birds such as these require large tracts of woodland, maintaining an intact forest is an important management goal. The many oaks and beeches in the park’s forests also provide food and habitat for wild turkeys. The park’s great horned and eastern screech owls depend on tree cavities or old hawks’ nests, which are generally in old, tall trees. The Eastern Screech Owl uses tree holes while roosting and feeding. Screech owls help
control the populations of rodents, such as the White-footed Mouse and other small mammals.

Another tree-cavity nester found in the park is the Wood Duck, the only perching duck in North America. As woodlands were cleared after European settlement, suitable nesting habitat for the species was destroyed, and with the additional pressure from hunting, it nearly became extinct. The installation of nest boxes has enabled the population to rebound. In Van Cortlandt Park, wood ducks have been observed in the lake with their young. Yearlings usually return to the place where they were born to establish a nest. Wood ducks are small and can use old woodpecker holes, for which they may compete with invasive European starlings, an edge species found near gaps in the forest where invasive shrubs and vines have taken over.

Some native birds, like the Common Yellowthroat and other warblers, prefer a scrubby meadow or woodland edge for nesting. Wetland environments in Van Cortlandt Park support a number of secretive marsh bird species, including the Sora. Because these birds often call during evening hours, they can easily go unnoticed. A systematic survey of the marsh birds that utilize the park’s wetlands is essential for proper wetland restoration and maintenance.

Mammals
After a long absence, large mammals are returning to Van Cortlandt Park. The White-tailed Deer, considered a rare visitor only 15 years ago, has entered the park from the suburbs of adjacent Westchester County. The Eastern Coyote, which is native to the Plains states but expanding its range in the Northeast, is increasingly seen in the park (see the Concerns and Challenges section).

Medium-sized native mammals recorded for Van Cortlandt Park include the Red Fox, Striped Skunk, Northern Raccoon, North American Opossum, and Eastern Cottontail. Small mammals include the Eastern Mole, Short-tailed Shrew, and Red Bat. Currently, a local scientist is conducting research on New York City bats, which will likely add to the species list for the park. Ten species of rodents are represented in the park, notably the Southern Flying Squirrel. This arboreal squirrel nests in tree cavities and therefore requires hardwood stands with snags and woodpecker holes.

Fish, Amphibians, and Reptiles
Nine fish species were observed during the 2009 state-conducted electroshocking survey of Van Cortlandt Lake. Most lake species are sport fish, although one introduced species, the Common Carp, has become a nuisance. It forages in mud, increasing the turbidity of the water, which can have a negative impact on native aquatic species. The removal of this nuisance species could have a positive effect on water quality and native fish populations.

Although Tibbetts Brook is somewhat degraded, it supports fauna more characteristic of undisturbed, non-urban wetlands. Large volumes of runoff are buffered by the brook’s floodplain, which slows down and filters the water. The Turquoise Bluet, a stream
damselfly, is found in the city only in Tibbetts Brook. The brook may also be supporting the uncommon American Brook Lamprey. This non-parasitic fish, which prefers sandy riffles in clear water, was last recorded in the park in 1979 near the Westchester border. A brief survey in the summer of 2010 failed to find the species, although staff members from the NYS DEC plan to continue searching appropriate habitat. That these species continue to exist in Van Cortlandt Park demonstrates that Tibbetts Brook has great habitat potential and should be restored and protected.

Van Cortlandt Park also includes habitat for a number of amphibian and reptile species (herpetofauna). Herpetofauna are generally in the middle level of the food chain, preying on forest floor invertebrates on land or aquatic invertebrates and fish in water, and are themselves prey for larger animals such as birds and raccoons. Amphibians have moist, permeable skin, making them susceptible to changes in the environment, and their presence therefore can be an indication of habitat quality. In Van Cortlandt and Inwood Hill Parks, NRG scientists are currently studying the response of the Redback Salamander to invasive flora and fauna and forest restoration. Results so far have shown that salamanders are larger and more abundant in areas with a high percentage of native groundcover, and that although restoration initially reduces the size of salamanders, over time their size increases until it is similar to those found in uninvaded forest. Until a few years ago, the Two-lined Salamander could be found in the park’s small streams and wetlands, but its recent absence has scientists concerned that the species may be extirpated from Van Cortlandt Park. There has been at least one observation of another salamander species, the Spotted Salamander, near a large vernal pool in the Northeast Forest.

At least four frog species are found in the park: the Green Frog, Bullfrog, Wood Frog, and Spring Peeper. Green frogs have certainly surpassed spring peepers in abundance, but the latter small tree frogs can still be heard calling at wetlands in the Northeast Woods. The current population of wood frogs may be from a recent reintroduction. Gray Treefrog, Pickeral Frog, Northern Leopard Frog, and Southern Leopard Frog have all been recorded in the past, and if no longer present in the park may be able to reestablish populations from nearby parks in Westchester County if habitat in Van Cortlandt Park is improved.

The park’s reptiles include one snake, the Eastern Garter Snake, and three turtle species: the native Eastern Painted Turtle and Eastern Snapping Turtle, and the non-native Red-eared Slider.

**Insects and Arthropods**

Twenty-four odonate species (16 dragonflies and eight damselflies) were recorded by NRG biologists over the past 12 years. While most are common throughout the region, some are rarely found in the city. The Unicorn Clubtail, a dragonfly that prefers low-oxygen lakes with muddy bottoms and slow streams, is found only at two sites in New York City, one of which is Van Cortlandt Park. The Red-belted White-face is present only in the Bronx in Van Cortlandt Park. Another dragonfly species not often seen is the crepuscular Shadow Darner, which flies late into the season near shady streams, lakes,
and forest edges. The Fawn Darter, a species sensitive to hydrological changes, occurs in the Tibbetts Brook wetland. All odonates hatch from eggs and complete a larval stage in the water before undergoing metamorphosis into flying adults. Clear, unpolluted water is usually a requirement for the gilled larvae, which prey upon small fish and aquatic invertebrates in streams, ponds, and lakes. Adult odonates, which eat mosquitoes and other invertebrates, are a food source for a number of avian flycatchers.

Several local butterfly enthusiasts have compiled lists of species found in Van Cortlandt Park. There should be a systematic effort to compile data on Lepidoptera (butterflies and moths) that have been collected by members of the New York Butterfly Club and other local experts. Park forests have large numbers of hickory, oak, and cherry trees, which are the top three hosts for butterfly and moth caterpillars. Caterpillars, in turn, are the primary food taken by songbirds to feed their young during the spring and summer. Van Cortlandt Park has the potential to host several rare Lepidoptera that feed on these trees, including the Hickory Horned Devil and the Luna Moth. These and other large moths in the Saturnidae (Wild Silkmoth family) have been declining for years, and any habitat that can support populations should be protected or restored. Other plants in Van Cortlandt Park are also hosts for rare butterflies and moths, including red chokeberry, the host of the Precious Underwing.

**Transportation and Trails**

Van Cortlandt Park is accessible by highway, trains, and buses. Two subway lines terminate at the park, the 1 train in the southwest and the 4 train in the southeast. The western entrances are accessible via the Bronx 9 bus, the BxM3 express bus, and the Westchester 1, 2, and 3 buses. The eastern entrances are accessible via the Bronx 16 and 34 buses, the BxM48 express bus, and the Westchester 4, 20, and 21 buses.

In addition to the three highways that run through the park—the Henry Hudson Parkway, Mosholu Parkway Extension, and Major Deegan Expressway—four park roads lead to facilities at different locations. The three highways, including their interchanges, comprise approximately 2 to 3 percent of the park’s total acreage.

An extensive network of trails and paths provide access to the park’s natural areas. The major trails include the Cross Country (8 miles total), Putnam (2 miles), Cass Gallagher (2 miles), John Kieran (1.7 miles), John Muir (1.5 miles), Bridle Path (1.5 miles), and Old Croton Aqueduct (1.1 miles). The total length of these trails alone is nearly 18 miles. A number of informal paths (“desire lines”) have also become established over the years as a result of constant visitor use.

Most of the trails are located in natural areas in the northern half of the park. They help visitors gain access to and appreciation of these areas but can have a negative impact on the soil and vegetation and make it easier for exotic invasive plants to be transported and established. Many of the desire lines in the natural areas are used for illegal ATVs and mountain bikes, causing serious damage to soil and vegetation. The large number of trails requires considerable maintenance. Park administration has identified problems of
insufficient signage, lack of interpretive aids, and inadequate maintenance, but it lacks the resources to address these. Given the financial constraints, the network of trails is too intricate and too long. It requires systematic review and planning, including the evaluation of desire lines and the impact of a bridle trail through the natural areas.

A study of the problems and needs of some of the main trails in the park and a plan for their improvement were undertaken in 2009 by the New York/New Jersey Trail Conference, contracted by the Friends of Van Cortlandt Park. Among the recommendations of the master plan were:

- Increased community involvement in trail maintenance,
- Increased signage,
- Prohibition of compact or full-size trucks on trails, except in emergencies,
- Elimination of equestrian use of trails,
- Use of trail docents who can call for backup when needed, and
- Trail relocation, realignment, and reconstruction where appropriate and necessary.

Overall, a broad and comprehensive approach to planning and managing the park’s trail system is needed.

**Archaeological, Cultural, and Economic Importance**

One of the earliest archaeological explorations of Van Cortland Park was conducted in 1890 by J. B. James, who found evidence of long-term occupation of the area, including pottery, stone implements, fire pits, and burial sites. A permanent village named Keskeskick by the natives existed inside the park’s boundaries. More recent explorations, including those of Arthur Bankoff and Fred Winter, have found other artifacts, including storage pits, campsites, and shell midden.

The Mosholu Golf Club House is a Colonial Revival structure of historical note. As the first publicly owned golf course in the country, the Van Cortlandt Golf Course is also historically significant. Both the Van Cortlandt Museum and Vault Hill have historic connections to the area’s founding families in the 17th century. The New Croton Aqueduct, which became operational in 1890, still supplies drinking water to New York City.

The more than 600 acres of natural areas in Van Cortlandt Park are of major economic importance. No price can be adequately placed on the value of the ecological services and recreational opportunities they provide.

**Research and Educational Importance**

The park’s natural areas provide valuable opportunities for research in urban ecology, history, and urban planning, as well as for science education. Academic institutions, private groups, high schools, and government agencies have already undertaken research on subjects ranging from soil nutrients to mammal and fish populations.
Research and educational opportunities should be enhanced. Studies relating to urban infrastructure and park planning as well as human interaction with urban ecosystems would improve our knowledge of urban ecology and provide important data for park managers.

A number of Permanent Sample Plots were established in the park by the research division of NRG several years ago. They offer a valuable baseline reference and opportunity for long-term monitoring of vegetation change, ecological processes, and human impacts. Existing data should be reviewed and updated frequently by park managers as part of this management plan.
CONCERNS AND CHALLENGES

In Van Cortlandt Park, as elsewhere, the needs of urban natural areas often must be balanced with the needs and desires of the surrounding communities. Land managers must come to terms with the historical and current uses of these areas as well as future restoration and management needs.

Urban natural areas are expected to fill many needs and are subject to many stressors. Some of these impacts are obvious to the casual observer, such as high foot traffic, littering, stormwater runoff from the surrounding hardscape, and increased noise from major roads. Others can be subtle, such as invasion by non-native species, increased risk of fire, and changes in microclimate and biodiversity. All of these factor into the decision-making of land managers.

Biological

Invasive non-native species, including pests and weeds, present the greatest threat to the natural areas of Van Cortlandt Park. As an international port, New York City has served as an active entry point for exotic pests and will likely continue to do so in the future. Unintentional introductions of plant diseases and pests have led to considerable changes in the makeup of the forests in the city over the past century. The chestnut blight fungus (*Cryphonectria parasitica*) has almost completely wiped out the American chestnut. Dutch elm disease (*Ophiostoma ulmi*) and beech bark disease, a relationship between the Beech Scale insect (*Cryptococcus fagisuga*) and the fungal pathogen *Nectria coccinea* var. *faginata*, lead to the premature death of their targets. The Emerald Ash Borer (*Agrilus planipennis*) and Asian Longhorn Beetle (*Anoplophora glabripennis*) have the potential to decimate a suite of native forest trees. The risk of additional introduced pests and diseases in the future is high, and these could have a profound impact on the makeup, quality, and ecological benefits provided by the park’s natural areas—making it all the more important to actively manage and protect them.

Invasive non-native plants can also exacerbate changes to native ecosystems. Invasive plants now dominate nearly the entire park (see Figure 2 and Appendix H).

Non-native plants are considered invasive if they cause or are likely to cause environmental or economic damage or harm human health. Invasive plants can displace native plants by outcompeting them for light and other resources. They tend to put out huge amounts of viable seed and grow quickly. Many are also clonal, creating monospecific stands that get bigger each year. Vines are particularly problematic. Oriental bittersweet, for example, is relatively shade tolerant and can persist in the understory; when a mature tree is lost the vine can climb over and suppress the saplings of the next generation. The sunny, open gap is then colonized by other invasive and aggressive native vines, creating a complex that persists indefinitely, preventing the gap from closing through tree regeneration. These vinelands, as they are known, expand since the invasive vine species often grow quickly, and regeneration of natives in the
urban forest floor is often slow, sparse, or absent. Small gaps become larger as the vines climb surrounding mature trees, eventually weighing down and killing them.

Vegetation surveys of Van Cortlandt Park were conducted in 1988 and 2010 using a process called “entitation,” in which units of similar vegetation cover are mapped. In addition to gaining an understanding of where invasive plants are dominant (Figure 4), analysis of this data has also allowed us to demonstrate the growth in cover of individual species. Evidence from the 2010 entitation suggests that vinelands and other invasive plants have gained ground in the park since 1988 (see Figures 2 to 12).

The formation of gaps and their colonization by successively different sets of plants is a normal part of forest development. However, recent hurricanes and other storms have intensified this process and created more gaps into which more vines and other invasives can be expected to establish. As of this writing, these gaps are being monitored with Geographic Information System maps, and management strategies are being discussed with the assumption that the increased number of canopy gaps could promote conditions for even more gaps as these openings change the dynamic of the interior forest.

In the last few years, garlic mustard and mile-a-minute vine have joined the long list of invasive plants in the park’s forests. According to the 2010 entitation report, garlic mustard, which had been dominant mainly along roads and some trails, has spread to many areas and become locally dominant in some parts of the understory (see Figure 4).

The increasing presence of deer and coyote are additional threats. During the last five years, the number of sightings and other signs of deer in the park, including deer trails and evidence of deer browse, have been growing. The White-tailed Deer is native to the area, but its increasing local population is a serious management concern. Unchecked deer populations expand rapidly, and preferred native plants within their reach quickly disappear. Invasive plants are generally unpalatable and become dominant, destroying the forest’s groundcover and mid-story and arresting the regeneration of native plants. Deer also pose threats to human health, increasing the risk of traffic accidents and spreading disease. With multi-layered forests becoming increasingly rare inside the city, those in Van Cortlandt Park should be protected from the potentially devastating growth of the deer population.

The Eastern Coyote has expanded its historical range substantially and has been present in New York State since at least the 1920s. The park’s first roadkill coyote was recorded in 1995, and over the past several years there have been many sightings. Coyotes could potentially reduce the populations of small mammals. They could also reduce visitation to natural areas, since the public generally fears them. Coyotes can, however, have some impact on increasing deer populations and are protected under the Environmental Conservation Law of New York State. Populations and impacts of deer and coyotes should be monitored, and control measures should be taken if their growth begins to cause harm.

Feral housecats pose a substantial threat to small mammals, reptiles, amphibians, and birds in the park. A recent study using cameras on cat collars has shown that outdoor
housecats kill an average of 2.1 animals per week. Although the study only involved housecats outdoors for an average of 5 to 6 hours per day, the American Bird Conservancy extrapolates that housecats and feral cats are likely responsible for the deaths of 4 billion animals per year, including 500 million birds per year across the country. Feral cats are fed in several locations around Van Cortlandt Park, allowing their numbers to increase to the detriment of native fauna. Park managers should explore working with animal lovers on solutions such as neutering or rescue and adoption.

Earthworms are another threat to the natural areas, particularly the forests. There are no native earthworm species in New York City; the earthworms now so abundant in the soil are exotic species. Many of the native understory plants and associated fungi evolved in the slightly acidic environment of the forest leaf litter. However, the earthworms multiply and spread unchecked, reducing the leaf litter layer. They also have a special gland that neutralizes the acidity of the organic matter, adding to the pH increase in park soil.
Figure 2. Vegetation Units Dominated by Exotic Plants in Van Cortlandt Park.
Figure 3. Vegetation Units Dominated by Vinelands During the 1988 and 2010 Surveys in Van Cortlandt Park.
Figure 4. Vegetation Units Where Garlic Mustard was a Dominant species in Van Cortlandt Park.
Figure 5. Vegetation Units Where Norway Maple has Become Dominant Since 1988 in Van Cortlandt Park.
Figure 6. Vegetation Units Where Black Locust was a Dominant Species in Van Cortlandt Park.
Figure 7. Vegetation Units Where Tree-of-heaven was a Dominant Species in Van Cortlandt Park.
Figure 8. Vegetation Units Where White Mulberry was a Dominant Species in Van Cortlandt Park.
Figure 9. Vegetation Units Where Oriental Bittersweet was a Dominant Species in Van Cortlandt Park.
Figure 10. Vegetation Units Where Multiflora Rose was a Dominant Species in Van Cortlandt Park.
Figure 11. Vegetation Units Where Porcelainberry was a Dominant Species in Van Cortlandt Park.
Figure 12. Vegetation Units Where Mugwort was a Dominant Species in Van Cortlandt Park.
Human

Human benefit from the park’s natural areas is one of the chief reasons for their existence. At the same time, the actions of users have a direct and indirect impact on the quality of the natural resources and habitats. Not only the type but also the intensity of use can be detrimental. Some of the more significant human threats to the park’s natural areas include:

- Trampling of vegetation, soil, and sensitive sites due to the departure from established trails and the creation of new desire lines (see Soil, below),
- Myriad unauthorized and incompatible uses, such as by ATVs and other vehicles (see Operations and Maintenance, below),
- Dumping and littering, including vehicles, construction waste, and a variety of solid wastes,
- Various kinds of vandalism, including damage to natural resources, and
- Fires resulting from carelessness or arson.

Dumping of domestic, garden, and construction wastes, vehicles, and automobile parts is a problem at various locations in the park, especially near the Yonkers border and along the highways (see Figure 13). Dumping and littering not only degrade the aesthetic experience but also pose a health risk to humans, plants, and aquatic life; adversely affect soil and water quality; encourage more dumping and other destructive activities; and place a constant burden on maintenance and operations staff and resources.

Dumping and Santaria sacrifices attract vermin and domestic and feral cats. Rubbish is also tossed from the windows of vehicles driving along the highways. Some garden waste can introduce invasive plants into the natural areas.
Figure 13. Vegetation Units with Dumping and Littering in Van Cortlandt Park 2008-2010.
While a formal analysis of the park’s fire history has not been done, experience suggests that the fires in the Croton Woods are not as large or as frequent as those in the Northeast or the Northwest Forests. Fires at Vault Hill meadow appear to be more common than those in the forests. Most park fires seem to be caused by campfires or other human activities, evidence of which can be found throughout the park (see Figure 14). When used as a management tool, fire can aid regeneration in meadows and forests and suppress the growth of some invasive species. Uncontrolled fire, however, can be ecologically detrimental, decrease air quality, and endanger lives and property.

To address the problem of wildland fires, the agency should begin to consistently collect data on the location, nature, and impact of the fires. The response to park fires has been led by the New York City Fire Department, but there are sites deep within the natural areas that they may not be able to reach. Formulation of a fire policy and response strategy is recommended.

Public awareness and enforcement can reduce many of the human impacts on the park. Developments such as greater understanding of climate change and biodiversity, and allocation of public resources through PlaNYC and the MillionTreesNYC program have heightened public interest in the environment. Direct engagement of the public surrounding the park to capitalize on this heightened awareness would be beneficial.

Enforcement remains an area of weakness for Van Cortlandt Park and the agency as a whole. Innovative strategies to encourage public awareness and compliance and/or increase enforcement will be required to curtail these human threats.
Figure 14. Vegetation Units with Evidence of Campfires and Partying in Van Cortlandt Park 2008 -2010.
Environmental

Urban conditions pose a number of environmental threats to the park’s natural areas. Air pollutants affect air, soil, and water quality as well as plant, animal, and human health. For example, polluting gases containing carbon, nitrogen, and sulfur, and dust released from vehicles and construction activity contribute to acid rain and the eutrophication of water bodies in the park. They can have a fertilizing effect on invasive plants, accelerating their growth. They also can interfere with plant respiration and trap heat in the atmosphere, exacerbating climate change.

The abundance of impermeable surfaces in urban environments prevents rainfall from percolating into the soil, resulting in large volumes of stormwater that erode soil, decrease water quality in aquatic habitats, and burden sewer systems. Natural areas have the capacity to detain and store stormwater. Regional, interagency collaboration could help reduce runoff by minimizing impermeable surfaces and increasing the acreage of absorptive green spaces. Within the park, excessive stormwater damage can be mitigated using techniques that reduce runoff volume and velocity. For example, reducing the number of trails in natural areas would reduce the flow of stormwater and allow more of it to be absorbed by the forest. Rain garden swales could be installed where sewers now drain rainwater from the large turf areas. On the Parade Ground, for instance, stormwater runoff would be greatly reduced if existing drains were surrounded by 100-square-foot “meadows.” Because this would require the reduction of some ballfield space, recreational users would need to understand the importance of minimizing stormwater runoff.

Climate

Historically, New York City’s climate has been characterized by relatively moderate amounts of rain and snow, and hurricanes and tornados have been rare. However, a pattern of destructive storms and a tornado in recent years caused tremendous damage, particularly to the park’s trees and forests, and if this pattern continues, repair and mitigation costs could increase exponentially.

Whether or not these storms are evidence of global warming, climate change has the potential to increase the intensity and/or frequency of such weather extremes, causing further stress to flora, fauna, personnel, and budgets. For example, plantings in the natural areas had to be watered in the summer of 2010 due to record temperatures and lack of rainfall. Another aspect of the climate change threat is the element of unpredictability, making planning and management more difficult. Climate change could have a significant impact on the park’s natural areas by changing the suite of species, accelerating the growth of invasive plant species, pests, and diseases. The park’s wildlife may change as a result of vegetation shifts. Ultimately, climate change may necessitate a new management approach that accepts and guides change in the species composition of Van Cortlandt Park’s natural areas.
Soil

Good, unaltered soil is a scarce and precious resource in urban environments. Among the many challenges Van Cortlandt Park’s soils face are compaction, poor drainage, altered profile and structure, increased pH, and contamination. These in turn affect the sustainability of the park’s forests and meadows.

The park has seen considerable development over the years, including the construction of roads, fields, fairways, and structures. This has degraded and fragmented the natural areas; and excavation during construction, the addition of construction debris, erosion, and the removal of leaf litter have changed the availability of organic material for nutrient cycling, reduced soil fauna, and buried the soil seed bank. It has also altered soil chemistry and increased compaction.

Compaction is one of the biggest soil problems in the park. High foot and vehicular traffic combined with construction activities reduce soil pore space, which reduces aeration and water infiltration, increases stormwater runoff, and encumbers root penetration. Underground engineering structures and utilities can become barriers to percolation and subsurface horizontal flow.

Most trees require a slightly acid to neutral soil. However, the abundance of construction debris and the large populations of non-native earthworms discussed above increase soil alkalinity. While the lack of empirical data makes a definitive determination impossible, the park’s soils are believed to be more alkaline today than they were a hundred years ago. This not only stresses the plants but ultimately can exclude certain species and favor others, affecting species composition and diversity.

As discussed above, air pollutants also contaminate the soil. High levels of particulate matter containing carbon can make soil hydrophobic, compounding the problems of increased runoff and poor stormwater infiltration. Road runoff, which contains petrochemical byproducts and salt, is another major source of soil contamination.

The hilly topography of the northern half of the park increases the potential for soil erosion, threatening the groundcover in the forests and meadows. Significant slope compounded with shallow soils, human disturbance, the absence of groundcover, and earthworm activity facilitates the loss of soil.

The trail system also contributes to soil impacts as it continues to be expanded by user-made desire lines. Improper routing and insufficient maintenance have led to heavy erosion, tread widening, and puddling.

Two sites in the park contain large amounts of coal ash due to dumping prior to 1930 (see the Overview section). The calcium carbonate in the ash may be yet another cause of soil pH increase, and the ash tested has traces of heavy metals. In addition, ash-filled soils are made up of coarser particle sizes and consequently hold less water.
Many of these challenges can be addressed in part by careful project planning. In addition, there should be a systematic effort to reduce the sources of some of these problems, such as limiting vehicular use and removing obsolete engineering structures.

**Financial Resources**

Financial crises affecting New York City have historically reduced the resources needed to manage parks, forcing managers to focus on maintaining the developed, high-use areas. The most recent financial crisis that began in 2008 is no exception. The Croton Forest Management Program has provided funding and resources that have enabled forest management activities to continue, although follow-up funding will be necessary when the program ends. The establishment of the Van Cortlandt Park Conservancy in 2009 created an institutional pathway for supplemental financing for the park in general and natural areas in particular. Financial resources are a limiting factor in the management of the park’s natural areas and will need to be acquired and sustained in the long term.

**Operations and Maintenance**

Most of the problems facing the park’s natural areas have resulted from insufficient maintenance, stemming principally from limited personnel and financial resources. Maintenance will continue to be a major challenge.

Prior to the advent of the Croton program, the Urban Forest and Education Program in the 1990s included dedicated restoration staff, but they were spread thin between both Van Cortlandt and Pelham Bay Parks. Van Cortlandt Park was forced to depend largely on various borough offices to address its natural areas problems. Due to limited resources, however, natural areas management was not given the attention it needed.

One specific operational problem is under-regulated use of the northern reaches of the park by visitors entering from Yonkers due to the limited presence of parks personnel. This has led to vehicle encroachment, dumping, littering, vandalism, substance abuse, damage to soil and vegetation, and threats to the security of other visitors. Collaboration with Yonkers authorities has partly addressed this problem, as have “hard” protection measures like guardrails and chain-link fencing. Educating and encouraging the support of the neighboring Yonkers residents would also help address the problem.

There is increasing interest among some park users and other stakeholders in creating meadows as a way of diversifying the park landscape. Maintenance would be required to keep the meadows from becoming woodland, and also to prevent the colonization and dominance of invasive plants that thrive in open conditions. Like forest gaps, meadows are likely to become vinelands in the absence of maintenance. The Parks Department recommends the creation of meadows as a lower-maintenance alternative to mowed lawns, especially in shaded, sloped, and difficult-to-maintain areas.

Meeting the long-term need for natural areas maintenance will require three things: (1) giving maintenance adequate emphasis in planning, (2) ensuring that resources are
made available to meet the long-term need for maintenance, and (3) enlisting the help of natural area stewards and volunteers.

Location and Land Use

The two subway lines terminating at the park and three highways running through it provide convenient access for park visitors. However, the commute to the northern extremity of the Bronx can limit recruitment of staff and volunteers. The park’s location on the border of New York City and Westchester County also poses jurisdictional challenges for natural area protection and maintenance.

Parks typically have a positive effect on the value of neighboring parcels of land and their use, but this is not the case along much of the western and northern boundaries of Van Cortlandt Park. However, urban land use and property values are dynamic in the long term. The park should seek to influence land use along its borders. Because some land uses inside the park but under the jurisdiction or ownership of other entities have an adverse impact on the natural areas, they should be evaluated periodically and as part of long-term park planning and policymaking.

Demographic

As described in the Overview section, the neighborhoods surrounding Van Cortlandt Park are economically and culturally diverse. The median family income varies widely among the different communities. There is an opportunity to encourage greater financial support from the more affluent communities on the northeast side of the park, as well as the west side neighborhoods of Riverdale and Moshulu. Many Westchester residents drive to the park daily, then use the two subway lines terminating there to continue their commute. It may be possible to build awareness of and support for the park among this group, expanding the present radius of influence. The students who attend premier private schools such as the Fieldston School, Horace Mann High School, and Manhattan College on the southwest side of the park can be recruited to serve as volunteers and conduct research projects.

Highways

Although the three highways that pass through Van Cortlandt Park are advantageous for drivers, they have an adverse effect on park ecology and resources. Among the negative impacts are the fragmentation of habitat and the increase in edge effects and wildlife mortality. They also serve as corridors facilitating the dispersal of invasive plants. In addition, they disrupt the hydrology of the landscape; increase runoff, soil erosion, and pollution; lower stream water quality; add to the urban heat island effect; and facilitate littering and dumping in the park. While conventional wisdom holds that highways are necessary to ease congestion, experience in other large cities indicates that this effect is
only temporary and that additional highways actually generate more traffic congestion.¹ In Seoul, South Korea, congestion decreased when planners replaced a highway with a five-mile-long park.² The benefits versus the drawbacks of closing one or both of the sections of the Henry Hudson and Mosholu Parkways that run through and interconnect in the park should be evaluated as part of long-term park planning.

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RECOMMENDATIONS

Natural areas restoration efforts in Van Cortlandt Park have been similar to emergency room triage. Degradation from years of increasing urbanization and passive management is extensive, making prioritization essential. As a result, the most degraded areas have been targeted first, because the problems in these areas have the greatest chance of spreading to the healthier woodlands, meadows, and wetlands.

As noted in the previous section, the greatest management concern is the reduction of invasive species (both plant and animal, existing and potential) in Van Cortlandt Park’s natural areas. The second most pressing management concern is reducing human impacts by, for example, installing guardrails and fences and increasing patrols and enforcement. Once initial restoration and stabilization is complete—the large pockets of established invasive species with significant risk of spreading have been controlled and access and use are sufficiently regulated—monitoring for new problems, management of aesthetic concerns such as removing old dumping and new litter, and cultivation of the surrounding community become possible.

The prioritization outlined above is implicit in the recommendations that follow, including the actions proposed for each of the eight management zones.

Zoning

Because Van Cortlandt Park is a large tract of land, dividing it into areas by land use type makes management more effective and efficient. It is also useful to subdivide the park further into eight management zones defined by ecosystem type, such as forest and wetland, and by the various roads and other boundaries that have created a series of distinct landscape units. These management zones and specific recommendations for each are described in detail later in this section.

Zoning Recommendation:

- To increase efficiency given the limited resources available, divide the park into core and intermediate natural areas subdivided into management zones.

Core Natural Area

Goal: The goal of the core natural area is to enhance and maintain ecosystem structure, function, and biodiversity, and maximize the ecological services provided.

The designation of the core natural area (Figure 15) is a key feature of this management plan. It combines existing natural areas of high ecological quality, including the Northeast and Northwest Forests, Croton Woods, and Tibbetts Brook wetland. The area does not include the northern portion of the Van Cortlandt Golf Course, the ball fields and playgrounds, the Arthur Ross Nursery, the Van Cortlandt Garage, or a buffer zone of 50 feet from all edges. Designation of a core natural area aligns with the Natural
Resources Group (NRG) strategy of working from the inside out to protect healthy areas first and reverse biological invasion.
**Intermediate Natural Areas**

**Goal:** The goal of the intermediate natural areas is to deter further degradation, remove invasive seed sources, and prepare for future ecological restoration.

Intermediate natural areas have some mature canopy and successional species but are not as ecologically intact as the core natural area. For example, the wetlands in the Shandler Recreation Area and the woodlands around Vault Hill have native canopy and some successional species but little regeneration. These areas should be managed to reduce production and dispersal of invasive seeds in preparation for future restoration. User impact in intermediate natural areas should be closely monitored for trampling and vandalism.

**Landscaped Wooded Areas**

**Goal:** The goal of these “park-like” settings is to provide long views and places for semi-active uses such as games and picnicking. Barbequing is currently allowed but should be phased out over the long term.

Landscaped wooded areas are not considered natural areas but are discussed in this plan because due to their proximity they can have a negative impact on natural areas. They can serve as seed sources for non-native and invasive plants and hosts for diseases and pests. They require more intensive management, especially arboriculture.

**Street Trees**

Street and landscaped trees will be managed largely by the borough forestry office or private contractors.

**Other Areas**

The management objectives and regimens of landscaped and recreational areas of the park are different from those of the core and intermediate natural areas. They will be treated as turf and horticulture areas and maintained by park gardeners. Conditions in some of these areas may have a negative impact on the natural areas by spreading exotic invasive seeds and disease agents.

**Cover Types**

Supported by the progress made in natural areas restoration since the 1990s, the recommendations in this management plan are based on the view that it is still feasible and practical to maintain New York City’s historical vegetation cover types. At the same time, the plan acknowledges that the vegetation, soils, physical environment, and climate may change in the decades to come. Monitoring during this time will provide valuable information on any substantial changes that occur, and future planning should take them into account. At this point, however, there is no reason to accept or create new assemblages of species.
FORESTS

Restoring and maintaining the following historic forest types are goals of this plan. Forests with an essentially mature and historical character will be maintained in that condition to the extent feasible. Degraded forests will be restored.

**Floodplain Forest**
This type of forest grows on mineral soils and is found along the edges of the Tibbetts Brook wetland. Typical tree species include red maple, silver maple, white ash, green ash, sweetgum, tupelo, American sycamore, cottonwood, swamp white oak, pin oak, black willow, and American linden. Other vegetation includes swamp sunflower, smooth nettle, marsh marigold, skunk cabbage, silky dogwood, and pussy willow. Animal species include the Wood Duck, Red-bellied Woodpecker, Blue-winged Warbler, and Tufted Titmouse.

**Red Maple – Hardwood Swamp**
This forest occurs in poorly drained depressions, such as at the Shandler Recreation Area and in the Northeast Forest. Dominant tree species typically include red maple, sweetgum, pin oak, and tupelo. Other vegetation includes skunk cabbage, sensitive fern, tussock sedge, turtlehead, swamp azalea, and spicebush. Animal species include the Blue-winged Warbler, Wood Duck, Spotted Salamander, Bullfrog, Green Frog, and Wood Frog.

**Oak – Hickory Forest**
This forest type occurs in well-drained soils, often loams or sandy loams, on ridge tops and slopes, such as in the Northwest Forest. Typical tree species include red, black, white, and scarlet oaks. Red oaks are usually found in the moister soils at the foothills, black oaks on mid-slopes, and white oaks on the ridge tops. Other species, such as shagbark, bitternut, and mockernut hickories, are often predominant, and American beech is sometimes co-dominant on moist sites. Other typical plants include maple-leaved viburnum, pinkster azalea, lowbush blueberry, flowering dogwood, blue-stemmed goldenrod, wild sarsaparilla, black snakeroot, bloodroot, tall meadow rue, rattlesnake root, toothworts, and trout lily. Animal species include the Great Crested Flycatcher, Red-eyed Vireo, American Redstart, Ovenbird, Wood Thrush, Eastern Gray Squirrel, Southern Flying Squirrel, White-footed Mouse, Opossum, Raccoon, White-tailed Deer, and Redback Salamander.

**Mixed Mesic Forest**
This forest is typically found on fertile, moist, well-drained sites. Multiple dominant species are found in different combinations, as in the Croton Woods. Oak-tulip stands are dominated by tulip trees, red maple, and red and black oaks. Beech-maple stands are dominated by sugar maple and American beech, and are often found on acid soils. Other typical plants include Canada mayflower, lady fern, New York fern, wild geranium, bloodroot, mayapple, Solomon's seal, spicebush, shadblow, arrowwood, and blackhaw viburnum. Animal species are similar to those of the oak-hickory forest.
Forest Management Recommendations:

- Undertake a forest inventory and mapping study to obtain a pool of valuable quantitative information to inform planning and management, such as species composition, species distribution, forest stature, woody biomass/volume, size distribution, and tree condition. Since no quantitative forest inventory has ever been done for the park’s forests, it would provide important baseline information. This information could also be used to make projections into the future, to determine growth and dynamics, and to provide information for fundraising and partnerships. It would supplement the entitation survey and research studies and could be used for mapping and spatial planning. The study could be done as a partnership with local or regional research institutions.
- Manage for multi-age, multi-story (stratified) native forests.
- A full forest restoration regimen should include systematic removal of invasive plants by repeated mechanical removal, slash management, and herbicide treatments, followed by complete replanting with appropriate native herbs, grasses, shrubs, and trees. For best results, vegetative management should continue for at least two years to fully treat plants re-sprouting from the roots and those emerging from the soil seed bank.
- Monitor regeneration within the forest core to determine the trajectory of forest health.

MEADOWS

Meadows, communities of forbs, graminoids, and other herbaceous plants, are integral, though temporary, elements of eastern forests. These transitional meadows occur where large openings or gaps in the forest canopy are created by severe meteorological events such as hurricanes, windthrows, or lightning-generated fires and produce conditions suitable for local meadow plants. They can also be created by intentionally managing forest landscapes as meadows. In the eastern forests, Native Americans repeatedly burned large areas to create openings to attract white-tailed deer for hunting. Whether natural or manmade, transitional meadows are in an early successional stage and will gradually be dominated by shrubs and vines, then trees over time. Keeping such areas in an early successional stage as open meadow is therefore never maintenance free.

However, transitional meadows do provide structural and functional ecological value. In some cases, they can be refugia for threatened species whose habitat has been compromised. They are important habitats for wildflowers, pollinators, including butterflies, bees, and other insects, birds, and rodents. They also provide ecological services and aesthetic value for humans. For these reasons, creating meadows in Van Cortlandt Park can be justified, assuming there has been careful consideration and planning for placement, installation, and management.

Although they are resource-intensive, meadows require less maintenance than turf and are more biologically diverse. Unlike lawns, meadows can be maintained by mowing just
once or twice annually. Converting turf areas to meadows is therefore recommended whenever feasible.

Creating meadows in canopy gaps at this time is not recommended. They would prevent forest succession, a major goal of this plan, and the considerable maintenance required would divert resources from priority restoration work. If creating meadows in canopy gaps becomes appropriate in the future, the current policy should then be reconsidered.

Restoring and maintaining the following historic meadow types at selected sites are goals of this plan.

**Grass – Scrub Meadow**
Grass – scrub meadow is found on the rocky Vault Hill site, historically perpetuated by thin soils and periodic fires. The scrub vegetation is mainly sassafras, *Rubus*, bayberry, and smooth sumac. The herbaceous vegetation includes little bluestem grass, dogbane, goldenrods, round-headed bush cover, daisy fleabane, butter-and-eggs, common milkweed, and trefoils. Wooded areas of short-stature trees such as black cherry, black oak, and sassafras, and smaller numbers of pin oak, black birch, gray birch, cottonwood, and black locust also occur.

**Wet Meadow**
This meadow type is found adjacent to the southern reaches of the Van Cortlandt Lake east of the Van Cortlandt pool. It is maintained in part through the presence of standing water for significant periods of the year. It was invaded by multiflora rose and porcelainberry, both of which were eradicated in 2008-2009. A handful of pin oaks have become established at the site, and there are dense stands of *Phragmites*.

**Well Drained Meadow**
This type of meadow currently does not exist in the park. Well drained meadows comprise a variety of herbaceous plants and wildflowers, including goldenrods, asters, milkweeds, and tick trefoils. Candidate sites in Van Cortlandt Park include Gun Hill Meadow and the sunny clearings on both sides of the road to the Allen Shandler Recreation Area parking lot, one side of which was recommended as a meadow site in the 1990 management plan. Another potential site is within the Department of Environmental Protection (DEP) Water Tunnel #3 compound in the Northeast Forest, which has maintained itself as non-woody vegetation for years. However, this site is heavily inhabited by invasive plants, and the ground is compacted as a result of the construction work. Intensive maintenance would be required to remove the invasive species and keep them out. Management of the site would also be complicated by the fact that it falls under the jurisdiction of the DEP. All of these meadows would be maintained by initial control of invasive plants and the planting of natives, followed by mowing once or twice a year and regular weeding.

**Meadow Management Recommendations:**

- Adopt a meadow management policy and plan for the park.
• Establish and maintain a wet meadow in the area behind the Van Cortlandt pool, across the path from the existing wet meadow, and a well drained meadow along the Shandler Recreation Area road.

• Choose meadow over lawn for open space whenever turf is not necessary. This would also ease demand on limited maintenance resources.

• Consider limiting meadows to sites that volunteer groups are willing and able to regularly maintain, and that have a slope no greater than 15 percent.

• Remove *Phragmites* in wet meadows.

**General Vegetation Management Recommendations:**

• Continue the current strategy of planting park natives only but re-evaluate this policy if new knowledge, such as from soil or climate data, indicates a need to shift to differently adapted species. Construction of a general decision-making model would be helpful for guiding overall planting policy. Factors including climate change, soil properties, native status, wildlife value, aesthetic value, occurrence at the site, historic range, and allelopathy should be included in this model.

• Use chemical herbicides as part of a broader integrated pest management (IPM) strategy to control invasive plants to minimize harmful impacts to surrounding native plants, wildlife, and the public. It is agency policy to use only trained and licensed applicators and appropriate protective gear. Impacts are further minimized by New York City law, which holds city agencies to a stricter standard than that prescribed by the New York State Department of Environment Conservation, the regulatory authority.

• To build upon the results attained under the Croton Forest Management Program, establish a landscape management team that would be responsible for overall natural areas and soil management, including forest restoration. This group would also do storm response work and scientific monitoring.

• Establish close working relationships between the landscape management team and the maintenance and operations unit of the park. Forest restoration and meadow and wetland management are all operations functions, albeit requiring specialized skills. They are operations functions because they maintain areas that supply services to patrons. In the interest of institutional efficiency and effectiveness, these more technical staff should work closely with, if not within, the park’s operations staff.

**Exotic Invasive Plants**

Current efforts under the Croton program to control invasive plants are a major step in improving the composition and regeneration of the natural areas. As discussed earlier in this document, the removal of invasive plants reduces potential seed sources and seed bank reserves of invasive species and favors the germination of native species present in the seedbank. The planting of containerized native plants under the forest canopy helps diversify forest composition and increase vertical structure, while planting them in open
areas helps create layers of vegetation to compete with and ultimately shade out invasive species. The option of seeding the understory with seed mixes is economical and avoids the importation of soil, but has potential disadvantages such as seed predation, soil erosion, and low germination rates. Regardless of the method employed, the restoration work should continue over the course of this plan and into the future.

To be fully effective, management of invasive species must also take place across the system, including the park’s golf courses and areas under the management of other entities. One way of achieving this is to establish an interagency invasive species management group comprising these entities and others.

**Invasive Plant Recommendations:**

- Adopt a concerted, region-wide approach to invasive species management by establishing an interagency group on invasive species management and control. This group should include representatives from Woodlawn Cemetery, the golf course administrations, the DEP and New York City Department of Transportation, the citywide and Van Cortlandt Park nurseries, the NRG, and the Friends of Van Cortlandt Park. There are invasive species problems requiring serious and immediate attention within the DEP Tunnel #3 and both golf course sites, all of which fall outside of the park’s jurisdiction. Management of these areas should be negotiated.
- Seek funding to continue the work of the Croton program and continue restoration work until all major disturbed areas of the landscape are restored.
- Follow the guidelines of existing sources of information such as the New York Cooperative Extension and the U.S. Department of Agriculture to determine proper control techniques.

**Area Protection**

Boundaries are important interfaces for maintaining the integrity of natural areas. Clear boundaries, public awareness, stakeholder collaboration, and agency enforcement all help protect natural areas. For a park as large as Van Cortlandt, these are particularly important. Another challenge facing the park is its shared northern boundary with the City of Yonkers and the jurisdictional issues that brings. The park continues to collaborate with Yonkers authorities whenever necessary.

**Area Protection Recommendations:**

- Continue long-term efforts to install and place guardrails, bollards, and rock boulders to prevent encroachment in the park, including illegal parking and ATV use.
- Continue efforts to install and place high fencing, bollards, and rock boulders to deter and prevent the dumping of garbage in the park.
- Conduct a survey to provide a clearer demarcation of the boundary with the City of Yonkers.
• Continue collaboration with Yonkers authorities on signage, public education, and enforcement along the park’s northern boundary. Involve the DEP in deterrence, surveillance, and enforcement efforts.
• Install signage prohibiting dumping and encroachment along the borders of the natural areas.
• Engage the community to encourage support for protection efforts and for work that has the potential to affect the park’s boundary areas.
• Work with Parks enforcement to increase patrol personnel and frequency in the core natural area and along park borders. Install cameras to enhance surveillance and deterrence.
• Develop an enforcement plan and recruit dedicated enforcement personnel for the park.

Soil

Soil is the basic substrate and source of nutrients for plants, yet soil erosion, compaction, alteration, and inundation are among the most urgent problems facing Van Cortlandt Park. No meaningful restoration can be achieved in the natural areas unless the soils are stabilized and disturbed soils remediated, since the latter will not improve on their own for a considerable period of time, even if the sources of disturbance are eliminated. Management should aim to protect, conserve, and amend soil as necessary.

A systematic soil survey is included in this plan. Some soil management options include soil conservation measures such as installation of engineering and cribbing structures, allowing natural nutrient cycling to take place, and adding sterile compost as needed during planting.

Soil Recommendations:

• Use the information from the New York City soil survey and mapping to determine actions and strategies necessary to manage the soils of Van Cortlandt Park.
• Develop capital projects for cribbing or other stabilization work at various sensitive sites, including Van Cortlandt Park East and along several trails.
• Adopt a policy of facilitating natural nutrient cycling in forests and other natural areas wherever appropriate.
• In areas with bare soil, apply wood chips or pruned wood strategically whenever feasible to retard erosion and encourage organic soil formation.
• Use site preparation and planting as opportunities to improve soil through the addition of topsoil, compost, and mulch.
• Encourage studies of the biology of the park’s soils.

Wildlife and Biodiversity

Van Cortlandt Park is an important natural incubator for New York City’s biological diversity, and supporting the park’s many breeding and migrant wildlife species is an
important goal of this plan. Wildlife habitat enhancement should be integrated into all natural areas management planning and practices. Management actions should aim to attract and protect native wildlife through, for example, planting choices and maintenance of vertical habitat structure. Native food sources should supplant those from invasive plants. Protecting snags, cavities, den trees, decomposing logs, and food sources, using integrated pest management, and noise reduction and buffering should all be factored into management decisions.

**Wildlife and Biodiversity Recommendations:**

- Provide habitat, food, and cover for desirable wildlife whenever possible.
- Consider potential impacts on wildlife when making decisions about and undertaking work in natural areas. For example, all silvicultural and forest restoration work should consider impact on wildlife. As much as possible, actions that cause the greatest benefit or least harm to wildlife should be chosen, bearing in mind the need for public safety.
- Consider impact on wildlife when selecting and planting species in the park.
- Once major infestations of invasive plants are eliminated, reduce the use of herbicides for the mostly routine maintenance work that subsequently will be required in the natural areas.
- Use citizen science as a means of conducting wildlife inventories and increasing public interest in the park’s natural areas.

**Public Awareness and Involvement**

High public awareness and involvement is essential for the long-term health and integrity of the park’s natural areas. Public education can reduce harmful disturbances by visitors and neighboring residents. In addition, volunteers can be an important supplemental source of manpower at a time when funding is limited. Both of these objectives can be achieved through stewardship and volunteer programs, and by working with existing community boards, schools, civic groups, private corporations, and religious groups.

**Public Awareness and Involvement Recommendations:**

- Actively encourage public awareness and participation to increase support for and involvement in natural areas management. A range of involvement should be pursued, including volunteering and donating. In particular, local community groups should be engaged in volunteer forest restoration, trail maintenance, and litter cleanup.
- Develop a corps of trained, volunteer natural areas stewards to empower concerned citizens to become substantively involved in reclaiming and maintaining the health of the park’s natural areas.
- Create a staff position to coordinate educational and volunteer activities in the park. This person should have a background in environmental education and be skilled in communication.
• Develop a photographic archive that includes images of the natural areas in the different seasons and in their best and worst states for use in informing and engaging the public. This archive would also be useful to restoration practitioners.

**Land Use and Visitation**

How all the land adjacent to and within Van Cortlandt Park is used can have a major impact on the integrity, value, and perception of the park and its natural areas. Land uses compatible with healthy natural areas both inside and outside the park will be fundamentally beneficial in the long term.

Among past land use decisions that have had a major impact on the natural areas was the creation of the park’s two golf courses. Management of these two sites has over the years neglected to address the aggressive growth of invasive plants, which have served as a major seed source for invasion in the park proper. Use of agrochemicals in areas of the golf course and along the Henry Hudson Parkway near Tibbetts Brook has led to contamination of the wetland habitat.

The 1986-87 user survey, which found that Van Cortlandt Park ranked fourth among Bronx attractions, suggests there is an opportunity to increase visitation in the park in general and natural areas in particular. The survey did not explore visitor use and perception of the natural areas. A broader survey that included these would be useful.

**Land Use and Visitation Recommendations:**

• Seek to become the acknowledged primary stakeholder (with the right of first refusal) in decisions relating to land within and adjacent to the park.
• Encourage a movement towards long-term regional planning as a way to promote benign development around the park.
• Conduct demographic and economic studies of the park’s natural areas to gain information helpful for management and strategic planning. Studies should include users and assess perceptions of the different natural areas of the park as well as willingness-to-pay options.
• Enforce the permit requirement for all picnicking in or adjacent to natural areas. Monitor picnicking in natural areas for impact on habitat, including soil, herbaceous vegetation, and trees. In the long run, discourage picnicking in natural areas.

**Aesthetics**

Aesthetics, the appreciation of beauty, is an important part of the experience of natural areas. Van Cortlandt Park’s natural areas help shape many of the views and provide the visual backdrop for park users as well as travelers on the perimeter and interior roads and highways. The natural areas also offer important scenic settings for commercial and noncommercial filming and photography. Aesthetics should be an important consideration when making decisions and undertaking work in natural areas, although
what is ecologically beneficial sometimes will need to be reconciled with what is visually attractive.

The following can enhance aesthetics:

- Planting species that provide attractive fall color, flowers, bark, winter berries, and winter foliage,
- Minimizing, cutting, and removing slash, and pruning or cutting damaged branches, shafts, and stumps,
- Screening unattractive or distracting views, buffering the sound of human activities, and enhancing natural sounds,
- Maintaining “mature stand” settings and actively managing vinelands,
- Creating expansive views into park-like settings and other open spaces such as ball fields and meadows, as well as overlooks and lookouts,
- The presence of healthy natural water features,
- Managing edges by removing invasive vines and landscaping with native plants,
- Topographic planning and management, and
- Trail design, including looping, curved sightlines and canopy tunnels, and proper maintenance.

**Aesthetics Recommendation:**

- Consider potential aesthetic impacts when making decisions with a potential effect on the natural areas experience.

**Trails and Roads**

The main thoroughfares that run through Van Cortlandt Park have had a major impact on the natural areas by fragmenting the forest and causing stormwater runoff and other forms of pollution. Improper routing and insufficient maintenance of trails have led to soil compaction and erosion and trampling of vegetation.

Trail planning and maintenance involves multiple aspects of park management. An effective trail system is one that is well planned, integrated, and managed. Positive steps in this direction include the development of a Trail Master Plan by the Friends of Van Cortlandt Park with technical assistance from the New York/New Jersey Trail Conference. Capital projects will result in major improvements to the Putnam and Old Croton Aqueduct trails.

**Trail and Road Recommendations:**

- Include nature trails in the core as an integral part of natural areas management.
- Conduct a field exercise to map park trails using Geographic Information System technology.
- Conduct a feasibility study of the current number and mileage of trails in the park to determine their appropriateness and sustainability.
• Conduct tri-annual inventories of desire paths, with the option of integrating them as part of the larger trail system.
• Build upon the study of trails undertaken by the Friends of Van Cortlandt Park in 2009 by conducting a comprehensive hydrologic assessment.
• Assess the net impact of three highways running through the park as part of long-term park planning, and evaluate the benefits versus the drawbacks of closing one or both of the sections of the Henry Hudson and Mosholu Parkways that run through and interconnect in Van Cortlandt Park.

**Emergency Response**

In the first half of 2010 alone two severe storms had a major impact on the park. The first caused tremendous damage, and cleanup required considerable outlay of resources. It took more than six days for one person to survey, collate, and process the damage to the more accessible sites. It required 15 days for a crew of four to cut up and clear obstructions, not including cleanup after the work. More than 700 trees were felled and over 2,500 were damaged. The cost of undertaking the reconnaissance, clearing, cleaning, and restoration work from this one storm was estimated at nearly one million dollars. With increasing climate change, storms could become more frequent and more severe.

Over the years there have continually been wildfires in the park’s natural areas. While the Fire Department has responded to many of these fires, there are areas that could be difficult for them to reach.

**Emergency Response Recommendations:**

• Develop a storm preparedness and response strategy for the park that incorporates some of the lessons learned from recent storms.
• Develop a fire prevention and management strategy for the park jointly with the Fire Department that includes development of prevention, detection, and suppression strategies.

**Research and Monitoring**

The collection and analysis of research and monitoring data provide essential information for natural areas management. Data collection and periodic analyses are helpful in a number of major ways, including work planning and effectiveness, strategic marketing, and organizational improvement. Research by Parks personnel and third parties can garner information about the natural resources base, present conditions and trends, and park users. Staff can routinely contribute to information gathering through the collection and analysis of data directly related to their work as well as incidental observations. Various types of natural resource-related information could be recorded at the end of the workday using basic forms to build a dataset that could help improve management decisions. This information collection should complement staff work in the field.
Research and Monitoring Recommendations:

- Continue monitoring permanent Sample Plots (PSPs) in the park to gain information on the history, composition, and dynamics of the park’s forests. Encourage use of the PSPs by third parties and Parks as a resource for measuring long-term vegetation change.
- Convene a symposium on research opportunities to help promote research in Van Cortlandt Park.
- Encourage research on urban forests, human interactions with green infrastructure in large cities, and long-term invasive plant management.
- Promote or conduct research on gap dynamics and regeneration as a key to understanding the forces driving maintenance and regeneration of the forest.
- Encourage efforts to compile data on Lepidoptera (butterflies and moths) that have been collected by members of the New York Butterfly Club and other local experts.
- Cultivate a culture of measurement, monitoring, and assessment to attain a high standard of science-based natural resources management.

Management Zones

The park’s eight management zones (Figure 16) and specific management concerns for each are described in detail below. To make it easy to pinpoint locations, entitation units are noted. The most pressing management concerns are listed as “priority.”
Figure 16. Van Cortlandt Park Natural Areas Management Zones
Northwest Forest

The northwestern portion of the park includes one of the largest contiguous tracts of forest in the borough, the 189.6-acre Northwest Forest (Figure 17). The zone is defined in the north by the Westchester County/New York City border. Apartment buildings in the City of Yonkers line almost the full length of this border. The entire western border of the zone is delineated by the busy thoroughfare of Broadway, and its southern and eastern edges by the Henry Hudson Parkway.

Three open lawn areas are located along the Broadway edge, two of them with baseball diamonds (entitiation units 704 and 713). A horse stable complex (unit 708) run by a private concessionaire occupies the 8.8 southwestern-most acres of the zone along with an additional 4-acre open field. Close to this same area, Parks, along with New York City Departments of Sanitation and Transportation, maintain a 2.7-acre complex (unit 709) of gas pumps, garage facilities, and parking lots. Also on the north edge of this site is a large salt storage shed. A paved road, Rockwood Drive, enters the park from Broadway, runs approximately 1,700 feet into the forest, and ends in a circular drive alongside a comfort station (unit 1209). Several formal paths crisscross the zone, many with remnants of their old asphalt surfaces. A bridle path and well-used bluestone cross country running trail loop around the zone. Part of the bridle path runs atop the old Putnam Railroad grade near the zone’s western edge, from the Henry Hudson Parkway in the south to the city border in the north. However, most of the zone is an expansive natural area.

The natural area includes roughly 154.5 acres of closed forest, 7.4 acres of woodland, 6.9 acres of vineland, 3.6 acres of open herbaceous plant communities, and 1.5 acres of scrub. The topography is varied: A pronounced upland ridge with rocky outcrops, cliff ledges, and varying vertical drops snakes its way north to south through the heart of the zone. The soils here are shallow, well-drained, and unlike in other areas of the zone, undisturbed, and the plant communities are generally healthy and thriving. These include black birch, white wood aster, path rush, and lowbush blueberry as well as white, black, and chestnut oaks. Flanking the rocky ridgelines are slopes also with a relatively healthy and multi-layered plant community including oaks, flowering dogwood, sugar maple, maple-leaved viburnum, Solomon’s seal, asters, northern hackberry, and ash. In the low-lying portions of the forest are rich, moist communities with sweetgum, large tulip trees, red maple, arrowwood, and spicebush. In the wetter areas, where water often stands for an extended time, skunk cabbage, jewelweed, ferns, and black tupelo are common. Other areas of closed forest are not quite as healthy, with a minimal presence of invasive plants such as multiflora rose, Asiatic bittersweet, Japanese honeysuckle, and Norway maple. In open areas some vine communities flourish, such as procelainberry, grape, and Asiatic bittersweet, while scrubby communities of multiflora rose are found in limited areas beneath the dappled light of black locust canopy. A few small areas of open herbaceous and grass communities are dotted throughout the zone, mostly at some edges and atop the rocky outcrops.
Description and Changes from 1988 to 2009

The centerpiece of the forest, a large unit (unit 981) has transitioned from a mixed oak/black birch-dominated canopy to more oak. Red and black oaks have largely replaced the earlier-succession black birch. This stretch of forest also has an abundance of native herbaceous and shrub species including spicebush, white wood aster, sarsaparilla, and Solomon’s seal. More representative of the state of the closed canopy forest are the many medium-sized units fanning out from the center of the forest (units 1074, 1035, 1501, 1450, 1491, 1454, 1033, 1521, 1499, 1498, 1448 among others). These contained even smaller units of mostly open or mixed woodland, some of which used to burn periodically. They have now transitioned into larger, more uniform units of closed forest including mature oak and hickory, creating the shade needed to help prevent the establishment of invasive vines and shrubs while at the same time providing a seed bank for natural regeneration. Regeneration of canopy and mid-story tree species is evident in the understory with the presence of black, red, chestnut, white, and some pin oaks. Black and red oaks have become more dominant throughout the zone.

On the outskirts of the forest core, more gaps have appeared due largely to increased vine pull-down (units 1519, 1486, 1492, 978, 1455, 1506). A greater abundance of vines has been observed in these units, and the gaps seem to perpetuate themselves. Also in this area, multiflora rose has increased in abundance in the understory. More notable in these peripheral areas is the increased presence of black locust as the dominant canopy species (units 1205, 1020, 1009, 1022). Because extra light can penetrate the thin locust canopy, species that thrive in dappled light have taken advantage of this shift, leading to an increased presence of multiflora rose in the shrub layer of these units, in some cases occurring as acre-plus monoculture stands. The past survey reveals these units were dominated by oak, cherry, and sassafras. A greater presence of invasive vines, notably Asiatic bittersweet, is also evident.

A large stretch of the forest that appears less degraded and less changed also borders the core area (units 1503, 1476, 1501, 1504, 1517, 1518, 1480, 1502 as well as other, smaller units). Typical in this area is a tulip tree and sassafras-dominated canopy, along with a lesser presence of oak, black cherry, and hickory. The black cherry is regenerating abundantly. On the forest floor the herb layer, including Solomon’s seal, white wood aster, snake root, and some ferns, seems to be growing. However, an increasing abundance of Asiatic bittersweet and native grape could retard the continued growth of this herb layer as well as regenerating canopy tree species.

Large expanses of vineland, predominantly porcelainberry and Japanese honeysuckle, have become well-established along almost the entire length of the Henry Hudson Parkway as it runs between the Northwest Forest and the Tibbetts Brook corridor (units 1463, 1465, 1474, 1470, 1475, 1484). The exposed edge of the forest provides ample sun for the vines to grow prodigiously up the stems of the mature oak and tulip trees typical there. This curtain effect of vines not only suppresses regeneration of the native woody plant community, but also pulls at the canopies of these mature trees, and in some cases
brings them down. This is a hazard to the parkway traffic and eliminates these important seed-bearing individuals.

On the western side of the zone is another complex of highly degraded units. These were heavily disturbed for decades, especially in the first part of the 20th century when coal was the main source of heating fuel and large expanses of this area were used as a coal ash dumping ground. When the dumping stopped the area was left open, and vinelands established and expanded (units 1003, 999, 998, 1016, 1017, 1027, 1014, 1205, 7130). In some parts of this large complex, invasive plant cover is 100 percent. This not only perpetuates degradation within this area but is an abundant seed source that threatens healthier stands of forest nearby.

Also notable is the increase in abundance of Norway maples. They are more widespread throughout the zone and in some units have become dominant, displacing native communities of ash, sugar maple, and elm (units 1008, 1009, 988, 709, 1003, 1547, 1014, 1497). Sycamore maples are also present though not nearly as abundant as the Norway maples, and cause the same problems.

A shift in some other species is evident over the last 21 years. American chestnut was present in some units (1496, 1494, 1487), but while still present as individual re-sprouts, most are no longer present. However, a new occurrence was noted in unit 1472. Hickories are more dominant in the understory throughout the zone. Hickory (bitternut being by far the most common) is regenerating in an array of site conditions and can be found in units ranging from dense vineland to healthy oak/hickory canopy. A hemlock grove noted in the 1988 survey (unit 1470) is no longer present. All other hemlocks surveyed in 1988 are now in decline due to the invasive insect Hemlock Woolly Adelgid (units 1473, 1463, 1465).

Man-made disturbances have changed as well. Dumped cars and other large pieces of debris noted in the 1988 survey in the inner forest units (1478, 1479, 1480) are no longer there. Fires were common throughout the zone, but are now are much less frequent. As a result, the healthy stands of forest throughout the zone tend to have a more complex, multi-layered understory than noted in 1988. The abundance of sassafras regeneratio observed 21 years ago has given way to groves of sugar maple and American ash. However, units in the north edge of the zone (1015, 1016, 1017, 1028, 1029) are prone to human disturbance, such as consumption of alcohol by large groups, illegal drug use, and large amounts of litter. Approximately 2,000 square feet of forest floor have been so compacted by trampling from the frequent gathering of large groups that vegetation no longer grows there. There is also evidence of deliberate vandalism to trees throughout the zone on a reoccurring basis, usually in the form of hacked up and crudely chopped down saplings.

**Northwest Forest Recommendations:**

- **PRIORITY**—Restore the most severely disturbed forest units. The first areas targeted should be the large complex of disturbed forest on the west side of the
zone (units 1463, 1465, 1474, 1470, 1475, 1484). Other areas in need of full-scale restoration are the rose thickets behind the stable (units 1204, 1205, 713) and along the old Putnam Railroad grade trail (units 990, 992, 993, 981, 1077).

- **PRIORITY**—Control the vinelands on forest edges (units 1463, 1465, 1474, 1470, 1475, 1484) to prevent seed dispersal.

- **PRIORITY**—Systematically remove Norway maple communities throughout the zone.
  - Conduct sweeps throughout the central part of the forest (units 1503, 1476, 1501, 1504, 1517, 1518, 1480, 1502) to prevent the spread of invasive vines and shrubs, especially Asiatic bittersweet. The sweeps should consist at minimum of basic pruning back, although cut-stump treatment would be most effective. The entire central portion of the zone should be covered in a four-year cycle. The cycle should be repeated until no longer needed.
  - Monitor the forest floor for the emergence of invasive plants within gaps in the canopy created by large fallen trees. Remove any invasive plants present—Asiatic bittersweet is of special concern in these areas. Plant restored gaps as needed.
  - Establish greater Parks Enforcement Patrol (PEP) presence on the edges of the zone to deter illicit use and littering, especially along the northern border.
  - Direct the Department of Sanitation to improve containment at the salt storage shed (units 1002, 709). A new shed was installed in 2009 yet two sides of it are exposed and wind gusts and rain can still carry salt into the forest.
**Northeast Forest**

The northeastern portion of the park is one of three large tracts of contiguous forest in Van Cortlandt Park (Figure 18), along with the Northwest Forest and the Croton Woods. The area totals 160.9 acres and is bordered by busy roadways: The Major Deegan Expressway runs the entire western length of the zone; East 233rd Street is to the south; and the eastern border is defined by Van Cortlandt Park East. Parkway North in Yonkers forms the zone’s northern border, but it is a quieter residential street with only a fraction of the traffic of the other thoroughfares.

Most of the zone consists of contiguous forest with a few active recreational areas: Gaelic Football Field (2.4 acres), four baseball diamonds and outfields (7.4 acres), and tennis courts (1.2 acres). A playground is located at the eastern edge of the zone (1 acre). A 2.6-acre lawn with large ornamental shade trees borders three of the ball fields and tennis courts in the southern portion of the zone in the area known as Indian Fields. In the northeast corner of the park is the DEP water tunnel access complex. This 7.8-acre area consists of an access structure with heavy surveillance and a paved access road that runs through the center of the site. The rest of the complex is a woodland and meadow community. An asphalt road enters the forested area in the north part of the zone and runs approximately 1,600 feet to a junction. There, it turns north into the 4.7-acre Arthur Ross Nursery, run by Parks & Recreation to provide plants for parklands throughout New York City. Back at the junction, the road, now gravel, continues westerly, past a locked swinging gate, and continues into the forest. In about 1,200 feet it ends at the remnants of an old, unmaintained paved access road to the Major Deegan Expressway. Its crumbling surface stretches north about 735 feet to the chain link fence lining the expressway and south for 278 feet to a tunnel that runs under the expressway and leads to the Croton Woods. Several trails crisscross the zone, including the eastern terminus of the John Muir Trail, which spans the park east to west.

The zone’s natural area comprises roughly of 85.8 acres of closed canopy forest, 52.9 acres of woodland, 11.7 acres of vinelands, 4.9 acres of open herbaceous plant communities, and 0.8 acre of scrub or sparsely vegetated land. In general, the forest undulates moderately in this zone, but at a higher elevation than the rest of the park. The highest point in the Bronx, 246 feet above sea level, is found at the northern edge of the zone. The closed canopy alternates with stretches of the more broken woodland canopy of predominately black locust. Red oak-dominated uplands, complemented by tulip tree, black birch, black oak, and black cherry in the northern tier of the zone, gradually slope down to wetter, lower areas with abundant sweetgum, pin oak, and red maple, and some American beech. Continuing south, this gradient empties into a large area that once was probably a large sweetgum swamp. Areas of fill have transformed most of the former wetland into upland with highly disturbed soils and a 4.2-acre *Phragmites* marsh. Continuing south, the land gradually rises into a healthier stand of red, black, pin, and white oak forest with spicebush and arrowwood dominating the understory.
Black locust and Norway maple dominate much of the forest/woodland from Indian Field in the south to the northern border of the park. Although native shrubs (spicebush, arrowwood), regenerating canopy trees (ash, hickory), and herbs (goldenrods, Solomon’s seal, Joe-pye weed, jewelweed) are abundant, much of the understory in this area is dominated by invasive plant species (mutliflora rose, Japanese angelica tree, mugwort, Asiatic dayflower, English ivy, black jetbead, Asiatic bittersweet).

The 1988 survey revealed that dumping, illegal ATV use, vagrancy, and fires were common in this zone. Most of this activity has ceased, but fires are set at least once a year, although on a smaller scale than before, and trash is still pervasive. Restoration has begun throughout the zone, and the resulting, more regular presence of Parks staff has curbed some of the harmful activity, such as the use of ATVs, which are now rarely seen in this part of the park.

Description and Changes from 1988 to 2009

In 1988, a large upland area was a closed canopy forest dominated by red and black oak, tulip tree, sweetgum, and black birch (units 1381, 1380, 1379). Some of the old canopy trees are still present, but the breaks in the canopy over the years have allowed fast-growing Japanese angelica tree, Asiatic bittersweet, and native wild grape to establish, and they now dominate the understory. The fringes of this area (units 1349, 1383, 1345, 1382) were once dominated by red oak. Although red oak is still present, black locust now dominates the canopy and mugwort, the ground layer. The greater amount of sunlight penetrating to the forest floor has allowed other potentially aggressive and harmful invasive plants to become established. If the current trend continues, this large area is likely to become considerably more degraded and much less diverse.

Farther out from this area, the landscape has become more degraded (units 1349, 1212, 1213). More invasive vines, such as porcelainberry and Asiatic bittersweet, have become established since 1988. Also present is Japanese knotweed, a great threat due to its potential to spread quickly via an aggressive root system.

To the south, a large expanse of forest remains largely the same as it was in 1988, with a closed canopy of red oak, pin oak, and sweetgum and an extremely moist floor with a seasonally flooded culvert running through it (units 1394, 1415, 1052, 1049, 1396, 1416). Red maple is common in the mid-story, and spicebush is prevalent throughout. Arrowwood, though not as abundant as spicebush, is also quite common. Pin oak has become more dominant as older individuals have closed the canopy and regeneration has produced numerous saplings in the understory. Forest floor plant diversity has increased, perhaps due in part to fallen or dying trees noted in 1988 that are now fully colonized by various mycelia communities. Also present is wild sarsaparilla, blackberry, Virginia creeper, regenerating red, black, and white oak, sensitive fern, wood sorrel, agrimony, and asters.

Most of the large-scale dumping and disposal of stolen cars once rampant in the forest along the zone’s northern tier has ceased, although some household and construction
trash continues to get thrown here. Ecologically, this border varies along its entire length, but some consistent characteristics are the abundance of Norway maples and diminished presence of regenerating oaks, an understory dominated by Japanese angelica tree, a less diverse herbaceous community than in 1988, and the presence of porcelainberry and Japanese honeysuckle in light gaps (units 1302, 126, 1214, 1347, 1348, 1213, 1201, 1176, 1175).

The water tunnel access complex, basically a low-quality meadow, has changed little since 1988 (units 1400, 1406, 1401, 1403, 1411). Cottonwood, cool season grasses, mugwort, Ailanthus, and smooth sumac are still present. White mulberry, black locust, and Paulownia have moved into the area as well as the fast-growing and potentially invasive bed straw and Japanese hops. Most noteworthy is the discovery of mile-a-minute vine in 2008. In an open area such as this meadow, the plant will thrive and disperse seeds throughout the park; in 2010 a population was found at Shandler, over a mile from the water tunnel site, and is now well established. An additional large population has been discovered just south of the Phragmites marsh, and vines are common at the edge of Indian Field. In summer 2012 the mile-a-minute biological control agent, Rhinoncomimus latipes, was discovered and has established a breeding population wherever the vine is found in the park. This weevil slowly decimates mile-a-minute populations where it is released intentionally in the region and offers hope that the vine will be of little concern in the future.

According to the first survey, the corridor along the nursery road and the northeast border of the zone were dominated by red oak and black cherry (units 1173, 1177, 1178, 1179, 1180, 1171, 1066). Cherry is still present, but where the large red oaks have largely fallen little regeneration has occurred, and Norway maples have become dominant. The area was a major dumping ground, but this activity has ceased. Much of the forest floor is deeply shaded by the thick Norway maple canopy, and as a result woodland herbaceous communities are less diverse. Buckthorn, Amur honeysuckle, Japanese angelica tree, Asiatic bittersweet, and Ailanthus, among other invasive plants, have moved in. Also found here are English ivy, privet, and black jetbead, as well as the native white oak, Virginia knotweed, smartweed, ragweed, jewelweed, spicebush, red maple and a few buckeye. Restoration has begun in this part of the zone, and light is beginning to make its way back to the forest floor. However, the soil seed bank no doubt is full of invasive species seeds, so careful follow-up maintenance will be needed to eradicate those emerging seedlings once all the Norway maples have been removed.

Most restoration work between 2007 and 2011 has focused on the central and southern part of this zone (units 1065, 1354, 1055, 1054, 1056, 1399, 1039, 1413, 1040, 1420, 1417, 1418, 1419, 1042, 1416, 1396), where vinelands and bush honeysuckle grow thickly in the disturbed ash soils. Removal of these invasive communities has been a priority, and much progress has been made. The canopy of these units is dominated by black locust, which allows more light to reach the forest floor than the native canopy. This will stimulate exotic invasive growth and require more management.
A 1.8-acre vernal pond in the middle of the zone remains much the same as it did in 1988 (units 1057 and 1058). Sweetgum, red maple, and pin oak dominate the canopy. False nettle, highbush blueberry, arrowwood, Virginia creeper, American elm, and gray dogwood are also present. The area is only occasionally dry at the height of summer, collecting rain and snow melt the rest of the year. The area surrounding the pond has a canopy of black locust, sweetgum, and black cherry (units 1063, 1060, 1392, 1064). European buckthorn is abundant in the understory, as are multiflora rose and Japanese angelica tree. Efforts are currently underway to eradicate these and other invasive plants in this area. Just west of the vernal pond is a large Phragmites swamp (unit 719) that also remains much as it was in 1988. A large population of spring peepers lives here. Fire remains a disturbance in the area.

Vineland communities and abundant multiflora rose grow in the disturbed edge along the Major Deegan Expressway comprising the entire western border of the zone (units 1301, 1310, 1302, 1303, 1304, 1309, 108, 107, 1351, 1353, 1352, 1053, 1048, 1049). Some restoration work has begun here and should continue. The invasive species in this area pose a threat far beyond the immediate environment since the exposed, forest-edge setting makes the fruit of the vines very visible to birds, which carry the seeds long distances. Fortunately, debris and auto dumping in this area, as in much of the rest of the park, are not nearly as rampant as they were 1988.

Northeast Forest Recommendations:

- **PRIORITY**—Continue the full restoration regimen where work has begun (units 1065, 1063, 1412, 1399, 1393, 1389, 1390, 1041, 1418, 1392, 1419).
- **PRIORITY**—Control the vinelands on the forest edges along the Major Deegan Expressway and north border.
- **PRIORITY**—Remove Norway maple communities throughout the zone.
- **PRIORITY**—Complete the installation of guardrails along the northern border of the zone to deter dumping of construction and household debris.
- **PRIORITY**—Establish greater PEP presence along the entire eastern edge of the zone to deter fires and other illicit activity. Mounted PEP should patrol the interior of the forest on a regular basis, especially after school lets out for the day and during school holidays. During dry spells and in early spring, when the area is most susceptible to fire, the local 47th NYPD precinct should be encouraged to post a cruiser periodically at different points along Van Cortlandt East to deter those entering the forest from lighting fires.
- **PRIORITY**—Continue to monitor the response of populations of mile-a-minute vine to the presence of the biological control agent *R. latipes*.
  - Encourage nursery staff to regularly monitor nursery grounds for invasive weeds and eradicate them as necessary. Of special concern is eliminating Japanese knotweed, Japanese honeysuckle, porcelainberry, and mile-a-minute vine and keeping them out of nursery stock where they can be transported citywide. The nursery should also be encouraged to cease
production of known invasive plants, such as burning bush and Japanese barberry.

- Explore wetland restoration possibilities for the *Phragmites* marsh (unit 719), including an impact study on current amphibian populations.
Figure 18. Northeast Forest Management Zone
Croton Woods

Located between the Northeast and Northwest Forests, the Croton Woods is a large stretch of contiguous forest that runs from the Westchester border south to the intersection of the Mosholo Parkway and Major Deegan Expressway (Figure 19). The zone is wide at its northern border (about 1/3 of a mile) and narrows to a point 1.2 miles south where the two roadways meet. The zone is 134 acres, defined on its north side entirely by the Westchester/New York City border and on the east side by the Major Deegan Expressway. The western border includes 0.6 mile of the Mosholo Parkway as well as the Van Cortlandt Golf Course and the north end of the Putnam Trail.

A long, west-facing slope from the low-lying valley of the Tibbetts Brook Wetland Corridor up to the higher elevations of the eastern part of the park runs north to south the entire length of the zone. At the top, the slope rounds off to the east without a pronounced ridge, and continues to gradually rise to the plateau where the highest elevations in the park (and the Bronx) are located in the Northeast Forest. A seasonal stream that ceases flowing in the driest months of the year drains this portion of the zone and much of the Northeast Forest. It feeds into a culvert that empties into Tibbetts Brook. Other drainages, much less pronounced and flowing only after significant rainfall, are found occasionally along the length of the slope. Also in the northeast corner of the zone are seasonal wetlands in small, poorly drained areas, some of them apparently the result of holes dug for cellars or structures that were once there.

The Croton Woods is entirely a natural area, with few breaks in a contiguous stretch of forest. In addition to the Major Deegan Expressway along the eastern border, a series of on-ramps separates the main stand of forest from an isolated patch of closed canopy forest in a traffic island. Just south, at the edge of the zone, a gas station and parking lot, along with small, maintained patches of lawn, occupy 0.78 acre. A defunct on-ramp to the Major Deegan Expressway on the eastern edge of the Croton Woods is now a crumbling paved path that arcs into the forest and ends abruptly after a few hundred feet. Because this on-ramp breaks the canopy, a substantial vineland has grown in.

Trails crisscross the entire zone, and two formal trails span the area. The John Muir Trail crosses the zone east to west. The landmark Old Croton Aqueduct Trail runs atop the actual aqueduct for the entire north/south length of the zone. The pipe, made of red brick and mortar, is visible in spots, and a prominent stone structure called the Weir Building is located midway through the zone atop the aqueduct. Although this trail is heavily used, other portions of the zone are some of the least travelled and most remote areas of the park.

The Croton Woods includes 91.4 acres of closed canopy forest, 22.9 acres of woodland, 18.2 acres of vineland, and 1.5 acres of herbaceous communities. The closed forest has rich, moist soils in the eastern edge of the zone and healthy well-drained soils on the western slope. Small rocky outcrops are found throughout the zone but are not nearly as prominent as those on the mounts in the western part of the park. The forest canopy in
the eastern portion consists largely of black oak, sugar maple, red oak, and sweetgum, while the western portion consists mostly of sugar maple, red oak, sassafras, and some American beech. Though invasive plant species are found throughout, the highest concentrations are along the edges and in the southern portion of the zone, where dumping and homeless encampments are also common. Of special concern are the vinelands that cover 13.5 percent of the zone. These vinelands are in or near some relatively healthy stretches of mature forest, and the risk of further degradation as the canopy trees come down is high.

**Descriptions and Changes from 1988 to 2009**

As is typical of Van Cortlandt forests, there is great diversity in the Croton Woods. In the zone’s core are relatively undisturbed units (1300, 1600, 1596, 1598, 1597, 1608) with an oak, tulip tree, and sugar maple canopy. These canopy species are regenerating abundantly in the understory. Most striking are the units with regenerating sugar maple (1596, 1597, 1598, 1608, 1627, 1562, 1563, 1611, and parts of others). The 1988 survey noted that sugar maple regeneration was beginning but not yet abundant. The 2010 survey revealed extreme abundance in over half of the zone, especially along the western slope. In addition, the young trees observed in 1988 have grown to individuals of seed-bearing size in even-aged stands. Sugar maple is a major component of the regional forests but is largely missing from those of New York City. The presence of the sugar maple population here attests to the high ecological value of Van Cortlandt’s forests. There is also a greater overall diversity of plant species now than in 1988. Though some of the understory is being aggressively shaded by the abundance of sugar maple, a variety of regenerating trees, shrubs, and herbs are present, including maple-leaved viburnum, Virginia creeper, arrowwood, red maple, bitternut and shagbark hickories, black cherry, flowering dogwood, hay-scented fern, false Solomon’s seal, jewelweed, poison ivy, and native grape.

However, there has also been an increase in invasive plants since 1988 (units 1562, 1563, 1580, 1601, 1586 among many other, smaller units). Especially problematic are porcelainberrry, Asiatic bittersweet, and Norway maple. Also present in abundance are multitiflora rose and mugwort. One of the most widespread invaders in the zone is garlic mustard, which is present in most units and abundant in half. The greatest management concern in this zone is the intensive vine growth that has occurred in the southern section. Open vinelands of porcelainberry and Asiatic bittersweet appear to be expanding into the forest (units 1576, 1558, 1571).

The northern border of the zone is relatively healthy, with a diverse forest of black oak, American beech, sugar maple, black birch, sassafras, hickory, white wood aster, sensitive fern, and avens. Norway maples have made their way into this area and are poised to become dominant once the smaller, mid-story individuals begin to bear seed. Although they are less abundant, other exotic species have become established along this edge, including English ivy, wineberry, porcelainberrry, Asiatic bittersweet, rose of Sharon, Japanese barberry, and winged euonymus. The rampant dumping of construction debris and abandoned cars noted in this edge of the park in the 1988 survey has decreased
significantly, although some dumping of household and landscaping waste persists. One the guardrail supported by Croton restoration funding is in place along the entire length of this perimeter, dumping should be minimized.

The west-facing slope that runs the length of the zone is, for the most part, thickly forested. However, in a small section in the north, which curves around the top of the Van Cortlandt Golf Course (units 1551, 1552, 1553) and is crisscrossed by many unofficial trails connecting the Old Croton Aqueduct Trail high on the slope with the Putnam Trail at the bottom, the ground is extremely compacted in places. Due to the trampling, barely any ground vegetation is growing in large swaths of the slope. Gullies and signs of heavy erosion are already present.

**Croton Woods Recommendations:**

- **PRIORITY**—Restore the most severely disturbed forest units. The first units targeted should be the areas in the south with multiple acres covered in porcelainberry and Asiatic bittersweet (units 1576, 1558, 1605, 1612, 1423, 1571 among other, smaller ones).

- **PRIORITY**—Stabilize the slope in the northwest portion of the zone (units 1551, 1552, 1553). Demarcate specific pathways to reduce the network of paths between the Putnam and Old Croton Aqueduct Trails. Install water bars and other erosion-control measures across the trails. Aerate and install cribbing on all other barren patches of the hillside. Plant native and appropriate shade-tolerant trees, shrubs, and herbs. Seed with native herbaceous woodland mixes in open planted areas. Signage in English and Spanish describing the work would be beneficial.

- **PRIORITY**—Since there is such a high concentration of sugar maples in this zone, take great care to monitor the forest for signs of Asian Longhorn Beetle infestations. The exotic invader targets sugar maple, among other species, to host its eggs and developing larvae. Ideally, trained foresters should survey the entire zone once a year, especially along the west-facing slope. If an infestation is detected, action should be dictated by the guidelines of the United States Department of Agriculture.

- **PRIORITY**—Complete the installation of guardrails and fencing along the northern border to deter dumping of construction and household debris.

- **PRIORITY**—Systematically remove Norway maple throughout the zone.
  - Conduct sweeps throughout the central part of the forest (units 1588, 1589, 1597, 1598, 1596, 1627, 1600, 1611, 1625, 1626) and take necessary action to prevent the spread of invasive vines and shrubs.
  - Encourage Yale University to conduct additional research in this area (see Appendix G.)
Figure 19. Croton Woods Management Zone
Tibbetts Brook Wetland Corridor

Tibbetts Brook begins in the City of Yonkers, draining paved residential areas and the parkland and woodland complexes of Tibbetts Brook Park and Dunwoodie Golf Course. It cuts through the middle of Van Cortlandt Park, providing the primary drainage for most of the landscape. Throughout its length the brook is severely altered with dams, weirs, and culverts and from running along major highways. One special concern is the almost complete coverage of the dammed lake in Tibbetts Brook Park with water chestnut. This exotic invader grows fast and can completely cover the surface of a water body in a very short time, severely altering the aquatic ecosystem. Unless action is taken upstream, Van Cortlandt Lake is extremely susceptible to invasion by water chestnut.

Within Van Cortlandt Park, the Tibbetts Brook Wetland Corridor zone is approximately 142.1 acres and comprised of five distinct sections, each with its own management concerns (Figures 20A and 20B). The first, northernmost section is a flat, wet forest and freshwater wetland through which the watercourse flows. A retention wall built long ago to mitigate runoff in the northern part of this section is now a wetland overrun with Phragmites. Below the wall a weir drains the Phragmites field, and the brook flows under the Henry Hudson Parkway. An overflow channel continues due south in this section and seasonally flows through a complex of disturbed wet forest and small, narrow ponds before entering a culvert and draining south of the Mosholu Parkway.

In the second section, the brook flows through two large wooded traffic circles formed by the Henry Hudson Parkway. It collects here in two small ponds, Maple Pond and Sycamore Pond, which are connected by a culvert that runs under the Henry Hudson and Mosholu Parkway exchange. It resurfaces south of the Mosholu, joins with the overflow channel, and flows into the third section, which is a narrow strip of wet forest between fairways of the Van Cortlandt Golf Course. The brook continues to flow south until opening up into Van Cortlandt Lake’s upper basin, which, along with the lake and its shoreline and surrounding forest, comprises the fourth section. The fifth section is a low-lying wetland beyond the retaining wall that supports the spillway that drains Van Cortlandt Lake. Water seeps from beneath the wall, and the low-lying topography makes this section a perennial wetland.

The zone is comprised roughly of 51.7 acres of woodland, 49.2 acres of closed forest, 18.3 acres of aquatic habitat, including open water, 14.9 acres of herbaceous plant communities, 6.8 acres of vineland, 0.8 acre of sparsely vegetated land, and 0.3 acre of scrub. Many of the plant communities found here are typical of low-lying, wet conditions. In the north, where the brook enters the park, there is a healthy closed forest of red oak, sassafras, black cherry, red maple, black tupelo, and hickory with a rich, native ground layer filled with ferns, horsetail, and native loosestrife. Farther south it becomes more disturbed, and invasive plant species such as Phragmites, porcelainberry, Asiatic bittersweet, and multiflora rose are common. Just before the brook empties into Van Cortlandt Lake there are parcels of wetland edge and forest communities, including populations of mature button bush and black willow. The shoreline of the lake has
abundant sassafras canopy and regeneration, along with black birch, black cherry, red oak, sweet pepperbush, and arrowwood. Soil compaction at the lake edge is a concern, and there is evidence of erosion, especially on the eastern shore where there is a lawn.

As of the writing of this document, the DEP is reviewing a plan to capture stormwater runoff within the Tibbetts Brook corridor and reduce outflows to the combined sewer system. Currently, outflow goes directly into the Broadway sewer, and during heavy rains contributes large quantities of water to the combined sewer overflows (CSOs). The DEP plan would create holding ponds with adjustable weirs to reduce outflow to the sewer system. An evaluation of the environmental impact of this plan should be conducted by Parks staff along with the DEP and their contractors. Sites being considered for construction of these pools are currently Phragmites marshes in the northern part of the zone. These sites are described below.

**Description and Changes from 1988 to 2009**

**North Section**
This section is mostly woodland that is closing in with red maple, black cherry, and box elder. Also present are tulip tree, ash, and pin oak. The floor has a wet area with herbaceous perennials including horsetail, hay-scented and sensitive ferns, skunk cabbage, white wood aster, and the uncommon fringed loosestrife in expansive mats (units 1279, 1239, 1241, 1282). Dumping is no longer a problem here. The understory appears largely undisturbed and healthy, and it is notable that bitternut hickory, absent in 1988, is now found here. This area is surrounded by a disturbed understory of multiflora rose and porcelainberry, and an overgrowth of native grape. The full canopy seems to be impeding invasive growth for now, but as canopy trees are lost these communities will be threatened by infestations of the surrounding invasive plants.

The Phragmites field that the stream flows south into (unit 1228) occupies most of this part of the zone. In 1988, this area was part of a large gray birch stand and a healthy herbaceous community, although Phragmites was present. Surrounding the Phragmites today and filling out the area to the south is a highly disturbed section of black locust woodland with abundant multiflora rose and Asiatic bittersweet growing in the understory (units 1293, 1292, 1291, 1294, 1295, 1235, 1290). Norway maples and a few sycamore maples are present throughout this area as well. On the exposed edges, curtains of porcelainberry drape from the canopy trees.

The overflow channel to the south in this section (units 1290, 1285, 1235, 1296, 1295), also very wet and low-lying, and with a good diversity (though relatively low abundance) of native plant species such as red maple, goldenrods, milkweed, elderberry, wood sorrel, woodland sunflower, and blackberry, would be an excellent place for large-scale forest and freshwater wetland restoration.

**Traffic Islands**
In the two traffic islands comprising the second section there is a patch of forest with mature tulip tree, red oak, and pin oak, and a highly disturbed understory of
porcelainberry, Asiatic bittersweet, and multiflora rose (units 1631, 1632, 1634, 1633, 1635). Where the brook widens into Maple Pond (unit 1632) and Sycamore Pond (unit 1635), crayfish, fish, tadpoles, and large snapping turtles reside. Eastern hemlock, recorded in this area in 1988, is no longer present. Although the other large, seed-bearing canopy trees are still intact, the regeneration noted in 1988 has ceased due to the abundant invasive vines. The 1988 management plan listed monitoring vine encroachment as a management concern. However, resources were not dedicated to this task, and the result is now apparent. Although considerable effort would be required, it is still worth saving this unique spot, whose ecological value is enhanced by its community of aquatic plants and animals.

Narrow Forest Corridor Between Fairways
In section three, the long strip of wet forest (units 1223 and 1226) between Van Cortlandt Golf Course fairways, the native black willow that was dominant in the 1988 survey is being replaced by exotic weeping willow, which was not found in that survey but is now dominant in sections. Much of this area is an intact, relatively healthy native forest corridor with native wetland species such as skunk cabbage, red maple, silky dogwood, elm, and pin oak. Some invasive species, including Japanese knotweed, Asiatic bittersweet, and bush and vine honeysuckles, are present and will be a growing concern as canopy trees come down and allow more light into the understory. Although the dumping of cars and large appliances is no longer a problem, litter and feces are.

Van Cortlandt Lake
*Phragmites* now dominates the edge of the upper lake basin (units 1220, 1126, 1130 among other, smaller patches). Open water comprises approximately 2.4 acres of this upper basin and, in addition to the abundant *Phragmites*, there is red maple, black willow, and an abundant native understory of button bush, elderberry, sweet pepperbush, and black cherry among many other wet area plant community species along the shoreline (units 1135, 1131, 1132, 1133, 1128). Also abundant, but not recorded in the 1988 survey, are the invasive species Asiatic bittersweet, Siebold viburnum, and multiflora rose.

The portion of the lake beyond the bridge spanning the Putnam Trail is 14.3 acres of open water. The lake has increased in size over the last 20 years due to dredging, and there is now water where there were large stands of *Phragmites* in 1988. Today, the western shoreline is a mixture of weedy vegetation and volunteer oaks, willow, and ash. Japanese knotweed, *Phragmites*, and mugwort, among other invasive species, are present (units 1139, 1138, 1137). The knotweed’s potential as a seed source is a major threat to surrounding areas (nearby unit 1118 is a steep slope vegetated almost entirely by Japanese knotweed). The lake’s western shore consists of a closed canopy forest dominated by black locust, black cherry, and some oak (units 1091, 1095, 1097, 1093). Norway maples are abundant in the mid-story, with some individuals poking into the canopy. The 1988 survey reveals that these maples were present but not dominant as they are now. However, this lakeside forest has many healthy areas with a red oak canopy, sassafras, and a shrub layer with abundant arrowwood. Regenerating ash and
hickory are common. Because foot traffic is excessive, soil compaction, litter, and feces are concerns.

Low-Lying Wetland Beyond the Lake
The low area just southwest of the spillway was once part of the Tibbetts Brook course. It has unique ecological value locally as it remains wet for most of the year from water via seeps from the lake overflow, ground water seepage, and local rainwater runoff. The Van Cortlandt Pool, which is a few hundred feet to the west, most likely supplies water as well. The majority of the area has been taken over by *Phragmites*, though the edges contain herbaceous wetland communities, including cattail (unit 1078). Cattail was dominant in the 1988 survey, but *Phragmites* has displaced most of it (units 1081, 1082, 1079). Porcelainberry and Asiatic bittersweet were not listed in the 1988 survey but are present as well. There is also some elderberry and pin oak. Bird activity is very high, and the area has even greater potential as a healthy freshwater wetland if the invasive plant growth is addressed. A raised wooden boardwalk runs through the area and is subject to occasional vandalism, including burning. Excessive trash accumulates in the area, given its proximity to barbequing grounds and the swimming pool.

Tibbetts Brook Wetland Corridor Management Recommendations:

- **PRIORITY**—Restore the most severely disturbed forest units. The first area targeted should be the north section that has some of the highest concentration of invasive vines in the entire park (units 1293, 1292, 1291, 1294, 1295, 1235, 1290).
- **PRIORITY**—Explore opportunities to conduct restoration work in conjunction with the proposed pond construction by the DEP. For example, can the scope of the project be expanded to include the eradication of invasive plants in the immediate area? Explore mitigation opportunities for the ecological enhancement of the park if the project is approved.
- **PRIORITY**—Reach out to the City of Yonkers to develop a plan to eradicate invasive plant species from natural areas in Tibbetts Brook Park. Water chestnut should be targeted as soon as possible for removal from the lake, and a plan to monitor for further infestations should be developed.
- **PRIORITY**—Remove *Phragmites* from the zone with a concentration along the perimeter of the upper basin of Van Cortlandt Lake (unit 1220, 1221, 1130, 1126). Also target the large stand in the northern portion of the zone if the DEP project is not located there (unit 1228). For best results, this process should take at least two years to fully eradicate treated plants that have re-sprouted.
  - Conduct sweeps throughout the narrow strip of relatively healthy forest between the fairways (units 1223, 1226, 1227, 1225) to prevent the spread of invasive vines and shrubs through it.
  - Explore wetland restoration possibilities in the *Phragmites* marsh below the outflow of the lake (unit 1078), including an impact study on amphibian and bird populations currently found here.
Figure 20A. Tibbetts Brook Wetland Corridor Management Zone North
Figure 20B. Tibbetts Brook Wetland Corridor Management Zone South
Vault Hill Woodland and Meadow

Vault Hill is in the west-central part of the park, a large portion of which is a steep upland of forest and open meadow (Figure 22). The geology is a continuation of the steep, glacially carved rocky outcrops found just to the north in the Northwest Forest. The zone is 45.6 acres and encompasses the area between the northern part of the parade ground and the Henry Hudson Parkway to the north, and the Van Cortlandt Golf Course to the east. A small section, also part of this complex, is a forested knoll to the north and west of the Parade Ground. Open herbaceous and grass communities are scattered throughout the center of this zone, the remnants of a once bigger meadow. These areas total about 5.6 acres, with the largest parcel at about 1.6 acres, though the latter fluctuates in size based on a current effort by volunteers to enlarge it by cutting down encroaching trees (mostly sassafras and sumac) along the perimeter. The remaining 40 acres of the zone is mostly closed canopy forest.

The zone experiences heavy foot traffic and activity. The Van Cortlandt Cross Country trail enters the forest here and loops through the interior of the zone. Other, smaller single tracks are found throughout all but the steepest sections. The meadow and rock outcrops attract activity such as bird watching, sunbathing, picnicking, and partying. Fires occur periodically throughout the zone. An especially open and exposed rock outcrop in the southern portion (unit 924) attracts many people for the views to the south. Below this outcrop are the ruins of the Van Cortlandt family vault, now overgrown with vegetation and in severe disrepair. Well-worn paths encircle this immediate area, and the ground is very compacted.

The zone includes 35.9 acres of closed canopy forest, 4.6 acres of herbaceous communities (including most of the meadow), 2.3 acres of woodland (distributed largely on the meadow and rock outcrop edges), 1.6 acres of scrub vegetation, 0.7 acre of vinelands, and 0.5 acre of sparsely vegetated landscape. The closed forest on the steep, west-facing hillside of the zone, in the interior, and on the small knoll along Broadway is dominated by black oak, red oak, and black birch. Along the meadow perimeter, and sporadically within the meadow, are sassafras, black locust, and black cherry, among other emerging woody plants. Grasses and pockets of herbaceous communities are found throughout the woodland, meadow, and rocky outcrops. As on the rocky outcrops throughout the Northeast Forest, soils here are shallow and well drained. However, in this zone the outcrops are largely exposed, not under tree cover, so grasses tend to dominate rather than woodland herbaceous communities. Asiatic bittersweet is present throughout the zone, in some places abundant to the point of infestation. Japanese honeysuckle is also found throughout the woodland and open portions of the zone, and abundant in sunny spots.

Description and Changes from 1988 to 2009

This zone is very diverse. The forest is composed of large areas of closed canopy dominated by black oak and black birch, with substantial regeneration of oak, cherry,
sassafras, ash, and hickories in the understory (units 956, 942, 966, 940, 949 as well as other, smaller units). This is the most common forest type throughout the zone and is relatively healthy. The composition of these units has remained largely unchanged since 1988, though Asiatic bittersweet has moved into some areas where it was not recorded before.

Other units dominated by black oak are found on the small knoll bordering Broadway, though the understory has a greater abundance of shrubs such as blackhaw, maple-leaved viburnum, and arrowwood (units 899, 900). The closer to the edges, the more this knoll tends to be degraded with a greater abundance of Asiatic bittersweet, multiflora rose, Japanese honeysuckle, wineberry, mugwort, some porcelainberry, and garlic mustard (units 892, 891, 893, 889, 900, 887, 897, 898). Some of these species, such as garlic mustard, were not present in 1988, but are now abundant. The vine species have increased in abundance in all units of the knoll area. Dumping was severe in 1988 but has now abated. Litter, however, is common on the edges of the area, especially along the Henry Hudson Parkway.

In addition to the oak and birch-dominated sections, large stretches of forest in this zone have a canopy of primarily sassafras. Abundant sassafras regeneration, resulting from past fires, is common, with distinct stands of varying age. Several of the younger stands are pure sassafras, though most of the older ones are more diverse, with oak, black cherry, black gum, ash, hickory, and gray birch, as well as emerging native herbaceous communities including asters, goldenrods, Virginia knotweed, ragweed, true and false Solomon's seals, white snakeroot, poison ivy, and Virginia creeper. As in almost every unit of this zone, invasive plants have moved in and become abundant since 1988, especially Japanese honeysuckle and Asiatic bittersweet. These closed canopy sassafras units have taken over areas that were largely scrub/woodland dominated by species including cool season grasses, big tooth aspen, black oak, black cherry, Rubus species, goldenrods, and dogbane.

In the middle of the zone, surrounded by closed canopy forest, is the scrubby remnant of a meadow (unit 934). The 1988 survey revealed that this was an extensive little bluestem meadow. It has now transformed into more of an old field, with cool season grasses, blackberry, white sweet clover, ragweed, late Eupatorium, butter-and-eggs, and goldenrods. Little bluestem is no longer present. Woody plants have also become established, such as black cherry, black locust, turkey oak, and Virginia creeper. Invasive Asiatic bittersweet and mugwort have established a stronghold and are on a trajectory to dominate the area. However, bordering the meadow and closing in from all sides is abundant regeneration of sassafras and smooth sumac, among other species (units 927, 959, 955, 935). These units were part of a scrubby old field community in 1988 and are now largely closed canopy forest, but Japanese honeysuckle, wineberry, mugwort, Asiatic bittersweet, and bush honeysuckle also have become established here and threaten the succession from scrub to forest.

The smaller, grass-dominated units found throughout the center of the zone (units 957, 951, 953, 954) grow on shallow soils and exposed rock. Twenty years ago, these areas
were a woodland of black oak, red oak, and black cherry. Currently, cool season grasses and black locust dominate, and poison ivy, ragweed, dogbane, boneset, sassafras, *Rubus* species, and sumac are present. It appears that the shallow soils are inhibiting the regeneration of woody plants, but fortunately there few invasive plants. Erosion, trash, and compaction, noted disturbances in 1988, appear to no longer be a concern.

A local environmental group and some staff naturalists are interested in keeping these open areas as meadow. Some fieldwork has been done, such as cutting back encroaching woody plants from inside the open area and its periphery. However, the encroachment of invasive plants, especially Japanese honeysuckle and Asiatic bittersweet, is the biggest threat to the open area and surrounding forest. If not addressed soon, these aggressive vines will eventually dominate the entire central portion of this zone.

**Vault Hill Recommendations:**

- **PRIORITY**—Eradicate the aggressive encroachment of Asiatic bittersweet and Japanese honeysuckle from the most disturbed units (925, 028, 927, 934, 723, 933, 930, 931, 959, 957, 955, 961, 954, 942, 963). The large exposed areas of this zone are prone to infestations of sun-loving, aggressive vines and are currently on a trajectory to become overwhelmed by them.
- **PRIORITY**—Eradicate Asiatic bittersweet and porcelainberry at the edge of the forest surrounding the small knoll near Broadway (units 893, 901, 889, 900, 892).
- **PRIORITY**—Eradicate vines along forest edges throughout the zone (units 903, 905, 902, 906, 917, 918, 920, 897, 898). Mugwort should also be treated systematically. Some portions of this area will be suitable for planting native woodland species once the invasive plants have been removed. Eradication of invasive plant species here will reduce the dispersal of their seeds to other areas of the park.
  - Devise a cohesive plan to manage the open areas of this zone. Whether meadow or forest establishment is the objective, the most urgent action is to eradicate encroaching invasive plants, especially Asiatic bittersweet and Japanese honeysuckle.
  - There is great interest within the local birding community, local naturalists, and some staff to maintain the area as a meadow and embrace the unique structure that exists there as habitat for sun-loving herbs and forbs, dragonflies, breeding birds, and butterflies, bees, and other pollinators. Since the structure is already in place, and since the soils here are inherently shallow and parent rock material close to the surface, this would be one of the best areas in the park for a meadow. Most of the park is heavily forested and most openings in the canopy have already begun to revert to closed canopy forest or woodland. Park managers, the NRG, local naturalist groups, the newly formed Van Cortlandt Park Conservancy, and friends groups should reach a consensus on whether a meadow should be created and maintained here or not. The benefits are clear, but successful
establishment of a meadow requires consistent maintenance and monitoring, especially given the presence of abundant invasive plants on site.

- If meadow is the objective, specific actions and a maintenance regime are required. Mow annually or periodically to keep woody plants from becoming established, and weed selectively to eliminate undesirable species. Fence off desire lines throughout the open area to redirect foot traffic and reduce soil compaction, and seed and/or replant sloped sections to reduce erosion.

- If a meadow is not desired, monitor reemerging woody species and weed out unwanted species, and consider planting native trees and shrubs. Since the area already has traces of an early succession woody plant community, plant species characteristic of a new forest, such as red maple, birch, black cherry, and eastern red cedar.
Figure 21. Vault Hill Woodland and Meadow Management Zone
Allen Shandler Recreation Area

This zone consists of 79.2 acres of forest and woodland next to regularly maintained active recreation areas in the southeast section of the park (Figure 22). Two baseball fields (unit 704), two barbeque areas, and a 2-acre parking lot (unit 705) are surrounded by a mostly intact natural area. To the south, the zone thins to a strip of forest that arcs around the Mosholu Golf Course to the site of the DEP Croton Water Filtration Plant. The northern portion of the zone borders the Major Deegan Expressway on the west and Jerome Avenue, a major Bronx thoroughfare, on the east. The southern portion borders the Mosholu Parkway on the west, West Gun Hill Road, another major Bronx thoroughfare, on the south, and the golf course, the filtration plant site, and another large, active recreation and landscaped area of the park on the east (units 707 and 713).

The zone includes roughly 54.7 acres of closed forest, 13.0 acres of woodland, 2.2 acres of open herbaceous plant communities, 0.8 acre of sparsely vegetated land, 0.8 acre of vineland, and 0.6 acre of scrub. Most of the closed forest is in the northern part of the zone, with canopy tree species such as black cherry, red oak, tulip tree, and hickories. Also plentiful are Norway and sycamore maples. A 1-acre planted white pine grove is at the zone’s northernmost tip (unit 721) and is bordered by open areas of porcelainberry vineland and disturbed understory shrub communities that until recently included multiflora rose, Asiatic bittersweet, and five-leaf aralia.

The middle of the zone has patches of relatively healthy moist forest, crisscrossed by a small network of paved paths. These patches include abundant white oak, sweetgum, and bitternut hickory in the canopy with black cherry, red maple, spicebush, arrowwood, sassafras, blackhaw, hornbeam, and highbush blueberry in the understory. The forest floor has abundant Virginia creeper, white avens, poison ivy, grape, smartweed, Virginia knotweed, skunk cabbage, giant ragweed, and many other native species. There is some encroachment of exotic invasive plants, but this is progressing slowly due to the otherwise healthy and robust native plant community. The invasives include Norway and sycamore maples, multiflora rose, Asiatic bittersweet, Japanese knotweed, white mulberry, and Asiatic dayflower.

The thin strip of forest and woodland that arcs around the golf course from the west has an abundant and diverse native tree canopy of hickory, some black walnut, American elm, and pin oak, but is dominated by black locust, Norway maple, and Ailanthus. This part of the zone becomes more disturbed to the south, with a stretch along the southern border consisting of black locust, Asiatic bittersweet, and mugwort with abundant native black cherry. Just north of the water filtration plant is a 3.5-acre wetland (unit 909). Several culverts run through it, and it is wet for most of the year. The canopy here is predominantly red maple, green ash, and sweetgum, with an understory of sweet pepperbush, blackhaw, blackberry, and highbush blueberry.
Description and Changes from 1988 to 2009

A belt of relatively healthy forest bisects the zone east to west, from the wetland (unit 909) to the moist forests south of the baseball fields (units 913, 884, 878, 877, 837). Red maple, white oak, black cherry, hickories, elm, and sweetgum dominate this forest, though invasive plant species are present. A network of asphalt trails, the road to the golf course clubhouse, and a picnic area disrupt the continuity of the forest, but it appears robust. According to the 1988 survey, red and pin oak were dominant, but today they are hardly evident. In the last 20 years this stretch of forest has changed from woodland to closed canopy forest. On the fringes of the wetland, red oak is still found (units 916, 915, 914, 908, 910), but Norway maples have moved in and dominate in some places. Also around the wetland abundant invasive ground covers, including English ivy and periwinkle, are creeping closer to the heart of the healthy woods. Asiatic bittersweet in the understory of this entire section of forest has also become more abundant.

Farther north in the zone is a large swath of forest dominated by Norway and sycamore maples, black cherry, and black locust (units 863, 857, 854, 873). Much of this was a picnic area when the recreation area was established, and remnants of the picnic tables’ concrete pilings were only recently removed. By 1988, the picnic ground had fallen into disrepair and was the scene of vandalism and large-scale dumping. Since then, the dumping has mostly ceased and vegetation has moved in. Unfortunately, invasive plant species have colonized this highly disturbed landscape, including Asiatic bittersweet, Japanese knotweed, porcelainberry, multiflora rose, five-leaf aralia, and the invasive maples. Ecological restoration is currently underway, and already a planted native palette, including tulip tree, oaks, elderberry, and spicebush, is thriving in the understory. However, the removal of so many maples has enabled considerable light to reach the forest floor, setting off an invasion of garlic mustard.

The strip of natural area that runs along the western and southern borders of the zone continues to be a mix of scrubby woodland and pockets of closed forest. The herbaceous community is still dominated by mugwort, and abundant Norway maple has become established in the open woodland. In fact, the maple now dominates many units in this area (unit 846 and 829, among others). Rampant dumping, including vehicles, was noted in the 1988 survey. Trash is still a concern, but the dumping has largely abated. However, there is dumping of household trash and a large homeless encampment in the southwest corner (units 727 and 818), which in 1988 was a landscaped edge. About half an acre of ground is extremely compacted and eroded. Herbaceous plants have been dug out and young trees chopped in half. Fires were once a big concern in this corner, but appear to be less frequent.

The forest edge along the south border with the golf course consists largely of a black cherry and black locust canopy with sporadic herbaceous ground cover (units 818, 815, 813, 821, 825). A ring of even-aged sassafras, which can grow vigorously after moderate ground fires, is among the evidence of past fire (unit 812). Asiatic bittersweet has moved into the area and dominates the understory in places. The lawn that cuts through the forest patches in this area was once part of the golf course (unit 713). When construction
of the water filtration plant altered the shape of the course, this became an abandoned fairway. It is now maintained as a lawn/field with periodic mowing, though mugwort has emerged and is on a trajectory to become dominant. This open area would be a suitable place for a meadow.

**Allen Shandler Recreation Area Recommendations:**

- **PRIORITY**—Eradicate the invasive ground cover encroaching on the wetland (units 910, 912, 913, 908), particularly English ivy and periwinkle.
- **PRIORITY**—Remove the homeless encampment and build-up of debris in the southwest corner of the zone (units 727 and 818). As more debris accumulates, the area becomes more inviting for dumping. These conditions also pose health and public safety concerns, made even more urgent by the two large city schools only a couple of hundred yards away. The abundant multiflora rose around the area should be removed as soon as possible not only for ecological reasons but also to make the area more exposed to the sidewalk and nearby street. Better visibility into the site will help minimize illicit use.
- **PRIORITY**—The most severely disturbed forest units in the southwestern portion of the zone (units 821, 813, 812, 815, 818, 727, 828, 728, 846, 811, 839 among other, smaller units) should receive a full restoration regimen.
  - Monitor the forest floor in the wetland (unit 909) for the emergence of invasive plants within gaps in the canopy created by large fallen trees.
  - Encourage and promote opportunities for scientific research in the wetland forest (unit 909), unique within the confines of New York City. It should be utilized as a novel, in-situ laboratory to expand our knowledge of urban forest/freshwater wetland dynamics.
  - Consider creating an upland meadow on the forest edge at the south end of the zone (units 713, 815, 812). This would be most appropriate after mugwort eradication has been completed. Once that has been accomplished, put down seed and plant a full palette of plugs of appropriate open field, full sun herbs. Consult local experts on which herbaceous species would best benefit local pollinators.
Figure 22. Allen Shandler Recreation Area Management Zone
**Van Cortlandt Golf Course**

Van Cortlandt Golf Course runs the north/south length of the park’s midsection (Figure 23). Its 120.8 acres include grass fairways, forest edge, and forest. This zone comprises three main sections, all with the similar management concerns. The northern portion of the course consists of two parallel links with a small pond, bordered by the forests and edges of the Tibbetts Brook Wetland Corridor to the west and the Croton Woods to the north and east. The Mosholu Parkway separates this section from the rest of the course. Most of the course lies to the south in a section bordered on the east by Mosholu Parkway, on the north and west by Vault Hill, and on the south by Van Cortlandt Lake and the Major Deegan Expressway. The Tibbetts Brook Wetland Corridor runs through the western part of this section and is flanked on the east and west by fairways. The third section of the course lies farther south in a hilly area of fairways, forest, and another small pond. It borders the Major Deegan Expressway on the west, the Mosholu Parkway on the east, and the residential street Van Cortlandt South on the south. A large portion of the course was built on filled-in Tibbetts Brook wetland and as a result is sinking in places and is often wet. Its long fairways and scenic forested surroundings, quite unique in a major city, make it popular with regional golfers.

The zone is primarily fairway consisting of cool season grasses in large, open lawn settings. It includes 73.5 acres of herbaceous or turf communities, 37.6 acres of closed forest, 4.9 acres of vineland, 2.8 acres of woodland, 1 acre of open water (3 small ponds), and 0.8 acre of scrub. The forest surrounding the south and central portions of the course is dominated by black cherry. Bitternut hickory, Norway maple, and some red oak are also present. Large, mature red oaks are common in the forest along the eastern border of the course. The forest is diverse, with native plant communities that include viburnums, hay-scented fern, slippery elm, flowering dogwood, hackberry, false Solomon’s seal, and jewelweed. For the most part, however, the understory is heavily disturbed and invasive plants are abundant, including garlic mustard and large, mature porcelainberry and Asiatic bittersweet vines along the Mosholu Parkway. In the northern portion of the course, the surrounding forest is relatively healthy with abundant sugar maple, red oak, tulip tree, sassafras, American beech, New York fern, wild geranium, poison ivy, and black birch, among other species, although the understory includes multiflora rose, Japanese knotweed, and garlic mustard. The entire course is enclosed by an old, rusting chain link fence that serves as a trellis for invasive vines for most of its length.

**Description and Changes from 1988 to 2009**

Forested “islands” within the course consist largely of old, ornamental tree species such as crabapple, London plane, Cornelian cherry, and hawthorn as well as some pin oak. In some places there are herbaceous communities (units 735, 1325, 1317, 1314 among others). The longer, much larger forest patches are more diverse, with abundant pin oak, linden, black cherry, native *Rubus*, sassafras, white ash, red maple, poison ivy, and Virginia creeper (units 1322, 1342, 771). There is some invasive vine growth, and
multiflora rose is common. In the 1988 survey, soil compaction, dumping, and erosion were concerns but have since virtually disappeared. Some trash and feces are still found occasionally throughout these areas.

The perimeter of the course is heavily wooded, but as in forest edges throughout the city, invasive plants have taken hold and proliferate in the open sun. Along the northern edges, Asiatic bittersweet is a primary concern (units 1230, 738, 740, 1329, 1150, 1149, 739), and porcelainberry is present along most edges as well. Although neither vine was mentioned in the 1988 survey, they are poised to become dominant once large trees on the edge come down. The edge along the central part of the course is much healthier, with abundant mature tulip tree, bitternut hickory, sycamore, red maple, and sassafras among other species (units 1320, 1321, 1319, 761). Asiatic bittersweet and porcelainberry are present, but not as abundant as in the north section. Borders in the south section of the course are severely disturbed with abundant invasive plant growth, including Asiatic bittersweet, bedstraw, mugwort, porcelainberry, Siberian elm, garlic mustard, Norway maple, white mulberry, Japanese honeysuckle, and multiflora rose (units 776, 774, 772, 769, 773, 789 among several other smaller units). In 1988, this section of the course was heavily disturbed with dumping, trash, compaction, and erosion, but now, as elsewhere in the park, these disturbances have been eliminated. There is still evidence of heavy foot traffic through the area, but vegetation has largely filled in the barren areas recorded in the last survey.

The forest edges along all roadways are severely disturbed, with an abundance of porcelainberry, Asiatic bittersweet, Japanese knotweed, Japanese honeysuckle, garlic mustard, and multiflora rose. The corridor along the Moshulu Parkway north of the Major Deegan exchange is a major concern as large, mature Asiatic bittersweet and porcelainberry vines have climbed up the large oaks at the edge of the forest (units 1357, 1359, 1361, 1363, 1365, 1369, 1435 among other, smaller units). This is damaging in several ways: Seeds from these vines are now quite high in the canopy, making dispersal farther from the parent plant via birds and wind possible. And because these vines that have spread into canopy trees are mature and exposed to full sun, seed production is prolific. The golf course grounds staff does not currently have a plan to address the encroachment of invasive plants.

Van Cortlandt Golf Course Management Recommendations:

- **PRIORITY**—Immediately kill all large Asiatic bittersweet and porcelainberry vines along the Moshulu Parkway (units 1357, 1359, 1361, 1363, 1365, 1369, 1435 among other, smaller units). Address other targets such as mugwort, garlic mustard, and multiflora rose at the same time. Edges of the Major Deegan Expressway should be inspected for similar infestations and control measures should be taken in the most disturbed areas.

- **PRIORITY**—The southern stretches of forest in the zone (units 776, 774, 772, 769, 773, 789 among several other, smaller units) should receive a full restoration regimen.
• **PRIORITY**—Control vinelands on forest edges along the entire perimeter of the golf course.

• **PRIORITY**—Establish a dialogue with golf course maintenance staff on the importance of controlling invasive plants. Strive to produce a mutually agreed upon work plan in which golf course staff takes ownership of some eradication measures in and around the natural area islands within the course and along the fenced edge. An example of the type of work the golf course staff could realistically take on is the maintenance of the Japanese knotweed along the west edge of the course, just south of the Henry Hudson/Moshulu Parkway exchange (unit 745). According to the 1988 survey, this section was mowed but has since been abandoned. Perhaps the strategy should be to resume mowing or plant trees. To increase the feasibility of the efforts, the natural areas maintenance proposed to golf course staff should include activities they already undertake.
  o Conduct sweeps through the natural area islands within the course (units 1324, 735, 1322, 1319, 1314, 771, 763, 1313, 765, and other, smaller units) to prevent the spread of invasive vines and shrubs into the surrounding forest.
  o Systematically remove Norway maple communities throughout the zone.
  o Install bathroom facilities at the north end of the course to cut down on golfers defecating in the forest.
  o Install signage along the course informing golfers of the significance of the surrounding forests. Signs explaining any restoration efforts would be especially helpful if the work significantly alters the landscape.
Figure 23. Van Cortlandt Golf Course Management Zone
Mosholu Golf Course

The Mosholu Golf Course occupies the southeastern corner of Van Cortlandt Park (Figure 24). It was once a 15-hole course, but the construction of the DEP Croton Water Filtration Plant eliminated six holes, reducing it to a nine-hole course. After construction is completed, 10 acres of the plant construction site will be reclaimed as golf course. Currently the course is 51.1 acres and consists mostly of grass fairways along with portions of forest and woodland. This is the smallest natural area in the park, but its proximity to larger natural areas (such as the forested wetland in the Shandler Recreation Area, unit 909) makes proper management important. The north, west, and south sections of the zone are encased by the Allen Shandler Recreation Area. The east side is bordered by the 12-acre filtration plant site. After the 10 acres are reclaimed, the zone and golf course will border a portion of the busy Bronx thoroughfare Jerome Avenue. This course, built in 1914, is well-used given its proximity to the terminus of the #4 subway line.

The zone is primarily fairway consisting of cool season grasses in large open lawn settings. It includes 30.4 acres of mostly turf and low herbaceous species, 9.4 acres of closed forest, 9 acres of woodland, 1.4 acres of vineland, and 0.9 acre of sparsely vegetated land. The forest surrounding the course is relatively healthy, with a canopy dominated by white oak, sweetgum, black cherry, bitternut hickory, sassafras, black locust, and some American beech. Though some invasive plants, such as multiflora rose, garlic mustard, mugwort, and Asiatic bittersweet, are present, the understory is relatively healthy. Within the course are natural area “islands” that tend to be more disturbed than the surrounding forest. The tree canopy in these areas consists largely of black cherry, bitternut hickory, white oak, sassafras, pin oak, sweetgum, and sycamore. The understory has abundant invasive plant growth, including Asiatic bittersweet, Japanese honeysuckle, and Japanese knotweed. The entire course is enclosed by an old rusting chain link fence that serves as a trellis for invasive vines for about one quarter of its length.

Description and Changes from 1988 to 2009

The forest islands within the course are mostly closed canopy. The northern areas tend to have canopies dominated by white oak, sweetgum, black cherry, and bitternut hickory (units 802, 805, 1260, 1259, 1250, 1264, 1261 among other, smaller units). The understory varies, but includes relatively abundant Virginia creeper, poison ivy, a variety of docks, wood sorrel, native violets, and asters. Also present is a relatively low abundance but wide variety of invasive plants such as Japanese knotweed, Japanese honeysuckle, mugwort, wineberry, Asiatic bittersweet, and porcelainberry. Regeneration of canopy tree species does not appear to be common, and the influx of invasive species could put these forest segments on a trajectory toward full infestation as the old trees fall. The plant community in these areas appears to have changed little since the 1988 survey, though black cherry seems to have become more dominant and the understory
has filled in with more invasive plant species. Unlike in 1988, dumping is no longer an
issue anywhere on the course.

The forest islands in the southern part of the course are largely dominated by black
cherry. Also present are white oak, swamp white oak, pin oak, black locust, and sassafras
(one of the few canopy trees regenerating with any kind of significance), with elderberry,
arrowwood, goldenrods, jewelweed, Virginia creeper, and Virginia knotweed in the
understory (units 800, 801, 799, 1256, 797, 798, 806, 807, 809, 808, 810). These units
also have low-lying wet areas that appear to have once been part of a watercourse that
flowed through the area toward Van Cortlandt Lake. Changes in topography and
pumping by DEP at the plant site apparently have altered the course, though it still
seems to accumulate water seasonally. Red maple, pin oak, and jewelweed are abundant
in these wetter areas. Also abundant are invasive plant species such as mutliflora rose,
mugwort, garlic mustard, Japanese honeysuckle, and Asiatic bittersweet, including a 1-
acre vineland of almost exclusively Asiatic bittersweet that acts as a robust source
of dispersal in to surrounding areas (unit 806).

Asiatic bittersweet is found at intervals along the entire perimeter of the course. It is
most abundant along the western border and along the edges of most of the forest
islands in the southern part of course.

**Mosholu Golf Course Recommendations:**

- **PRIORITY**—Eradicate Asiatic bittersweet from the southern portion of the
course (unit 806). This is the number-one priority within this zone and should
take place as soon as possible.
- **PRIORITY**—The natural area islands within the course (predominantly units
800, 799, 810, 807, 808, 798, 797, 1259, 802, 804, 1260, 1250)
should receive
a full restoration regimen.
- **PRIORITY**—Control vinelands on forest edges along the perimeter of the entire
golf course.
- **PRIORITY**—Establish a dialogue with golf course maintenance staff on the
importance of controlling invasive plants. Strive to produce a mutually agreed
upon work plan in which golf course staff takes ownership of some eradication
measures in and around the natural area islands within the course and along the
fenced edge. To increase the feasibility of the efforts, the natural areas
maintenance proposed to golf course staff should include activities they already
undertake.
  - Install signage along the course informing golfers of the significance of the
surrounding forests. Signage explaining any restoration efforts would be
especially helpful if the work significantly alters the landscape.
  - Conduct sweeps through the natural area islands within the course after initial
restoration is complete as a maintenance measure to prevent the spread of
invasive vines and shrubs into the surrounding forest.
Figure 24. Moshulu Golf Course Management Zone
Implementation and Sustainability

Sustainability for Van Cortlandt Park’s natural areas does not mean only financial, social, and ecological soundness but also the institutional capability to perform the cyclical processes of data collection and analysis, and the planning, execution, monitoring, and evaluation of actions.

This section of the plan presents a general guide to implementing recommended management actions and a look at the requirements for long-term management of the natural areas, beginning with a description of the work currently being undertaken by the ten-year Croton Forest Management Program and following with some ideas for institutional capacity.

The Croton Forest Management Program
The goal of the Croton program in Van Cortlandt Park is to arrest the decline of the park’s forests and to help restore them. The program is based on initiatives to control invasive plants, the planting of native species, silvicultural treatment of existing forests, soil conservation and management, trail management, and boundary protection. The work plan for the Croton Forest Management Program in Van Cortlandt Park is described in Appendix A.

Work carried out under the Croton program has provided useful guidelines for personnel, materials, and equipment required for specific activities as well as expected work outputs.

Personnel and Institutional Structure
Upon conclusion of the Croton program, the staff should become part of a forest management crew, which should fall under an overarching landscape management unit at Van Cortlandt Park. This unit should be under the leadership of a single director and have within its purview all forest, meadow, and wetland management, arboriculture, gardening, soil conservation, and trail management functions. This integrated arrangement is expected to lead to significant cost savings, greater efficiencies, and reduced land-use conflicts.

Staff
Due to the technical nature of natural areas management and restrictions on the use of chemicals and machines, park staff will undertake most of this work. However, there is an excellent opportunity for the direct or indirect involvement of members of the public, and this should be actively promoted. Forest management staff should be year-round, complemented by seasonal employees, interns, and community service personnel where appropriate, and supervised by a team leader. The team leader should have a degree in forest management as well as good administrative, human resources, communication, and teaching skills to work well with the staff, volunteers, and the public. He or she should also have experience with Global Positioning Systems (GPS) and Geographic Information Systems (GIS) technology.
Ideally, each core area would have at least two dedicated trained staff with good communication skills who work well with the public and volunteers. Staff should have academic training or practical experience in ideally two or more of the following areas:

- Silviculture and forest management,
- Soil science and management,
- Operation and routine maintenance of two-cycle, diesel and gasoline engines, machines, and vehicles,
- Meadow management,
- Wetland management,
- Wildlife management, and
- Environmental education and working with the public.

**Volunteers, Interns, and Community Service Participants**
Volunteers will work under the supervision of staff. Requirements, opportunities, and other guidelines for volunteers are already spelled out in park policies. A special group of adult volunteers called natural areas stewards is already in place, and will continue to receive training, hand tools, and site assignments that enable them to work with less field supervision.

**Training Needs**
Staff will need training in a number of areas, including:

- Tree pruning and felling techniques for urban areas,
- Chainsaw and small machine safety, operation, and maintenance,
- Preventive maintenance and operation of diesel- and gasoline-engine vehicles, including specialized training for small utility vehicles,
- Integrated pest management (IPM) best practices, including appropriate and lawful herbicide use, and
- Customer service and interacting with the public.

Astute staff selection and the cultivation of appropriate values are important ingredients for building the personnel base necessary for an outstanding natural areas management program.

**Equipment and Materials Requirements**
The Croton program has provided the vehicles, small equipment, general supplies, and planting material needed for restoration and maintenance of the park’s natural areas. When the program ends, resources will need to be available for acquisition and maintenance of equipment and supplies.

**Vehicles**
Vehicles will be necessary to transport materials, equipment, and personnel to locations throughout the park. Small utility vehicles that can be driven on trails to the farther reaches of the park and can carry a small motor-operated sprayer would be helpful. Gators were used under the Croton program, but these vehicles, though relatively
inexpensive, have low ground clearance, open bottoms, and basic features. They have broken down regularly in woodland and snow conditions and are not suitable for snow removal or in areas where there is salting or surface water.

A vehicle capable of performing soil-related work will also be necessary. Under the Croton program, Bobcat skid steer vehicles were purchased. The advantages of these vehicles were cost and the number of attachments they come with, but the skid steer causes much soil damage. The articulating designs of Bobcat or other manufacturers, such as Volvo, are a better option.

Another necessary vehicle, which is useful for storm damage work on street trees, is the chipper with winch. Generally, this has proven sufficient to cut and move the materials into the woods where they can decay and recycle. Operation of the chipper requires a vehicle with an enclosed bed at the back for shooting the chips, and a dump feature to offload them.

Finally, a 300-gallon water rig is necessary for watering planted material, especially ball- and burlap trees along edges or in open areas. Normally, small container plants put into the woods do fairly well without irrigation, but record high temperatures during the summer of 2010 made it necessary to provide supplemental irrigation. A smaller tank with a capacity of 50 to 100 gallons is necessary for spraying large areas for invasive plant management.

Staff will need to be trained in the operation, safety, and routine maintenance of all of the above equipment.

**Small Equipment**

A range of small equipment is necessary for a variety of purposes, including auguring of planting holes, hedge trimming, weed whacking, and chainsaw work. These have been provided under the Croton program, but replacement and maintenance budgets will be required when the program ends. Experience during the Croton program suggests that the small equipment used, made by Stihl, has a useful life of three to five years. A more environment- and user-friendly option worth considering is 4-cycle machines, technology that is commercially available but still being improved.

**Native Planting Materials**

Most of the planting undertaken under the Croton program utilized trees and shrubs in one-gallon containers and herbaceous plant plugs. These were supplied by the Greenbelt Native Plant Center and paid for under the program. Ball- and burlap trees were obtained from private sources. Procurement of both of these, as well as other planting materials, will be necessary in the long run. A native planting list for the park can be found in Appendix C.

**Financing, Fundraising, and Cost Management**

It is well established that natural areas provide a range of environmental, psychological, and recreational benefits to humans. The scarcity of natural areas in intensely populated
urban natural areas like New York City increases their benefits and value. Recreation includes not only sports and other active pursuits but also a number of so-called passive uses, such as the enjoyment of nature. One challenge facing urban parks administrations is the perception that these “amenity” benefits, though desirable, are optional rather than essential. This perception is a serious challenge for funding natural areas. On top of this is the notion that these public benefits ought to be free, eliminating the option of user fees. While some of the benefits of urban natural areas are classified in economics under “intangibles” because they are not tradable services, the cost of having and maintaining them is indeed substantial and not often fully appreciated. Despite the financial challenges caused by the recent recession, Mayor Michael Bloomberg acknowledged the importance of continuing to fund and keep parks open.

To sustain the capability to manage and maintain the park’s natural areas, new and additional funds will be necessary immediately upon conclusion of the Croton program. Over the long term, diverse funding and revenue sources will be necessary to supplement financing from the city. The best way to extend and solidify the benefits of all the good work and meaningful results achieved by the Croton program would be to ensure that there is no relapse into inattention to natural areas management and maintenance due to a lack of resources.

The establishment of the Van Cortlandt Park Conservancy increases opportunities for funding and raising revenue. Astute marketing of the case for funding and innovative ventures to generate income are necessary. Business initiatives, partnerships, funding, and fees will need to be explored. There are successful examples of innovative financing, such as the urban park system in Wheeling, West Virginia, which derives 99 percent of its revenue from non-tax sources. Commissioner Randolph Worls has pointed out two key lessons learned, both of them applicable to Van Cortlandt Park. First is that creating first-class facilities can attract paying customers, and second is that local parks can attract people from out of town if they offer quality experiences.3

Increasing the efficiency of management efforts by strategically following the goals outlined in this plan can manage costs without sacrificing quality. However, this must be pursued in tandem with fundraising and revenue generation.

**Monitoring, Risks, and Assumptions**

Two kinds of monitoring are recommended. The first is technical: monitoring studies to determine the impact of management interventions in natural areas. The protocol for management in natural areas developed by the NRG can be utilized for this purpose or modified, as appropriate. Means of verification include annual or other periodic measurements as well as annual reports and entitation reports.

The second form of monitoring is programmatic: measuring overall program deliverables against the stated goals, objectives, and timelines. Because none exist as yet,

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indicators for this form of monitoring need to be set. Means of verification include annual reports, monthly horticulture reports, and other periodic reports.

A number of assumptions underlie the proposed actions in this management plan. A number of risks are also associated with the recommended actions. The precautionary principle should be adopted as a risk-management strategy, meaning that whenever there is uncertainty or risk, the preferable option is to err on the side of caution.

Some of the assumptions and risks associated with the goals and actions set out in the plan are:

- Public support and financing for the management of the park’s natural areas will be forthcoming and sufficient;
- The Conservancy will add significantly to the park’s revenue generation;
- New York City Parks & Recreation will support the ideas and actions recommended in this plan;
- Catastrophic climatic, human, or biological occurrences with the potential to fundamentally impede the health and survival of the park’s natural areas will not occur;
- There will be political support for implementing the plan, or political support can be generated;
- Political change at the municipal level will not adversely affect the continuity in implementation of this plan; and
- Competent, qualified, and experienced personnel will be available and recruited.
REFERENCES


Metcalf and Eddy of New York, Inc. & Hazen and Sawyer Environmental Engineers and Scientists. (2003). Croton water treatment plant draft supplemental environmental impact statement, Volume A.


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GLOSSARY

ACID RAIN – The result of sulfur dioxide (SO₂) and nitrogen oxides (NOₓ) reacting in the atmosphere with water and returning to earth as rain, fog, or snow.

ACIDIC – With a pH below 7.0 (the point of neutrality).

AESTHETICS – The principles that deal with beauty and visual satisfaction.

ALKALINE – With a pH above 7.0 (the point of neutrality).

ALLELOPATHY – The inhibition of growth in one plant species by chemicals produced by another species.

BEDROCK – The solid rock underlying the soil and from which the soil is partly derived.

BIODIVERSITY – The degree of variation among living things, including the variability in genes, species, and habitats.

BIOMASS – The total amount of material from the living organisms in an area.

BUFFER – A piece of land or water adjacent to or surrounding an area that is intended to protect the area. For instance, a forest may be 300-400 feet wide with a buffer of 50 feet surrounding it.

CANOPY – The uppermost layer of a forest consisting of the branching, spreading part of the tall trees.

CLIMATE – The long-term average weather patterns in a particular place.

CLIMATE CHANGE – Long-term change in weather patterns including, for example, change in the average temperature or the frequency of extreme weather.

CLOSED FOREST – A forest in which the canopy trees form a continuous, interlocking layer with at least 80 percent closure.

DISTURBANCE – A change in environmental conditions that affects an ecosystem in a pronounced way.

ECOLOGY – The study of the distribution and abundance of living things and their interactions among themselves and with their environment.

ECOLOGICAL RESTORATION – The intentional process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. It may include recovery of ecosystem function (natural processes), integrity (species composition and community structure), and sustainability (resistance to disturbance and resilience). A restoration project uses a reference ecosystem as a model for planning and begins with an understanding of the ecosystem’s historic trajectory. The goal is to return the ecosystem
to a state that resembles a prior state or to another state that could be expected to develop naturally within the bounds of the historic trajectory. The restored ecosystem may not necessarily recover its former state, since contemporary constraints and conditions can cause it to develop along an altered trajectory. Nonetheless, the targets to be achieved in restoration do not rely on the former state and should be more concerned with ecosystem function, biodiversity, integrity, and sustainability.

ECOSYSTEM – The total of all interacting living and non-living things in a specific environment.

ECOSYSTEM FUNCTION – The dynamic attributes of ecosystems, including interactions among organisms and interactions between organisms and their environment.

EDGE EFFECTS – Changes in microclimate, vegetation, and species composition that occur where two habitat types meet.

ENTITATION—The process of identifying and describing discrete vegetation units (entities) to produce a general inventory of an area’s plant communities based on species and structure conducted by means of aerial photograph interpretation, field reconnaissance, and geographic information systems (GIS).

EUTROPHICATION – An increase in nutrients in an ecosystem, usually water, that usually causes an increase or decrease of plant growth.

EROSION – The dislocation and movement of particles of soil or rock by water, wind, or ice.

EXOTIC SPECIES – An introduced species not native to an area.

FOOD CHAIN – A group of organisms related to each other by the fact that each member of the group feeds on the one below it in a feeding hierarchy.

FOREST – A community of plants that is dominated by trees.

FOREVER WILD PRESERVE—A natural area within New York City parks with high habitat value. Such sites are the largest intact natural areas and have connectivity with other important natural areas. They typically have relatively undisturbed soils and exemplify historical regional ecosystems of freshwater wetland, upland forest, tidal marsh, grassland, and coastal shrubland communities. Most also include rare plants or animals.

GREEN INFRASTRUCTURE – An interconnected natural life support system consisting of waterways, wetlands, woodlands, wildlife habitats, and other natural areas and open spaces that support native species, maintain natural ecological processes, and contribute to the health and quality of life of people and communities.

GROUNDCOVER – Low-growing plants, generally herbaceous, that provide protection from erosion and drought.
HABITAT – The place where a living thing naturally or normally lives and/or forages.

HABITAT Fragmentation – A process of change that involves the breaking up of habitat into smaller, disconnected pieces or fragments thus reducing ecosystem function and diversity.

Herbaceous Vegetation – Plants that lack permanent woody stems but instead are composed of succulent material and usually die back in winter in the temperate zone.

Herbaceous Communities – Areas where grasses, graminoids, and other herbaceous plants are the predominant cover, though woody plants may have a limited presence.

Hydrology – The science dealing with the properties, amounts, and circulation of water on the surface of the land, within soil or rocks, and through the atmosphere.

Important Bird Area – An area recognized by the National Audubon Society as important habitat for the conservation of bird populations.

Interior Habitat – Habitat that lies beyond the influence of both microclimatic and biotic edge effects and therefore manages to sustain the viability of the plant and animal communities that depend on its generally stable environmental conditions.

Invasive Species – A species that is not native to an area and whose introduction to that area causes or is likely to cause ecological or economic harm or harm to human health.

Landscape – The physical, living, human, and engineering features of an area of land.

Land Use – How the land is used, whether for industry, residences, recreation, or conservation.

Liana – A woody vine. Examples include summer grape (native) and oriental bittersweet (invasive).

Litter Layer – The top layer of soil, usually in a forest, composed of leaves and other plant material in a not yet fully decomposed form.

Meadow – An area or field vegetated primarily by non-woody or herbaceous vegetation.

Native – A component of an ecosystem prior to colonial America.

Natural Area – An area with substantial ecological value. Such areas may or may not overlap with Forever Wild sites. They serve as habitats, buffers, and ecological connecting corridors protecting species and facilitating the movement of pollinators, seeds, and wildlife across a fragmented landscape.
NATURAL RESOURCES – Naturally occurring elements in the environment that are of current or potential use to humans or other living things.

PROPAGULE – Any plant material that can propagate or reproduce a plant. Examples are seeds and stem cuttings that can grow into new plants.

pH – The acidity or alkalinity of a soil, expressed in pH values. For example, soil pH is classified as follows in the NYC Soil Survey:

- **Extremely acid** < 4.5
- **Very Strongly acid** 4.5 to 5.0
- **Strongly acid** 5.1 to 5.5
- **Moderately acid** 5.6 to 6.0
- **Slightly acid** 6.1 to 6.5
- **Neutral** 6.6 to 7.3
- **Mildly alkaline** 7.4 to 7.8
- **Moderately alkaline** 7.9 to 8.4
- **Strongly alkaline** 8.5 to 9.0
- **Very strongly alkaline** > 9.1

REFERENCE ECOSYSTEM – The ecosystem that existed prior to colonial America. The reference ecosystem serves as a model for planning a restoration project, and later for its evaluation. In its simplest form, the reference is an actual site, its written description, or both.

REGENERATION – The process of renewal, growth, or restoration of an organism, natural community, or natural process.

SPARSELY VEGETATED AREAS – Areas with predominately bare mineral soil, gravel, asphalt, or concrete; plants may be scattered or absent.

SCRUB – Shrubland or thicket composed mainly of woody plants 1 to 15 feet tall.

SHRUB – A short woody plant, usually under 15 to 20 feet (5 to 6 meters) tall that consists of multiple stems branching near ground level.

SOIL – The unconsolidated or loose covering on the Earth's surface, usually occurring naturally or, in urban environments, partly formed from materials introduced by human activities.

SOIL HORIZON – A layer of soil, approximately parallel to the surface, with distinct characteristics produced by soil-forming processes. An uppercase letter is used to represent the major horizon, followed by numbers or lowercase letters, which represent subdivisions. The 2011 New York City Soil Survey includes the following:

- **O horizon** – organic soil material from fresh and decaying plant residue
- **A horizon** – mineral horizon at or near the surface enriched in organic matter.
- **B horizon** – mineral horizon below an A, characterized by one or more of the following:
  1) accumulation of clay, sesquioxides, humus or a combination of these;
  2) blocky or prismatic structure;
  3) redder or browner colors than the A or C horizon.
C horizon – mineral horizon, excluding bedrock, little affected by soil forming properties.
M layer – human manufactured subsoil layer that is physically root-limiting.
R layer – hard bedrock.

Subdivisions or kinds of major horizons include:

a – highly decomposed organic material (sapric); used with O
b – buried genetic horizon
e – intermediately decomposed organic material (hemic); used with O
g – strongly gleyed (from anaerobic conditions), chroma of matrix or ped faces 2 or less
i – slightly decomposed organic material (fibric); used with O
u – horizon containing artifacts
w – development of color or structure; used with B

SUCCESSION – A process through which the plant communities in an ecosystem change as the plants respond to and modify their environment.

SUSTAINABILITY – The use of resources through methods, systems, and strategies that meet present goals while maintaining the economic, social, and ecological value of the resources.

VIABILITY – The ability to live, develop, and propagate as an ecological entity. Among the prerequisites for viability are appropriate size and shape, good health, and protection from significant negative human impacts.

VINELAND – An area characterized by the presence of at least 30 percent woody vines, often found on forest edges and disturbed open areas.

WATERSHED – The land area over or through which water from rain and snow melt drains downhill into a body of water (river, lake, wetland, etc.).

WETLAND – An area of land whose soil is saturated with water either permanently or seasonally.

WILDLIFE – All plants, animals, and other organisms that are not domesticated and normally are found in the wild.

WILDLIFE CORRIDOR – An area that connects two habitat fragments and permits movement and genetic interchange of populations that otherwise would not be easy or possible.

WOODLAND – Habitat dominated by trees in which the trees do not occur as densely as in a forest and therefore have more sunlight and less shade under the canopy layer. Closure of a woodland canopy is between 30 percent and 79 percent.

ZONING – A technique in land use planning that designates permitted uses of land.

In the Croton Forest Management program, we generally adopted the Natural Resources Group strategy of first targeting areas having the greatest amount of native structure and of working outwards. This strategy is recommended by Scott, who suggests that the idea is to move from the best towards the worst to allow existing advance regeneration and seeds of native plants the best change to regenerate.

Howell identifies at least six approaches to forest restoration, parts of which are built into the strategy we employ at Van Cortlandt Park.

For sites with some canopy present:

- Plant fast-growing tree and canopy species to help close gaps and create sub-canopy strata.
- Plant shrubs along with the trees, both planted at high density to crowd out competing invasive weeds. Self thinning and mortality as expected to naturally occur.
- Supplement the ground layer, if necessary, with native herbaceous species.

For open sites:

- Plant fast-growing tree species to help create a canopy layer.
- Plant shrubs along with the trees, both planted at high density to crowd out competing invasive weeds. Self thinning and mortality as expected to naturally occur.
- Supplement with native herbaceous species.
- Supplemental planting, especially with late Successional, ground layer, and shrub layers will be planted as follow-up over the next decades.

The work plan is presented as two separate sets of actions based on the two complementary restoration projects executed by Van Cortlandt Park (VC) AND the Natural Resources Group (NRG).

Van Cortlandt Work Plan Details

- **VC2_S11**
  - *Dominant invasive plants: Multiflora rose, Norway maple, porcelainberry, garlic mustard, bittersweet*
  - This unit actually contains two distinct areas within the highly disturbed Shandler Recreation Area. One is a forested wetland with perennial standing water. It appears to be a relatively intact wetland community. Work there will require only limited planting following the removal or treatment of Norway maples and multiflora rose. The other area, closer to the Deegan, is more mesic and more severely dominated by canopy Norway maples.

- **VC6_S11**
- **Dominant invasive plants:** Multiflora rose, Norway maple, porcelainberry, garlic mustard, bittersweet, black locust, Japanese honeysuckle

Porcelainberry and bittersweet were the targets of a foliar application in fall 2010. In early spring the crew will apply herbicide targeting remaining multiflora rose and Japanese honeysuckle at least a month before planting commences in spring 2011. Much of the area is already ready for planting.

- **VC1_F11**
  - **Dominant invasive plants:** multiflora rose, Norway maple, garlic mustard, bittersweet, black locust

  This is a disturbed site beside the rich moist interior Northeast Forest. The invasive plants dominant here are present in the nearby undisturbed forest, with a few large invasive trees and an understory crippled by bittersweet and grape vine in places. The crew has been cutting and pulling the vines during the winter seasons in order to facilitate forest regeneration. At the site, the crew will target multiflora rose along VC East over winter and early spring 2011. In areas identified for planting, the crew will remove or kill Norway maples and black locusts and spot spray invasive vines. The crew will be careful not to let too much light reach the forest floor in order to prevent invasion of mile-a-minute vine from nearby sites. Despite the presence of invasive plants, this area has a rich diversity of native shrubs and substantial sugar maple recruitment.

- **VC3_F11**
  - **Dominant invasive plants:** Norway maple, bittersweet, porcelainberry, tree of heaven, white mulberry, Siebold’s viburnum, shrub honeysuckle, Japanese knotweed

  This site is a steep engineered slope from the parade ground to the Putnam Trail and the Tibbet’s Brook Wetland. The crew will treat Norway maple, bittersweet, porcelainberry, knotweed, tree of heaven, white mulberry, Siebold’s viburnum, and shrub honeysuckle with cut-stump treatments during the winter and foliar applications during the summer.

- **VC4_F11**
  - **Dominant invasive plants:** Norway maple, multiflora rose

  This site is a slope adjacent to a wetland. The top of the slope is mostly Norway maple and the slope itself is largely multiflora rose. Replacing these with native plants will increase the habitat value of the area and reduce runoff and erosion. The crew will target invasive plants during winter 2011 and the subsequent growing season.

- **VC5_F11**
  - **Dominant invasive plants:** porcelainberry, mugwort

  This site, adjacent to a planting site, was once lawn that has been allowed to serve as a meadow, having not been cut for some years. Some native wildflowers did colonize the site, but it is mostly grasses and mugwort. The crew treated porcelainberry there and on the planted slope in fall 2010. In order to suppress the undesirable plants there to establish a diverse and aesthetically pleasing meadow the area will be subject to repeated herbicide applications during the course of the year, with one final application in late summer about a month
before planting commences. This area will be planted with native herbaceous plugs in September as part of a volunteer program in partnership with the Urban Park Rangers. The crew will also inquire with the Native Plant Center about possible seed mixes to diversify and bolster the planting effort. The Urban Park Rangers will be in charge of maintaining the area during the first two years, after which point maintenance requirements should diminish substantially. This could be a great pilot for similar efforts around the park at its edges and will greatly increase the habitat value and aesthetics of the meadow.

- **FoVC1_F11**
  - *Dominant invasive plants: porcelainberry, mugwort, tree of heaven, Norway maple, white poplar, white mulberry, bittersweet*
  - This area of the park is one of great neglect and misuse. Evidence of sexual activity and drug use is prevalent in and around this area; a large fire pit was present in the middle of the field in summer 2010. The woodland itself is highly dissected, having served as a barrier between now-defunct fairways, but does not appear to have been subject to great disturbance in the past. The plant communities there are consistent with the topography of the area and mostly are recruiting successfully. However, invasive plants are moving in, especially on the edges and where canopy trees have fallen. The crew will undertake foliar and basal bark application of herbicide during the growing season, followed by cut-stump treatment of resprouting porcelainberry. Friends of Van Cortlandt will subsequently take the lead on restoration, planting and stewardship of the area with the aid of interns and community volunteers as part of a project partially funded by a DEC grant.

- **VC7_S12**
  - *Dominant invasive plants: Norway maple, English ivy, wisteria, bittersweet*
  - This area is plagued by a well-established wisteria invasion, in addition to English ivy. Spring 2011 will give the crew a chance to evaluate the success of late fall treatment of wisteria. During early spring 2011 the crew will treat English ivy.

- **VC8_S12**
  - *Dominant invasive plants: tree of heaven, porcelainberry, mugwort*
  - This site is at the base of a slope behind the dog run at the northern edge of the Parade Ground. The slope itself is dominated by upland native plant communities, but at its base are a number of invasive trees and a curtain of porcelainberry. The crew cut the porcelainberry vines in summer 2010 and will spray them during the growing season in 2011.

- **VC9_S12**
  - *Dominant invasive plants: tree of heaven, porcelainberry, mugwort, black locust, multiflora rose, Japanese honeysuckle, garlic mustard*
  - This slope is highly disturbed, having supported a railroad right-of-way in its history. The crew will treat mugwort, Japanese honeysuckle and multiflora rose during spring 2011 and porcelainberry in summer/fall 2011. Undesirable trees will be thinned during winter 2011-12.

- **VC10_F12**
  - *Dominant invasive plants: Norway maple, multiflora rose, bittersweet*
This area is a disturbed slope between Mosholu Parkway and the bike path. Where the golf course fence ends, work will extend to the west toward Classic Playground. There is also a possibility of improving the habitat value of the edge of the golf course inside the fence, currently dominated by mugwort.

**VC11_S13**

*Dominant invasive plants: Porcelainberry, bittersweet, burning bush*

The identified area encompasses large canopy gaps along the Old Croton Aqueduct Trail overrun by porcelainberry among other invasive plants. It has been hedge trimmed previously; foliar treatments will take place in summer/fall 2011, with follow-up in 2012.

**VC12_S13**

*Dominant invasive plants: Periwinkle, English ivy, bittersweet*

This unit comprises the Jerome Wetland. Areas will be treated for periwinkle, English ivy, and bittersweet, with herbicide applications taking place outside of the delineated wetland. Within the wetland, help may come from hand-pulling by volunteers and staff.

**VC13_F13**

*Dominant invasive plants: Mile-a-minute vine, Japanese hops, Japanese knotweed, Phragmites, bedstraw, princess tree, mugwort, mulberry*

This area is the DEP water tunnel # 3 site within the park. Following the installation of the tunnel, the area has become overrun with invasive annuals, perennials and trees. The crew will continue to try to prevent the seed production of mile-a-minute vine in the area by mowing, hedge-trimming and hand-pulling. Foliar applications will begin on the southern edge of the site and will target woody perennial invasives in fall 2012 or earlier if time allows. In spring 2013 the area will be treated with post-and pre-emergent herbicides in preparation for planting.

**VC14_S14, VC15_S14**

*Dominant invasive plants: knotweed*

These areas are well-established tracts of Japanese knotweed. Annually, the crew will cut these stands three times during the growing season, applying herbicide in late fall until control is achieved. By spring 2014 we hope to plant these areas.

**VC16_S14**

*Dominant invasive plants: knotweed, mile-a-minute, Norway maple, shrub honeysuckle, bittersweet, porcelainberry, mulberry, Japanese angelica tree, bedstraw*

This area is the northern border of the Northeast Forest. Guardrails and fencing installed in 2010 have ameliorated problems of dumping and parking on Parks land, allowing restoration of the area to proceed. It is largely a Norway maple-dominated stand, but has many other invasive plant issues. Where Norway maples dominate, the understory is bare. Elsewhere, the above enumerated invasive plants are dominant in the understory.

**VC17_F14**

*Dominant invasive plants: bittersweet, multiflora rose, porcelainberry*
The crew will target multiflora rose and bittersweet dominated areas along the Major Deegan Expressway. Foliar treatment should begin in 2012.

**VC18_S15**

*Dominant invasive plants: multiflora rose, bittersweet, Norway maple, mulberry*

The crew will restore the abandoned railway corridor in the Northwest Forest, currently dominated by invasive trees, shrubs and vines but near relatively undisturbed habitat to the east.

**VC19_F15**

*Dominant invasive plants: bittersweet, porcelainberry, tree of heaven, wineberry*

The crew will restore vine-dominated landscapes along the Henry Hudson Parkway. Hedge trimming will be followed by foliar application and subsequent cut stump treatments.

**NRG Work Plan Details**

**NRG1_F11**

*dominant invasive plants- porcelainberry, Asiatic bittersweet, multiflora rose, Norway maples*

This is a very large area and highly disturbed site. It will take multiple years to restore it. Clearing began in this area in the winter of 2009. Treatment and additional clearing will continue through summer 2009 and go through 2011. The majority of the site will be planted in fall 2011, though a smaller upland portion will be planted in spring 2011.

**NRG2_F12**

*dominant invasive plants- porcelainberry, Asiatic bittersweet, multiflora rose, Norway maples*

This is a large area of complex plant communities, ranging from relatively healthy understory to disturbed vinelands and everything in between. A portion of this area is Norway maple forest where treatments will begin spring 2010. The vineland and disturbed understory portions of the area will begin in summer 2010 and should be ready for planting by 2012. Some of the less disturbed areas could be ready for planting by fall 2011.

**NRG3_F12**

*dominant invasive plants: porcelainberry, Asiatic bittersweet, multiflora rose, bush honey suckle, garlic mustard*

This is a continuation of VC3 and VC4, but we cannot began cutting or treating here until pre-restoration monitoring is completed by the NRG science team. Monitoring began here in spring 2009 and ended fall 2010. At that time work in the site will begin and planting can begin in the fall of 2012. NRG scientists have set up a board transect through the site to measure abundance of salamanders and they have for routinely conducted bird surveys from late spring though the fall in both 2009 and 2010. Other data was collected as well, such as vegetation surveys to characterize the area before any restoration begins.
After restoration is complete and the area planted, post restoration monitoring can begin, as early as spring 2013.

**NRG4_F13**

*dominant invasive plants: multiflora rose, Norway maples, mugwort, Japanese honeysuckle*

A very large area in the extreme northwest corner of the park, it will take multiple treatments to clear this area. The invasives are intertwined with spots of healthy oak/hickory canopy and mid-story regenerating native trees and shrubs. Cutting and treatments can begin here summer 2011 and continue through to 2014. Planting throughout the site will most likely occur in spots, and probably not until spring 2013 and continue through fall 2013.

**NRG5_S12**

*dominant invasive plants: mugwort, Asiatic bittersweet, porcelainberry, white mulberry, multiflora rose*

This area was cleared in the fall of 2008 and treated in winter 2009. Follow up foliar spray treatments were conducted in the early summer 2009 and summer 2010. Follow up treatments are required for reemerging vines and mugwort which will take place through the summer of 2011 and continue to spring 2012, just before planting. Planting is planned for this site in spring 2012.

**NRG6_S12**

*dominant invasive plants: Asiatic bittersweet, multiflora rose, bush honeysuckle, devil's walking stick*

This is a small disturbed area on the edge of a previously planted restoration site and a vernal pond. The area is used as a local hang-out for drinking and some drug use as evidence by the litter left and is characterized by compacted and bare soil, vines encircling a small opening and an invasive shrub layer spreading out into the understory. Work should begin here in spring 2011 and planted spring 2012.

**NRG7_F12**

*dominant invasive plants: bush honeysuckle, multiflora rose, Asiatic bittersweet, garlic mustard, porcelainberry, mugwort, gout weed, mile-a-minute vine*

This is a very large area (4 acres). Most of the clearing of very large bush honeysuckle as well as rose and vines were done throughout 2008 and winter 2009. Cut stump of some of the largest B. honeysuckle occurred in winter 2009. Hand pulling garlic mustard occurred spring 2009. Broadcast treatments continued through to early fall 2010. Half of the site was then planted as a MillionTrees volunteer event, with 3000 containerized trees and shrubs. The northern half, represented on the map, will continue to receive delicate herbicide foliar treatments as well as brush cutting and chain sawing as needed. The area is planned to be planted in fall 2012.

Preparing this area to plant has taken additional time than is typical due to the sensitivity of the amphibian populations within and adjacent to the area. A vernal pond borders one side of the site and an open Phragmites marsh the other.
Spring peeper and other native frog plants as well as salamanders are found here and herbicide treatments can be fatal to them. Therefore, working in partnership with our science staff, we have determined that we will not use triclopyr-based herbicides in the site at any time and we will not apply broadcast sprays of any herbicides during the frog and salamander breeding seasons, which is roughly June through September.

- **NRG8_S12**
  - **dominant invasive plants:** *European buckthorn*
  - This is a relatively small area with an understory thick with buckthorn. This is another site the science team has set up a monitoring transect in and has conducted bird surveys for pre-restoration monitoring. The site can be cut stumped starting fall 2010 and planted spring 2012. After planting the area, post restoration data will be collected.

- **NRG9_S13**
  - **dominant invasive plants:** *multiflora rose, Asiatic bittersweet, garlic mustard, porcelainberry, mugwort, ailanthus*
  - This is an area along a park woodland road, west of and bordering the north-bound lane of the Major Deegan Highway. Spotty areas within otherwise healthy forest fanning out from the site need to be cut and treated - much of it using the cut stump method. The area has already been brush cut and a big-scale herbicide foliar treatment was conducted in summer 2010. Planting can begin in this site spring 2012. Part of it can also be planted along with site NRG5_S12 as a volunteer planting event.

- **NRG10_F15**
  - **dominant invasive plants:** *phragmites, multiflora rose, Asiatic bittersweet, garlic mustard, porcelainberry, mugwort*
  - This is a very large site between the Putnam Trail and the Sawmill Parkway. It is a wetland with Tibbets Brook running through it. Phrag removal is needed and would take repeated treatments to effectively eradicate it. In addition to the sensitive wetland work, removal of surrounding vine lands along the Parkway would be needed. Because of the scale of restoring this, area it would be a good contractor job. Work should begin here by the beginning of 2012 and planting could begin by fall 2015. Given the size of the area, multiple plantings and work on the site could go well beyond the completion of the Croton-funded project.

- **NRG11_F14**
  - **dominant invasive plants:** *porcelainberry, multiflora rose, Asiatic bittersweet, garlic mustard, mugwort, phragmites*
  - This area marks where the Henry Hudson and Sawmill Parkways meet and is located in two densely wooded traffic circles. Freshwater wetlands are located in this area and extensive vine removal is required here. Work could simultaneously be conducted here and VC14. Most of the work in this site entails invasive plant removal from the forest understory and will therefore not receive a abundance of planted material. Planting here could occur in fall 2014.
- **NRG12_F15**
  - Dominant invasive plants: *porcelainberrry, ailanthus, Asiatic bittersweet, mugwort*
  - This area is spread out along the south-bound lane of the Major Deegan highway, behind a Mobile gas station. The area has been previously worked on by the UFEP program over a decade ago and more recently has seen seed source management vine sweeps. Much of the area remains a invasive-filled first succession meadow, and much of the restoration work will consist of eradicating vine lands on the edge. Additional work will be needed of sweep for invasive shrubs and vines growing in the understory of the forest beyond the open meadow. Work should begin here late in 2012 and continue through the end of the project. Planting could be done in fall 2015.

- **NRG13_S15 and NRG14_F15**
  - Dominant invasive plants: *Asiatic bittersweet, Japanese honeysuckle*
  - Once the edge problematic areas are under greater control, attention can be shifted to more of the forest interior areas where invasives tend to flourish in blow-down areas and other gaps in forest canopy. The largest tracks of forest in the park and the target of this effort are the Northwest Forest (NRG13_S15) and the Croton Forest (NRG14_F15). These areas are relatively small but numerous and are spread throughout a large expanse of forest. Cut stump sweeps should occur in these gaps and other disturbed portions of these forests and relatively small-scale plantings follow. Foliar spray treatments could also help in the effort but will kept to a minimum since these forests are the most pristine portions of the park and all efforts will be made to eliminate or extremely minimize collateral damage to the native plant communities. Some minor sweeps were made through the Northwest Forest at the beginning of 2010, but were not continued. More focus should be put on these sweeps once the larger areas are more contained, roughly in late 2012 to early 2013. Planting could begin in spring 2015 and continue in fall 2015.
## APPENDIX B: Native Plants of Van Cortlandt Park and Their pH Tolerances

### NATIVE PLANTS AND THEIR pH TOLERANCES

<table>
<thead>
<tr>
<th>TREES TOLERANT OF WIDE RANGE</th>
<th>Common name</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>Acer negundo</td>
<td>Boxelder</td>
<td>5.0-8.0</td>
</tr>
<tr>
<td>Betula papyrifera</td>
<td>Paper birch</td>
<td>5.0-8.5</td>
</tr>
<tr>
<td>Carya cordiformis</td>
<td>Bitternut hickory</td>
<td>5.6-8.0</td>
</tr>
<tr>
<td>Juglans nigra</td>
<td>Black walnut</td>
<td>4.6-8.2</td>
</tr>
<tr>
<td>Juniperus virginiana</td>
<td>Eastern red cedar</td>
<td>4.6-8.5</td>
</tr>
<tr>
<td>Morus rubra</td>
<td>Red mulberry</td>
<td>6.3-8.0</td>
</tr>
<tr>
<td>Ostrya virginiana</td>
<td>American hophorbeam</td>
<td>4.2-8.0</td>
</tr>
<tr>
<td>Prunus serotina</td>
<td>Wild black cherry</td>
<td>4.3-8.0</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>TOLERANT OF HIGHLY ALKALINE SOILS (pH &gt;= 8.0)</th>
<th>Common name</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>Celtis occidentalis</td>
<td>Common hackberry</td>
<td>6.5-8.5</td>
</tr>
<tr>
<td>Cornus amomum</td>
<td>Silky dogwood</td>
<td>6.0-8.5</td>
</tr>
<tr>
<td>Cornus racemosa</td>
<td>Gray dogwood</td>
<td>6.0-8.5</td>
</tr>
<tr>
<td>Fraxinus pensylvanica</td>
<td>Green ash</td>
<td>6.0-8.0</td>
</tr>
<tr>
<td>Salix nigra</td>
<td>Black willow</td>
<td>6.5-8.0</td>
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<tr>
<td>Ulmus americana</td>
<td>American elm</td>
<td>6.6-8.0</td>
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<table>
<thead>
<tr>
<th>INTOXORANT OF HIGHLY ALKALINE SOILS</th>
<th>Common name</th>
<th>pH</th>
</tr>
</thead>
<tbody>
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<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>Betula nigra</td>
<td>River birch</td>
<td>4.0-6.5</td>
</tr>
<tr>
<td>Fagus grandifolia</td>
<td>American beech</td>
<td>4.1-6.5</td>
</tr>
<tr>
<td>Liquidambar styraciflua</td>
<td>Sweet gum</td>
<td>4.4-5.6</td>
</tr>
<tr>
<td>Liriodendron tulipifera</td>
<td>Yellow poplar</td>
<td>3.8-6.5</td>
</tr>
<tr>
<td>Quercus palustris</td>
<td>Pin oak</td>
<td>4.7-5.0</td>
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<table>
<thead>
<tr>
<th>TOLERANT OF MODERATELY ALKALINE SOILS (pH 6.5 – 7.9)</th>
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<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>Sugar maple</td>
<td>5.5-7.3</td>
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<tr>
<td>Amelanchier canadensis</td>
<td>Shadbush</td>
<td>5.0-6.5</td>
</tr>
<tr>
<td>Betula populifolia</td>
<td>Gray birch</td>
<td>5.0-7.5</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>American hornbeam/ironwood</td>
<td>4.0-7.5</td>
</tr>
<tr>
<td>Carya glabra</td>
<td>Pignut hickory</td>
<td>4.8-7.5</td>
</tr>
<tr>
<td>Carya ovata</td>
<td>Shagbark hickory</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Carya tomentosa</td>
<td>Mockernut hickory</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>Sugar maple</td>
<td>5.5-7.3</td>
</tr>
<tr>
<td>Amelanchier canadensis</td>
<td>Shadbush</td>
<td>5.0-6.5</td>
</tr>
<tr>
<td>Betula populifolia</td>
<td>Gray birch</td>
<td>5.0-7.5</td>
</tr>
<tr>
<td>Carya cordiformis</td>
<td>Bitternut hickory</td>
<td>5.6-8.0</td>
</tr>
<tr>
<td>Carya ovata</td>
<td>Shagbark hickory</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Carya tomentosa</td>
<td>Mockernut hickory</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Celtis occidentalis</td>
<td>Common hackberry</td>
<td>5.2-7.7</td>
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<tr>
<td>Cornus florida</td>
<td>Flowering dogwood</td>
<td>5.5-7.0</td>
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<tr>
<td>Fagus grandifolia</td>
<td>American beech</td>
<td>4.1-6.5</td>
</tr>
<tr>
<td>Fraxinus pensylvanica</td>
<td>Green ash</td>
<td>6.0-8.0</td>
</tr>
<tr>
<td>Hamamelis virginiana</td>
<td>Witch hazel</td>
<td>6.0-6.5</td>
</tr>
<tr>
<td>Liquidambar styraciflua</td>
<td>Sweet gum</td>
<td>4.4-5.6</td>
</tr>
<tr>
<td>Liriodendron tulipifera</td>
<td>Tulip tree/yellow popular</td>
<td>3.8-6.5</td>
</tr>
<tr>
<td>Nyssa sylvatica</td>
<td>Black tupelo</td>
<td>5.0-6.0</td>
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<tr>
<td>Pinus strobus</td>
<td>Eastern white pine</td>
<td>3.8-6.5</td>
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<tr>
<td>Populus grandidentata</td>
<td>Big-toothed aspen</td>
<td>5.0-6.3</td>
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<tr>
<td>Quercus alba</td>
<td>White oak</td>
<td>4.2-5.5</td>
</tr>
<tr>
<td>Quercus palustris</td>
<td>Pin oak</td>
<td>4.7-5.0</td>
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<td>Quercus rubra</td>
<td>English oak</td>
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<td>Quercus velutina</td>
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<tr>
<td>Rhus glabra</td>
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<td>6.0-7.0</td>
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<tr>
<td>Rhus typhina</td>
<td>Staghorn sumac</td>
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**TOLERANT OF MODERATELY ACID SOILS (pH 5.0 - 6.5)**

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<tr>
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<th>pH</th>
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<tbody>
<tr>
<td>Acer rubrum</td>
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<tr>
<td>Acer sacchrinum</td>
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<td>4.0-7.0</td>
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<tr>
<td>Betula lenta</td>
<td>Black/sweet birch</td>
<td>4.0-5.0</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>American hornbeam/ironwood</td>
<td>4.0-7.5</td>
</tr>
<tr>
<td>Carya glabra</td>
<td>Pignut hickory</td>
<td>4.8-7.5</td>
</tr>
<tr>
<td>Fagus grandifolia</td>
<td>American beech</td>
<td>4.1-6.5</td>
</tr>
<tr>
<td>Juglans nigra</td>
<td>Black walnut</td>
<td>4.6-8.2</td>
</tr>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>pH</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Liquidambar styraciflua</td>
<td>Sweet gum</td>
<td>4.4-5.6</td>
</tr>
<tr>
<td>Liriodendron tulipifera</td>
<td>Tulip tree/yellow popular</td>
<td>3.8-6.5</td>
</tr>
<tr>
<td>Ostrya virginiana</td>
<td>American hophorbeam</td>
<td>4.2-8.0</td>
</tr>
<tr>
<td>Pinus strobus</td>
<td>Eastern white pine</td>
<td>3.8-6.5</td>
</tr>
<tr>
<td>Quercus alba</td>
<td>White oak</td>
<td>4.2-5.5</td>
</tr>
<tr>
<td>Quercus palustris</td>
<td>Pin oak</td>
<td>4.7-5.0</td>
</tr>
<tr>
<td>Quercus prinus</td>
<td>Chestnut oak</td>
<td>~ 3.5</td>
</tr>
<tr>
<td>Quercus rubra</td>
<td>English oak</td>
<td>3.8-6.5</td>
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<tr>
<td>Sassafras albidum</td>
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**SHRUBS**

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<tr>
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<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clethra alnifolia</td>
<td>Sweet pepperbush</td>
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<tr>
<td>Lindera benzoin</td>
<td>Spicebush</td>
<td>4.4-7.7</td>
</tr>
<tr>
<td>Rhododendron viscosum</td>
<td>Swamp azalea</td>
<td>4.0-6.0</td>
</tr>
<tr>
<td>Rubus allegheniensis</td>
<td>Common blackberry</td>
<td>4.5-7.5</td>
</tr>
<tr>
<td>Rubus occidentalis</td>
<td>Black raspberry</td>
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<tr>
<td>Sambucus canadensis</td>
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<tr>
<td>Vaccinium angustifolium</td>
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<tr>
<td>Viburnum acerifolium</td>
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<tr>
<td>Viburnum prunifolium</td>
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**HERBS**

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<th>pH</th>
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<tbody>
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<td>Solidago caesia</td>
<td>Blue-stemmed goldenrod</td>
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</table>
APPENDIX C: Native Planting List for Van Cortlandt Park

<table>
<thead>
<tr>
<th>Botanical name</th>
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<tbody>
<tr>
<td><strong>Shrubs</strong></td>
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<tr>
<td>Clethra alnifolia</td>
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<td>Silky dogwood</td>
</tr>
<tr>
<td>Cornus racemosa</td>
<td>Grey dogwood</td>
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<tr>
<td>Lindera benzoin</td>
<td>Spicebush</td>
</tr>
<tr>
<td>Myrica pensylvanica</td>
<td>Northern bayberry</td>
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<tr>
<td>Rhododendron viscosum</td>
<td>Swamp azalea</td>
</tr>
<tr>
<td>Rubus allegheniensis</td>
<td>Common blackberry</td>
</tr>
<tr>
<td>Rubus occidentalis</td>
<td>Black raspberry</td>
</tr>
<tr>
<td>Sambucus canadensis</td>
<td>Elderberry</td>
</tr>
<tr>
<td>Vaccinium angustifolium</td>
<td>Lowbush blueberry</td>
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<tr>
<td>Viburnum acerifolium</td>
<td>Maple-leaved viburnum</td>
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<tr>
<td>Viburnum dentatum</td>
<td>Arrowwood</td>
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<tr>
<td>Viburnum prunifolium</td>
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<tr>
<td><strong>Trees</strong></td>
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<td>Boxelder</td>
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<tr>
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<td>Red maple</td>
</tr>
<tr>
<td>Acer saccharinum</td>
<td>Silver maple</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>Sugar maple</td>
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<tr>
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<td>Shadbush</td>
</tr>
<tr>
<td>Betula lenta</td>
<td>Black/Sweet birch</td>
</tr>
<tr>
<td>Betula populifolia</td>
<td>Gray birch</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>Hornbean/ ironweed</td>
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<tr>
<td>Carya cordiformis</td>
<td>Bitternut hickory</td>
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<tr>
<td>Carya glabra</td>
<td>Pignut hickory</td>
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<tr>
<td>Carya ovata</td>
<td>Shagbark hickory</td>
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<tr>
<td>Carya tomentosa</td>
<td>Mockernut hickory</td>
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<td>Celtis occidentalis</td>
<td>Common hackberry</td>
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<td>Cornus florida</td>
<td>Flowering dogwood</td>
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<tr>
<td>Fagus grandifolia</td>
<td>American beech</td>
</tr>
<tr>
<td>Fraxinus pensylv</td>
<td>Green ash</td>
</tr>
<tr>
<td>Hamamelis virginiana</td>
<td>Witch hazel</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------</td>
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<tr>
<td><em>Juglans nigra</em></td>
<td>Black walnut</td>
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<tr>
<td><em>Juniperus virginiana</em></td>
<td>Eastern red cedar</td>
</tr>
<tr>
<td><em>Liquidambar styraciflora</em></td>
<td>Sweet gum</td>
</tr>
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<td><em>Liriodendron tulipifera</em></td>
<td>Yellow poplar</td>
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<tr>
<td><em>Nyssa sylvatica</em></td>
<td>Black tupelo</td>
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<tr>
<td><em>Pinus strobus</em></td>
<td>Eastern white pine</td>
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<td><em>Quercus alba</em></td>
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<td><em>Quercus coccinea</em></td>
<td>Scarlet oak</td>
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<td>Pin oak</td>
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<td><em>Quercus prinus</em></td>
<td>Chestnut oak</td>
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<tr>
<td><em>Quercus rubra</em></td>
<td>Northern red oak</td>
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<tr>
<td><em>Quercus velutina</em></td>
<td>Black oak</td>
</tr>
<tr>
<td><em>Rhus glabra</em></td>
<td>Smooth sumac</td>
</tr>
<tr>
<td><em>Rhus typhina</em></td>
<td>Staghorn sumac</td>
</tr>
<tr>
<td><em>Salix nigra</em></td>
<td>Black willow</td>
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<tr>
<td><em>Tilia americana</em></td>
<td>Sassafras</td>
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<td>American elm</td>
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<td>Rosy sedge</td>
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<td>Path rush</td>
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<td><em>Danthonia spicata</em></td>
<td>Poverty oat grass</td>
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<tr>
<td><strong>Forbs</strong></td>
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<tr>
<td><em>Eurybia (Aster) divaricata</em></td>
<td>White wood aster</td>
</tr>
<tr>
<td><em>Solidago caesia</em></td>
<td>Blue-stemmed goldenrod</td>
</tr>
<tr>
<td><em>Eupatorium rugosum</em></td>
<td>White snakewood</td>
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<tr>
<td><em>Eupatorium purpureum</em></td>
<td>Joe pye weed</td>
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<tr>
<td><em>Symphotrichum cordifolius</em></td>
<td>Heart-leaved / bluelwood aster</td>
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<tr>
<td><em>Parthenocissus quivefolia</em></td>
<td>Virginia creeper</td>
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<tr>
<td><em>Solidago canadensis</em></td>
<td>Canada goldenrod</td>
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<tr>
<td><em>Solidago rugosa</em></td>
<td>Rough-stemmed goldenrod</td>
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<tr>
<th>Species</th>
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<td><em>Viola sororia</em></td>
<td>Dooryard violet/ wolly blue violet</td>
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<td><em>Arabis hirsuta</em></td>
<td>Hairy rock cess</td>
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<td><em>Chimaphila maculata</em></td>
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<td>Bluecurls</td>
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<td><em>Helianthus decapetalus</em></td>
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<td><em>Helianthus divaricatus</em></td>
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<td><em>Dennstaedtia punctilobula</em></td>
<td>Hay-scented fern</td>
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<td><em>Thelypteris noveboracensis</em></td>
<td>New York fern</td>
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<tr>
<td><em>Fragaria virginiana</em></td>
<td>Wild strawberry</td>
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APPENDIX D: Unit Descriptions for Van Cortlandt Park Soil Survey

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called non-contrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the
detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Centralpark sandy loam, 3 to 8 percent slopes is a phase of the Centralpark series.

Map units dominated by a single component are called *consociations*. Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Chatfield-Hollis-Rock outcrop complex, 15 to 25 percent slopes is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pavement & buildings is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

**Soil Map Unit Descriptions**

**CCHC Chatfield-Charlton-Hollis complex, 0 to 15 percent slopes, very rocky.**
This map unit consists of gently to moderately sloping, well drained soils on glaciated uplands where the underlying gneiss and schist bedrock may be near the surface. The very deep Charlton soils, moderately deep Chatfield soils, and shallow Hollis soils were so intermingled that it was not practical to map them separately. This unit is found in wooded areas of the park.

A typical area is about 47 percent Charlton soils, 33 percent Chatfield soils, and 15 percent Hollis soils. Inclusions of rock outcrop, moderately well drained Woodbridge soils and somewhat poorly drained Tonawanda soils together make up the remainder (about 5 percent) of the map unit. Rock outcrop can be usually be found on the summits of hills and ridges, while Woodbridge and Tonawanda soils are found in small upland depressions.

**CCHRC Chatfield-Charlton-Hollis-Rock outcrop complex, 0 to 15 percent slopes (photo).** This map unit consists of gently to moderately sloping, well drained soils on glaciated uplands where the underlying gneiss and schist bedrock is near the surface and outcrops somewhat extensively. The very deep Charlton soils, moderately deep Chatfield soils, and areas of rock outcrop were so intermingled that it was not practical to map them separately. This unit is found in wooded areas of the park.

A typical area of this map unit is about 38 percent Chatfield soils, 32 percent Charlton soils, 18 percent Rock outcrop, and 8 percent Hollis soils. Inclusions of moderately well drained Woodbridge and somewhat poorly drained Tonawanda soils together make up the remainder (about 4
percent) of the map unit, mostly in small upland depressions.

**CCD  Chatfield-Charlton complex, 15 to 35 percent slopes, very rocky.**

This map unit consists of steeply sloping, well drained soils on till plains where the underlying gneiss and schist bedrock may be near the surface. The moderately deep Chatfield soils and very deep Charlton soils were so intermingled that it was not practical to map them separately. This unit is found in wooded areas of the park.

A typical area is about 55 percent Chatfield soils and 32 percent Charlton soils, 3 percent Rock outcrop. Inclusions of shallow Hollis soils, moderately well drained Woodbridge soils, and somewhat poorly drained Tonawanda soils together make up the remainder (about 10 percent) of the map unit.

**ChB  Charlton loam, 3 to 8 percent slopes.** This map unit consists of gently sloping, very deep and well drained soils formed in till derived mainly from gneiss and schist on glaciated uplands. This unit is found in wooded areas of the park.

A typical area is about 85 percent Charlton soils; inclusions of well drained Paxton soils, moderately well drained Woodbridge soils, and somewhat poorly drained Tonawanda soils together make up the remainder (about 15 percent) of the map unit.

**ChC  Charlton loam, 8 to 15 percent slopes.** This map unit consists of gently sloping, very deep and well drained soils formed in till derived mainly from gneiss and schist, on glaciated uplands. This unit is found in wooded areas of the park.

A typical area is about 85 percent Charlton soils; inclusions of well drained Paxton soils, moderately well drained Woodbridge soils, and somewhat poorly drained Tonawanda soils together make up the remainder (about 15 percent) of the map unit.

**ChD  Charlton loam, 15 to 25 percent slopes.** This map unit consists of moderately steep, very deep and well drained soils formed in till derived mainly from gneiss and schist, on glaciated uplands. This unit is found in wooded areas of the park.

A typical area is about 85 percent Charlton soils; inclusions of Paxton soils, moderately deep Chatfield soils, and moderately well drained Woodbridge soils together make up the remainder (about 15 percent) of the map unit.

**ChE  Charlton loam, 25 to 35 percent slopes.** This map unit consists of steep, well drained and very deep soils formed in till derived mainly from gneiss and schist, on glaciated uplands. This unit is found in wooded areas of the park.

A typical area is about 85 percent Charlton soils; inclusions of Paxton soils and moderately deep Chatfield soils together make up the remainder (about 15 percent) of the map unit.
CHRD  Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes. This map unit consists of moderately steep well drained soils on till plains where the underlying gneiss and schist bedrock are near the surface and outcrop extensively. The moderately deep Chatfield soils, shallow Hollis soils, and areas of Rock outcrop were so intermingled it was not practical to map them separately. This unit is found in wooded areas of the park.

A typical area of this map unit is about 55 percent Chatfield soils, 23 percent Hollis soils and 16 percent Rock outcrop. Inclusions of very deep Charlton soils and moderately well drained Woodbridge soils together make up the remainder (about 7 percent) of the map unit.

FFA  Fluventic Hapludolls-Fluvaquentic Endoaquolls complex, 0 to 3 percent slopes, frequently flooded. This map unit consists of nearly level soils in floodplains. As they are too variable to be assigned a series name, they have been classified to the family level which better reflects the range of characteristics. Fluventic Hapludolls are moderately well drained alluvial soils with a thick dark surface. Fluvaquentic Endoaquolls are poorly drained alluvial soils with a thick dark surface. These soils were so intermingled that it was not practical to map them separately. This unit is found along Tibbett’s Brook.

A typical area of this unit is comprised of about 50 percent Fluventic Hapludolls and 40 percent Fluvaquentic Endoaquolls. Inclusions of somewhat poorly drained soils and very poorly drained soils together make up the remainder (about 10 percent) of the map unit. Due to the inconsistent and often flashy flow of the Tibbett’s Brook these recent alluvial deposits are highly variable, often with little or no geomorphic indication that the soil type has changed.

GbA  Greenbelt sandy loam, 0 to 3 percent slopes. This map unit consists of nearly level, well drained Greenbelt soils. These soils form in a thick mantle of clean (less than 10 percent human artifacts) loamy human transported materials (fill) derived from the cutting, filling, and reworking of local soil materials during park development. This unit is predominantly found in turf covered areas on ball fields and the golf course.

A typical area of this map unit is comprised of about 80 percent Greenbelt soils; inclusions of moderately well drained North Meadow soils, sandy fill soils, and fill soils with more than 35 percent coarse fragments together make up the remainder (about 20 percent) of the map unit. As fill materials can be highly variable, these soils are found (in) scattered (areas) throughout the map unit, usually with no geomorphic indication that the soil type has changed.

GbB  Greenbelt sandy loam, 3 to 8 percent slopes. This map unit consists of gently sloping, well drained Greenbelt soils. Greenbelt soils have formed in a thick mantle of clean (less than 10 percent human artifacts) loamy fill material derived from
the cutting, filling, and reworking of local soil materials during park development. This unit is predominantly found in turf covered areas on ball fields and the golf course.

A typical area of this map unit is comprised of about 80 percent Greenbelt soils; inclusions of moderately well drained North Meadow soils, sandy fill soils, and fill soils with more than 35 percent coarse fragments together make up the remainder (about 20 percent) of the map unit. As fill materials can be highly variable, these soils are found (in) scattered (areas) throughout the map unit.

GbC  Greenbelt sandy loam, 8 to 15 percent slopes. This map unit consists of moderately sloping, well drained Greenbelt soils. Greenbelt soils have formed in a thick mantle of clean (less than 10 percent human artifacts) loamy fill material derived from the cutting, filling, and reworking of local soil materials during park development. This unit is predominantly found in steeper portions of the golf course.

A typical area of this map unit is comprised of about 80 percent Greenbelt soils; inclusions of moderately well drained North Meadow soils, sandy fill soils, and fill soils with more than 35 percent coarse fragments together make up the remainder (about 20 percent) of the map unit. As fill materials can be highly variable, these soils are found (in) scattered (areas) throughout the map unit.

GbD  Greenbelt sandy loam, 15 to 25 percent slopes. This map unit consists of moderately steep, well drained Greenbelt soils. Greenbelt soils have formed in a thick mantle of clean (less than 10 percent human artifacts) loamy fill material derived from the cutting, filling, and reworking of local soil materials during park development. This unit is mainly found in highway embankments.

A typical area of this map unit is comprised of about 80 percent Greenbelt soils; inclusions of fill soils with more than 35 percent coarse fragments and sandy fill soils that together make up the remainder (about 20 percent) of the map unit. As fill materials can be highly variable, these soils are found (in) scattered (areas) throughout the map unit.

NaA  Natchaug muck, 0 to 3 percent slopes, frequently ponded (photo). This map unit consists of nearly level, very poorly drained Natchaug soils. These soils form in woody and herbaceous organic materials overlying loamy deposits in depressions on till plains. This unit is found in low-lying areas along Tibbetts Brook and south of Van Cortlandt Lake.

A typical area of this map unit is about 85 percent Natchaug soils; inclusions of very poorly drained mineral soils, soils with greater than 51 inches or organic material, and soils with less than 51 inches of organic material over sandy deposits together make up the remainder (about 15 percent) of the map unit.
NoA  **North Meadow sandy loam, 0 to 3 percent slopes.** This map unit consists of nearly level, very deep and moderately well drained North Meadow soils. These soils form in a relatively thin mantle of clean (less than 10 percent human artifacts) human-transported materials (fill) over upland depressions or in drainageways. This unit is found in both turf-covered and wooded areas throughout the park.

A typical area of this map unit is about 80 percent North Meadow soils; inclusions of somewhat poorly drained soils, moderately well drained soils with greater than 35 percent coarse fragments, well drained Greenbelt soils, and poorly drained soils together make up the remainder (about 20 percent) of the map unit.

PbGAI  **Pavement & buildings-Greenbelt complex, 0 to 3 percent slopes.** This map unit consists of nearly level areas of Pavement and buildings and well drained Greenbelt soils in more developed portions of the park. These areas were so intermingled it was not practical to map them separately. Greenbelt soils have formed in a thick mantle of clean loamy fill material derived from the cutting, filling, and reworking of local parent materials during urban development.

A typical area of this map unit is about 55 percent Pavement and buildings and 38 percent Greenbelt soils. Inclusions of fill soils with greater than 35 percent coarse fragments and moderately well drained North Meadow soils, both found in yards, open spaces between buildings, and abandoned parcels, together make up the remainder (about 7 percent) of the map unit.

PbGBI  **Pavement & buildings-Greenbelt complex, 3 to 8 percent slopes.** This map unit consists of gently sloping areas of Pavement and buildings and well drained Greenbelt soils in the urban core. These areas were so intermingled it was not practical to map them separately. Greenbelt soils have formed in a thick mantle of clean loamy fill material derived from the cutting, filling, and reworking of local parent materials during urban development. This unit is found in city housing communities where high rise buildings are surrounded by large courtyard areas.

A typical area of this map unit is about 55 percent Pavement and buildings and 38 percent Greenbelt soils. Inclusions of fill soils with greater than 35 percent coarse fragments and moderately well drained North Meadow soils, both found in yards, open spaces between buildings, and abandoned parcels, together make up the remainder (about 7 percent) of the map unit.

PbtA  **Pavement & buildings, till substratum, 0 to 3 percent slopes.** This map unit consists of nearly level areas where pavement and buildings cover 90 percent or more of the landscape. Till may be found below a depth of 40 inches. This unit can be found in anywhere in the park where paved surfaces dominate.

A typical area of this map unit is about 92 percent Pavement and buildings; inclusions of Greenbelt soils, soils with greater than 35 percent coarse fragments, and moderately well drained North Meadow soils, all found in yards, open spaces between buildings and
abandoned parcels, together make up the remainder (about 8 percent) of the map unit area.

**PbtB  Pavement & buildings, till substratum, 3 to 8 percent slopes.** This map unit consists of gently sloping areas in the urban core. Pavement and buildings cover 90 percent or more of the landscape where till was once likely the dominant parent material. Till may be found below a depth of 40 inches. This unit can be found anywhere in the park where paved surfaces dominate.

A typical area of this map unit is about 92 percent Pavement and buildings; inclusions of Greenbelt soils, soils with greater than 35 percent coarse fragments, and moderately well drained North Meadow soils, all found in yards, open spaces between buildings and abandoned parcels, together make up the remainder (about 8 percent) of the map unit area.

**PnA  Pompton loam, o to 3 percent slopes.** This map unit consists of nearly level, very deep moderately well drained and somewhat poorly drained soils formed in glacial meltwater deposits derived mostly from schist and gneiss, in outwash plains and valleys. This map unit is found along Tibbett’s Brook and Van Cortlandt Lake.

A typical area of this map unit is about 85 percent Pompton soils; inclusions of moderately well drained North Meadow soils, well drained Riverhead soils, and poorly drained soils make up the remainder (about 15 percent) of the map unit.

**PxB  Paxton loam, 3 to 8 percent slopes.** This map unit consists of gently sloping, very deep and well drained soils formed in dense basal till derived mostly from gneiss and schist, on hilltops and hillsides in glaciated uplands. This unit is found in wooded areas of the park.

A typical area of this map unit is about 85 percent Paxton soils; inclusions of moderately well drained Woodbridge soils, somewhat poorly drained Tonawanda soils, well drained Charlton soils, and moderately deep Chatfield soils together make up the remainder (about 15 percent) of the map unit.

**PxC  Paxton loam, 8 to 15 percent slopes.** This map unit consists of gently sloping, very deep and well drained soils formed in dense basal till derived mostly from gneiss and schist, on hilltops and hillsides in glaciated uplands. This unit is found in wooded areas of the park.

A typical area of this map unit is about 85 percent Paxton soils; inclusions of moderately well drained Woodbridge soils, somewhat poorly drained Tonawanda soils, well drained Charlton soils, and moderately deep Chatfield soils together make up the remainder (about 15 percent) of the map unit.
**RvFoB Riverhead-Flatbush complex, 3 to 8 percent slopes.** This map unit consists of gently sloping, well drained Riverhead and Flatbush soils. Riverhead soils form in glacial outwash deposits derived mainly from gneiss and schist, and Flatbush soils in a thin layer of human transported materials over outwash deposits. This unit is found along Tibbett’s Brook.

A typical area of this map unit is about 50 percent Riverhead soils and 30 percent Flatbush soils; inclusions of somewhat excessively drained sandy soils, and moderately well drained and somewhat poorly drained Pompton soils make up the remainder (about 20 percent) of the map unit.

**SiA Siwanoy silt loam, 0 to 3 percent slopes (photo).** This map unit consists of nearly level, very deep and poorly drained soils formed in silty deposits in depressions on till plains. This unit is found in wooded areas of the park and on the golf course.

A typical area of this unit is about 80 percent Siwanoy soils: inclusions of somewhat poorly drained Tonawanda soils, very poorly drained soils, and moderately well drained Woodbridge soils together make up the remainder (about 20 percent) of the map unit.

**TwB Tonawanda silt loam, 3 to 8 percent slopes.** This map unit consists of gently sloping, very deep somewhat poorly drained soils formed in silty deposits in depressions and lower portions of till plains. This unit is found in wooded areas of the park.

A typical area of this unit is about 80 percent Tonawanda soils: inclusions of poorly drained Siwanoy soils, moderately well drained Woodbridge soils, and well drained Charlton soils together make up the remainder (about 20 percent) of the map unit.

**WdB Woodbridge loam, 3 to 8 percent slopes.** This map unit consists of gently sloping, moderately well drained soils formed in dense basal till derived mostly from gneiss and schist, on the lower portions of hillsides in glaciated uplands. This unit is found in wooded areas of the park.

A typical area of this unit is about 80 percent Woodbridge soils: inclusions of somewhat poorly drained Tonawanda soils, well drained Paxton soils, and poorly drained Siwanoy soils together make up the remainder (about 20 percent) of the map unit.
### Faunal Species Inventoried in Van Cortlandt Park, 1990

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<th>Species</th>
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<td>Shiners</td>
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<td>Little Brown Bat</td>
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**Birds**

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<td>Snowy Egret</td>
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139
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APPENDIX F: List of Recommendations, 1990 Natural Areas Management Plan

MANAGEMENT RECOMMENDATIONS

The primary management goal in Van Cortlandt Park is to preserve it. But a commitment to preservation does not mean that the need for management will disappear. Undeveloped parkland will profit from varying degrees of management. Management decisions will be based on the total resource although specific management recommendations will be outlined in this document by Management Zones (Map 35). For more detailed explanations of the procedures and methods recommended in this section see the Natural Areas Maintenance Guide, which serves as a supplement to this plan.

Specific entitation units are referred to in this section (Map 4).

OBJECTIVES

The primary management objective will be to discourage development (with the exception of some areas along the park perimeter) and maintain the undeveloped areas in a naturalistic state. To preserve and enhance the scenic, recreational, and wildlife habitat values of the natural parklands, park management should:

1. Protect the integrity of natural areas by encouraging native species growth, tree regeneration, and natural vegetation and wildlife diversity.

2. Encourage positive use through (1) education and interpretive programs; (2) then provision and maintenance of facilities for these uses; and (3) the implementation of a program of signs to encourage public concern and involvement.

3. Reduce fragmentation of habitats through the consolidation of areas of similar habitat type. This can be accomplished by supplementing and restoring existing habitats.

4. Monitor natural areas systematically, as use and management of the park’s natural landscape increase, to determine the effects of various uses on the ecosystem.

Vault Hill Meadow
This unique meadow of little bluestem grass and Sassafras scrub is located on the eastern slope of the rocky ridge to the east of the Parade Ground (map 37). If faces the Van Cortlandt Golf Course and is named for the Van Cortlandt family burial vault, located at the southern end of the ridge. The grassy flats and rocky outcrops along the ridge, particularly the cliffs themselves (unit 32) and areas around the burial vault are the site of gatherings during the day and night. A cross-country running trail winds its way throughout the area.
The 2.9 acres of little bluestem (unit 27) and the 4.7 acres of Sassafras scrub (units 28, 53, and 54) comprise the bulk of the meadow. Rubus, bayberry, black oak, and smooth sumac make up the remaining 1.7 acres of scrubland; dominant herbaceous species include cool-season grasses, dogbane, goldenrod, and round-headed bush cover. The rich herbaceous diversity includes wild asparagus, daisy fleabane, butter-and-eggs, common milkweed, wild sensitive plant, and many tick trefoil species. Wooded areas of threes (all about 15 feet tall or less) consist primarily of black cherry, black oak, and Sassafras plus some pin oak, black birch, gray birch, bigtooth aspen, black locust.

Because of its isolation, the Van Cortlandt burial vault has been severely vandalized. Party goers leave behind broken glass and graffiti. Because the area is adjacent to athletic fields and the cross-county trail, team names are scrawled on the cliffs. Occasionally campers use the area. Fire has been both a help and a hindrance to the diversity of vegetation in the meadow. Both little bluestem and Sassafras growth are stimulated when burned, and the stands of Sassafras—a fast-growing, pioneer tree species—have increased more in acreage and may outcompete the grasses and herbaceous species if the fires continue at the same frequency.

**Primary Goal:** Designate and maintain Vault Hill Meadow as a Preserve

**Priority Actions**

1. Upgrade and clearly mark the cross-country trail, which has severe erosion problems.

**Management Recommendations**

1. Explore ways to prevent excessive Sassafras expansion and keep the meadow open (e.g., use of brush hog and selective removals).

2. Establish periodic PEP and police patrols in warmer months (particularly at night) to discourage gatherings near Vault Hill cemetery and the cliffs.

3. Examine ways to remove graffiti from the cliffs (e.g., hydroblasting) and remove it at least once a year.

4. When the Van Cortlandt cemetery is restored in future Capital Project plans, explore ways to protect it with secure fencing and/or barbed wire.

5. Encourage use of the cliffs (unit 32) by the UPR as a panoramic vista as well as an excellent site to view bird migration.

**Van Cortlandt Wetlands**

This 89-acre zone runs north-south centrally through Van Cortlandt Park from the Yonkers border almost to Van Cortlandt Park South. It is bounded by the Van Cortlandt Golf Course, the Henry Hudson Parkway in the northwest, and the Parade Ground in the southwest, and interrupted by two former railroad lines (maps 38a and 38b). The significant feature of the zone is the 75-acre wetland it contains. However, it is far from being an undisturbed wetland system; during the construction of the Henry Hudson Parkway, Tibbetts Brook was channeled by culverts or enclosed by stone retaining walls to receive road run-off (which it still does today). Some original wetland was landfilled
to build the golf course and railroad embankments. The tracks and telegraph poles of the Putnam Line and the chain-link fence of both railroads remain. Other historic sites in the zone include a cemetery dating from the early 1700s in the southern wooded area (unit 382) and 13 pillars erected by the New York Central Railroad to determine the best stone to use in building Grand Central Station. Van Cortlandt Lake is used for fishing and ice skating; picnicking takes place along its embankments. The Putnam Railroad tracks are used extensively by hikers, dog walkers, nature enthusiasts, and for sexual activities. The southern section of the wetland (below the golf course bridge) is used an interpretive area by the Urban Park Rangers and is the site of the John Kieran Nature Trail. South of the Van Cortlandt Mason and east of the swimming pool are very popular picnic spots around a wet meadow. North of the golf course bridge (above unit 407), the wetlands are much less frequented because of poor access.

In spite of the disturbed nature of the Van Cortlandt Wetlands, they contain diverse and valuable plant communities. There are aquatic plant communities of arrow arum and water lilies (units 16 and 398), cattails (13 and 391), burred (414), and Phragmites (12, 389, and 395); wet meadows of sedges, rushes and grasses (units 14, 19, and 21). Around the northern periphery of the lake is a scrubland of buttonbush, red maple, and arrowwood (unit 404). North of the upper basin is a swampy woodland (unit 407) of red maple, black willow, and white ash. North of the Mosholu parkway Extension, the wetland is more disturbed: purple loosestrife and Phragmites displace many wetland species, but even here there are swampy spots of black willow, red maple, silver maple, and white ash (units 433, 438, 439 445). On higher and drier, or more disturbed, ground--such as the railroad embankments and the area west of the lake’s basins--are woods of pioneering and exotic trees: black locust, black cherry, Norway maple, and Sassafras with some patches of oak species.

Some of the management problems in the area include DPR maintenance crews who are depositing woodchips to absorb water in the wet meadow (units 12, 13, 14, and 19) and mowing too close to its border. They are also discarding leaves on the wooded border east of the Parade Ground (units 384, 393, and 401), which is prohibiting growth of understory and groundcover vegetation. There are many compacted footpaths leading from the Parade Ground east to the railroad tracks where the fence is broken in places. Fishing and picnicking is frequent along the lake’s western edge which results in trash accumulation, compaction, and erosion. Above the nearby golf course bridge (unit 407), there is no designated foot trail; the pedestrian bridge is falling apart and entry is through holes in the gold course fence. Phragmites and purple loosestrife are taking over areas of cattails (units 12, 19, 395, 400, and 434). There is severe dumping within the study area in Yonkers. At the city line, sanitary and stormwater sewage is directly discharged into the brook. A detailed hydrogeological study and recommendations are included earlier in the report under “Hydrology”.

**Primary Goal:** Establish and maintain the Van Cortlandt Wetlands as a Preserve.

**Priority Actions:**

1. Prevent DPR maintenance crews from discarding leaves east of the Parade Ground. Stop the use of woodchips to absorb water from the wet meadow (units 12, 13, 14, and 19) and establish a 5 to 10-foot buffer around it to keep lawnmowers from damaging aquatic vegetation.
2. Place signs throughout wetland to identify it as a preserve under New York State Freshwater Wetlands protection.

3. Monitor activities around Van Cortlandt Lake to protect waterfowl and prevent abuse such as throwing stones or hitting golf balls into the lake.

**Management Recommendations**

1. Direct City of Yonkers to repair leaking sanitary sewer discharging into Tibbetts Brook at McClean Avenue in Yonkers.

2. Limited dredging may be advisable (where valuable wetland will not be extensively disturbed) in Van Cortlandt Lake and its lower basin, which may contain nutrient-enriched sediment. Dredging Sycamore pond to its original level (approximately 3 feet) may be beneficial. See “Hydrology”.

3. Lead or cesium profiles in the lake sediment should be constructed to look for marker events and develop a more exact depositional history.

4. Redirect stormwater drains from the Major Deegan Expressway away from the lake.

5. Explore methods to control Phragmites and purple loosestrife expansion.

6. Establish PEP patrols in lower woods west of Van Cortlandt Lake to discourage improper park use.

7. Repair fence or erect new, more vandal-proof fence along east end of Parade Ground and close off most of the trails in this area with native barrier planting such as conifers and hawthorns. Woodchip the remaining trails.

8. Designate specific fishing points and associated trails on the western shore of Van Cortlandt Lake. Establish rocky outcrops with slate or other materials for fishermen to stand on and stabilize eroding shoreline with plantings.

9. Repair holes in fence and pedestrian bridge north of upper basin.

**Vault Hill Woodland**

This 24.5-acre woodland extends around the northernmost tip of the Parade Grounds, with the Henry Hudson Parkway to the north and Broadway to the west (map 37). There are two sections: the knoll near Broadway and the wooded ridge east of the Parade Ground. The latter portion surrounds Vault Hill Meadow and provides cover for wildlife using the meadow. The woodland is a heavily used, undesignated picnic and party spot. The Vault Hill Woodland includes small patches of vines, scrub, and herbaceous communities.

The forests and woodlands, totaling 21.5 acres, are generally of two types. The outermost edges are mainly disturbed forests and woodlands of exotic and pioneering species and contain black locust, black cherry, Ailanthus, Sassafras, and sycamore maple. The less disturbed, inner portions of the woodlands contain large red, pin, black, and white oaks.
which grow in the midst of the knoll or just west of the meadow. The understudies in most of these units are open because of burning or trampling. The Vault Hill Woodland includes small patches of vine, scrub, and herbaceous communities. There are three vinelands (totaling 2 acres) dominated by bittersweet (units 72, 88, and 104). Unit 72 is a small vineland (less than 0.25 acres) that contains black oak, black cherry, catbrier, and bittersweet. Unit 88 is much larger (1.75 acres) with black locust, rose, and Sassafras. Bittersweet covers patches of herbaceous plants (e.g. mugwort and common ragweed), trees, and shrubs in unit 104. There are two scrub areas: unit 97 near the pedestrian crosswalk over the Henry Hudson Parkway to the Northwest Forest is dominated by Cornelian cherry; and unit 102, close to the Van Cortlandt Golf Course, is a Rubus patch. Herbaceous communities include a small grassy opening (unit 78) on the top of the knoll and two units off the Henry Hudson Parkway--a grassy edge with red oaks (unit 84), and a meadow of spotted knapweed and cool-season grass (unit 108). The forested slope on the knoll in unit 71 is severely eroded; tree roots are exposed and groundcover is sparse. Other areas on the Broadway knoll (71, 72, 73, 74, 75, 76, and 77) and on Vault Hill (units 63, 64, 65, 66, 67, and 68) are eroded and compacted, but to a lesser degree. Wooded areas along the edge of the Parade Ground (units 63, 64, 65, 66, and 67) are full of trash and are trampled by picnickers, athletes and spectators. Many of the rocky hilltops are party areas, particularly units 68, 76, 77, and 78, which are trashy and compacted. Some dumping occurs off the Henry Hudson Parkway in units 84 and 85.

**Primary Goal:** Establish and maintain Vault Hill Woodland as a Wildlife Area.

**Priority Actions:**

1. Remove trash and debris from the knoll and the western woods (especially units 63-65) and establish a regular maintenance routine.

2. Prevent severe erosion in unit 71 by such techniques as cribbing and planting native shrubs and groundcover.

**Management Recommendations**

1. Prevent erosion in forest south of Vault Hill Meadow (units 63-65) by cribbing, planting, and discouraging undesignated paths.

2. Establish periodic PEP, UPR and police patrols on the knoll during the warmer months to discourage vandalism.

3. Explore the possibility of using portable toilets on the eastern edge of the Parade Ground during the summer months to reduce the pressure on the surrounding wooded areas.

**Northeast Forest**

This is a 117-acre forest bounded by the major Deegan Expressway (west), 233rd Street (south), Parkway north along the Yonkers border, and Van Cortlandt Park East (Map 39). Recreational areas include a playground, handball and basketball courts, a ball field and Gaelic football field. The area in the south known as Indian Field includes baseball and football fields, tennis courts and a bocci court. The Parks Department operates a greenhouse and nursery in the northeast corner, which is currently being upgraded and
expanded. Construction on Water Tunnel #3 (unit 351) occupies 4 acres adjacent to this. The forest is heavily used by the surrounding communities; cyclists, dirt bikers, dog walkers, nature lovers, and children frequent the trails.

In low-lying sections, wet-site species have taken a firm hold. Swamp-like areas of sweetgum and pin oak (units 272, 302, and 333) and sweetgum and red maple (units 287 and 320) are located adjacent to a Phragmites stand (unit 313). In the northwest corner of the Phragmites stand, a patch of concrete debris (unit 339) was recently removed, creating a small, open pond. Other wetland areas include black willow with a false nettle groundcover, two woodland/forests of red maple (units 322 and 342, the latter dominated by white ash), a sweetgum and red oak forest (unit 341), a very small patch of Phragmites (unit 321), and a forest of red maple, pin oak, sweetgum, and sweet pepperbush (unit 374).

Areas of higher elevation are dominated by oaks—red, black, white and pin. Two units (337 and 3310 have tulip sharing the upper canopy with oaks. Large, sprawling woodlands and forests make-up 96 acres or 82.5 percent of the Northeast Forest. Thirteen acres of forest has been disturbed, most are now dominated by black locust and/or black cherry. Ailanthus and Norway maple are only exotic species here but there are few of them.

Dirt bikes cause most of the soil compaction here. Unit 309 adjacent to Van Cortlandt Park East is almost devoid of groundcover vegetation; most of the compaction is confined to the trails, however. Fires seem to be a frequent occurrence, happening at least once or twice a year. During athletic games and special events, people park next to the wooden bollards along Indian Field. Vehicle access has been prevented by stones and logs; occasionally an abandoned auto is found stripped and burned in the woods or on/near the access road to the nursery. There is a gate about halfway up the road, but it is not always locked. A watchman is on duty 24 hours at the nursery. Because of its diverse cover types, the Northeast Forest would be an ideal interpretive area. An Urban Park Ranger substation in the Allen Shandler Recreation Area would provide a uniformed presence to deter vandalism, with educational programs conducted in the northeast Forest to benefit the Woodland and Wakefield communities. UPR presence, lacking on the east side of the park, should reinforce positive use in this active areas.

**Primary Goal:** Designate and maintain Northeast Forest as an Interpretive Area. Establish a UPR substation in the parkhouse in the Allen Shandler Recreation area.

**Priority Actions:**

1. Establish routine PEP and police patrols to discourage arson and dirtbiking by ticketing offenders and confiscating dirtbikes usually in use near the Van Cortlandt Park East playground.

2. Formalize an agreement with the Westchester County Department of Parks, Recreation, and Conservation to prevent parking on the wooded border of Parkway North in Yonkers. If signage, ticketing, and towing do not work, install guardrail or fences.
3. Remove trash and debris from Forest bordering Parkway North and some of the wooded areas along Van Cortlandt Park East. Establish a regular maintenance routine.

4. Install wooden bollards in unit 260 (near the bocce court) to prevent illegal parking and reduce both erosion and compaction.

5. Remove illegal shelter near Major Deegan Expressway overpass.

6. Remove invasive vines and accumulating trash from path that parallels the Major Deegan Expressway.

Management Recommendations

1. Block off excess trails in the southern end and narrow the wider paths with barrier plantings, woodchipping, etc.

2. With the cooperation of the Westchester Department of Parks, Recreation, and Conservation, establish an official senior citizens’ sitting area and garden in the northwest (units 375 and 377) where they currently exist.

3. Establish a compost pile at the nursery and have Bronx Forestry remove wooden debris along access road and some nearby trails.

4. Explore wetland restoration possibilities both in open water and adjacent Phragmites.

5. Investigate the pollution source from culvert in unit 312 that drains from the Major Deegan Expressway into Phragmites stand unit 313.

Croton Forest
Located in the middle of Van Cortland Park, this management zone is defined by the Old Croton Aqueduct, which runs underground down its center (Maps 40a and 40b). Bounded by the Yonkers border to the north, the Moshulu Parkway Extension and Van Cortlandt Golf Course to the west, and the Major Deegan Expressway to the east, the woods come to their southern tip where the Major Deegan Expressway passes over the Moshulu Parkway Extension. The Old Croton Aqueduct can be followed above ground on the Old Croton Aqueduct Trail, which has been listed in the National Register of Historic Places since 1974. Of the 127.5-acre wooded areas, 77 acres form closed-canopy forest and 50.5 acres form open woodlands. From south to north, tree species become less diverse; there are larger tracts of uniform species composition. Overall, there is a lot of red and black oak, hickory species, tulip tree, and sweetgum; in addition, some black cherry and Sassafras. These upland areas are shared by flowing dogwood, black birch, white oak, Norway maple, and black locust. Sugar maple is present and is regenerating, which is unusual in New York City Parks. Other regenerating tree species include black cherry, hickory species, white ash, Sassafras, and Norway maple. In wetter sites, sweetgum is growing with red maple, white ash, spicebush, and arrowwood. Black walnut, American sycamore, and American elm (unit 630) comprise a woodland of more than 7.5 acres in the south.
Vineland bittersweet and wild grapes (totaling 13 acres) are scattered throughout the woods. At the southern end, porcelain berry (unit 609) covers a large area (5 acres). Most herbaceous sites (9.5 acres) are dominated by mugwort. Cool-season grasses (units 633 and 673), Japanese knotweed (unit 617), Phragmites (unit 613), and jewelweed (units 621, 646 and 684) dominate other herbaceous areas. Two small shrublands of Rubus and smooth sumac (unit 641) and arrowwood (unit 683) have overtaken canopy openings near the Croton Trail. The two service stations along the Major Deegan Expressway (unit 628) and the private property (unit 689) on the northeast corner comprise the 1.6 acres of desert delineated in this area.

Overall, the Croton Woods is used only occasionally by joggers, cyclists, or walkers along the Old Croton Aqueduct Trail. Areas adjacent to the Yonkers border are very disturbed with trash and dumping. West of the Old Croton Aqueduct Trail, there is a very compacted section were cyclists and/or dirt bikers have set up a course (particularly the northern end of unit 679 and unit 693). East of the trail, dog walkers have carved out many small paths; dumping and trash is abundant; and another compacted area like unit 679 is being created in unit 692 by bikers. Erosion is severe in some spots, particularly west of the Old Croton Aqueduct Trail where surface runoff has cut some deep gullies. Vehicle access, one a major problem in this section of the park, has been curtailed by newly installed guardrails and fences; however, there are a few spots where car thieves are gaining access and leaving stolen, stripped cars.

**Primary Goal:** Designate and maintain The Croton Woods as a Natural Area.

**Priority Actions:**

1. Correct erosion and compaction on the Old Croton Aqueduct Trail and upgrade it. Stabilize area near the exposed wall (a severely eroded gully runs west, downslope from here), but leave wall exposed for historical interest. Erect signs that designate the trail’s state-protected status.

2. Remove abandoned vehicles and block access to sensitive areas (see Maps 7 and 10). Monitor these areas occasionally.

3. Erect signs at the Yonkers borders stating that dirtbiking are illegal in New York City and violators will be prosecuted. Increase patrols by PEP to enforce these rules. Install wooden bollards to keep out automobiles, at fence openings along Yonkers border and Major Deegan Expressway.

4. Restore northern section of unit 679 and units 692 and 693, where dirtbikers have caused severe soil compaction by re-establishing plants and healthy soil structure.

5. Close or remove leaking fire hydrant in unit 615 or remove it.

6. Stabilize eroded gullies in units 694 and 697 where trees with exposed roots are leaning dangerously over private homes on Tibbetts Road and Hancock Avenue.

7. Prevent further dumping of organic debris on park border near Tibbetts Road (units 679 and 695) by establishing park signage.
8. Remove illegal shelters throughout area (Map 7).

Management Recommendations

1. Explore ways to establish groundcover vegetation in Norway maple forest (unit 625).

2. Keep an unmowed strip (about 15 to 25 feet wide) downslope and west of the southbound service station (unit 628).

3. Alert Westchester County Department of Parks, Recreation, and Conservation of dumping and possible encroachment violations behind homes off Sedgwick Road and Hancock Avenue (units 696, 698-700).

4. Monitor sugar maple and black walnut growth and regeneration and protect their habitat.

Northwest Forest
In the northwest corner of the part is a large tract of land (188 acres) bordered on the east and south by the Henry Hudson Parkway, and on the west by Broadway. The northern border is delineated by the Bronx County line (Map 41). Throughout the area are cross-country trails and bridle paths that are extensively used by runners, horseback riders, bird watchers, and dog walkers. There are a few ball fields along Broadway and a mown grassy area (unit 1) frequented by sunbathers and picnickers. The Parks Department and Department of Transportation share a garage and employee parking lot off Rockwood Drive near Broadway. There is also a stable (unit 119) managed by a concessionaire, and an area used by the Sanitation Department (unit 138) on this road. In the summer DPR holds free concerts in the woodland near the comfort station in units 115 and 120.

The landscape of the Northwest Woods is extremely varied. There are rocky cliffs and ledges in the southeast and in the central and northern portions. The soils are shallow and dry in these areas. Large forests and woodlands of red, black, and white oaks with some tulip trees grow here. The less disturbed black oak, black birch, and red oak forest (unit 124) covers over 31.5 acres of the west and central area; it has a healthy understory of shrubs, and regenerating oaks and black birch, and the groundcover consists mainly of native herbaceous plants. There are many units of more open, disturbed oak woodland that is often burned and that has open understory of meadow-like herbaceous species or thickets of Sassafras and other trees. Scattered in the oak woodland are small vine patches of wild grape growing over saplings or shrubs or covering the ground. This type of community seems to thrive in areas opened up by fire.

The rocky areas slope into richer and more moist forests of sweetgum (unit 169), tulip tree (unit 151), and, in the more depressed spots, swamps of red maple, arrowwood, and spicebush (unit 202), white ash, red maple, sweetgum, and black tupelo (unit 128), sweetgum and white ash (unit 139), and a patch of lizard’s tail (unit 131). A small stand of Eastern hemlock (unit 134) close to the Henry Hudson Parkway adds a bit of diversity. In the west, near Broadway, the forests and woodlands are younger, more highly used, formerly disturbed, and characterized by an increase in the dominance of exotic and pioneering species. There are closed forests of black cherry and black locust east of the stables (unit 109) and behind the garage (units 147, 150, and 161). Just north of the
garage is a large closed forest of black locust, black cherry, and mulberry with scrubby understory. There are several herbaceous units. Two spots where mugwort occur, one near the overpass to the Vault hill Woodland (unit 112) containing other herbaceous meadow species, and another between ball fields off Broadway and a forested edge (unit 187). Other herbaceous units are dominated by cool-season grasses. The meadow near the stables (unit 119) also contains spotted knapweed; the old field off Broadway near Yonkers (unit 220) contains black cherry and pin oak in addition to the grasses; and unit 243 in the same area near Broadway has a mixture of goldenrod and grasses. Closer to Yonkers are open areas that contain great ragweed, Rubus, and rose admixed with the grasses (units 232, 247, and 249).

In the forested and open grassy areas off Broadway there is a lot of trampling and trash. The woods are accessible to dumpers from an alley south of Caryl Avenue in Yonkers. Behind the apartment buildings on the Yonkers border, trash and dumping forms hills of refuse that slope into the park. There is also severe dumping within the study area in Yonkers (units 233, 258). Inner portions of the Northwest Woods (e.g. unit 237) are heavily used by picnickers and paramilitary clubs on maneuvers and the surrounding woods (unit 246) are being abused -- trees are hacked and graffiti is widespread. Two abandoned, vandalized service stations on the Henry Hudson Parkway (unit 228) are a potential hazard to park users because of the activities that may occur in them and the risk of fire from them spreading into the park. North of Rockwood Drive, near the stables and garage, is an unpaved lot (unit 138) used by the Sanitation Department as temporary storage for leaves and garbage collected by street sweepers. After the trash is transferred to larger trucks, the area is scraped and the soil and remaining garbage is pushed into the surrounding woods (unit 137). This practice destroys the vegetation and creates a rat problem. There is also a salt pile in the area (unit 146) that should be properly contained since nearby vegetation is damaged.

Throughout the Northwest Woods, a complex network of volunteer and designed trails, including the cross-country trail, are used by runners, nature enthusiasts, and horseback riders concurrently. The unpaved paths are compacted and eroded, and on some, sand is deposited, trails are widened and storm channels are cut (perhaps by horse-stable staff or running clubs). Trees and rocks surrounding the trails are garishly pained with team names and directional signs.

**Primary Goal:** Establish and maintain The Northwest Woods as a Natural Area.

**Priority Actions:**

1. Remove debris from behind buildings at the northern park border, and discourage further dumping by instituting a program of signs and establishing PEP and police patrols.

2. Remove trash in woods and meadows east of Broadway and establish regular maintenance.

3. Remove graffiti from trees and rocks along pathways.

4. Revoke permits of paramilitary clubs and ban their maneuvers in the park.
Management Recommendations

1. Reduce the frequency in mowing in units 220 and 243 to leave an herbaceous meadow edge near the woods east of Broadway.

2. Block access more effectively in unit 249 with bollards or fencing near the alley off Caryl Avenue.

3. Establish regular PEP, UPR, and police patrols in warmer months to the area where people gather (unit 237 and wooded spots east of Broadway in the northern section) to reduce vandalism and trash.

4. Monitor regenerations of oaks and other native species and protect their habitat.

5. Replace missing guardrail near the Henry Hudson Parkway.

6. Inform Westchester County Department of Parks, near McClean Avenue (units 233 and 258). Look into the possibility of establishing a cooperative agreement to maintain the area.

7. Demolish abandoned service stations on the Henry Hudson Parkway. After removing rubble, allow these spots to revert to a natural landscape, or fence them off from the park and make them emergency shoulders for the highway.

8. Explore the possibility of removing the temporary sanitation dump (unit 138) and restoring the area. If it cannot be relocated, pave the surface and fence it off from the surrounding forest. This will prevent further damage to the adjacent vegetation and reduce the rat problem.

9. Designate trails (horseback, cross-country, pedestrian, etc.) uniformly throughout the Northwest Woods. Erect signs indicating their use and have DPR maintain them. Upgrade the existing trails by closing unnecessary paths, repaving and woodchipping. Prevent illegal private maintenance of the trails.

10. Monitor eastern hemlock in unit 134 because it is the only coniferous stand in this section of the park. It is prone to disturbance due to its proximity to the path.

Van Cortlandt Golf Course
This 122.5-acre course is oddly laid out in three parallel strips down the center of the park (adjacent to the wetlands) and one triangular section east of the Major Deegan Expressway in the southern end (Maps 42a and 42b). Built in 1895, the gently sloping, 18-hole course was the first public golf course in the United States. The golf course was built on a filled-in freshwater wetland; because of its age, the ground is wet and sinking in many spots. It has over 88.5 acres of fairway and 7 acres of woodland consisting of willow oak, pin oak, American hornbeam, European basswood, and London planetree. Two units of evergreens, Austrian pine (unit 484), and white pine (unit 465), provide possible roosting and nesting sites for owls. Other forested areas are a combination of pioneering and exotic species and planted species. Black cherry dominates 12 acres of
the 28-acre wooded areas. There are also Sassafras and pin oak, black locust, crab apple, red and white oak, tulip tree, hickory species, red maple, and yellowwood.

Four acres of meadow have developed in unmowed areas. Mugwort comprises over two acres; there is a little bluestem and goldenrod meadow (unit 451) and a goldenrod and dogbane meadow with Japanese honeysuckle (unit 470). The course also boasts a man-made pond (unit 480). Some patches of wild grape are growing atop black cherry (472) in the course’s southern triangle section.

**Primary Goal:** Maintain the Van Cortlandt Golf Course as an Active Recreation Area.

**Priority Actions:**

1. Direct golf course managers not to dump debris in the rough and natural areas and work with them to establish a compost pile.

2. Aid management in exploring ways to alleviate the waterlogged fairway.

3. Remove illegal shelter in unit 454.

**Management Recommendation**

1. Educate golfers—through use of signs/posters—about the vegetation on the golf course.

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**Moshulu Golf Course**

Built in 1914, this 85-acre course is situated in the southeast corner of the park at West Gunhill Road and Jerome Avenue (Map 45). It is a 15-hole course with a 63-acre fairway and almost 9 acres of woodland strips in between. The woodland consists of London planetree, Austrian pine, Sassafras, black cherry, pin oak, and American elm. Forested areas on the perimeter of the course consist primarily of black cherry and/or oak (white and pin). There are a few wet-site forests of pin oak and red maple (units 504, 505, and 507), black willow (unit 518), pin oak (unit 517), and a white oak/sweetgum/pin oak woodland (unit 511) totaling over three acres. A small patch of Japanese hops (unit 515) provides the only covertype diversity in the golf course.

**Primary Goal:** Maintain the Moshulu Golf Course as an Active Recreation Area.

**Priority Action:**

1. Inform golf course managers not to dump debris in the rough and natural areas and work with them to establish a compost pile.

**Management Recommendation**

1. Educate golfers – through use of signs/posters—about the vegetation on the golf course.

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**Highway Sections**

**Primary Goal:** Designate and maintain the Highway Section as a Natural Area.
Priority Actions:

1. Establish regular maintenance routine to remove trash and debris.

2. Replace missing guardrail.

3. Removed abandoned auto in unit 528.

4. Remove dying and dead Ailanthus (units 523, 526, 558, 561 and 562) where they pose a hazard to passing motorists.

Management Recommendations

1. Establish a cooperative agreement with the New York State Department of Transportation to maintain the integrity of the park setting through the establishment of scenic roadsides.

2. Initiate meadow management techniques such as mowing cycles, fertilizers, scraping, etc., in unit 528.

3. Restore unit 525, which has good potential for wildlife habitat, by restoring natural soil structure, reestablishing groundcover, etc.

Landscaped/Recreation Area

Much of the Landscaped/Recreation Area is located in the southwest corner of the park. On the west, it stretches north from Van Cortlandt Park South along Broadway to the Major Deegan Expressway for a short distance and then extends along the border of the wetlands and Vault Hill Woodland (Map 44).

This management zone is rich in both history and recreational facilities. It contains the Van Cortlandt Mansion (built in 1748) which is listed on the National Register of Historic Places. Currently the mansion and its grounds are part of a city restoration project. The Van Cortlandt family cemetery, located on Vault Hill, is also a significant historical site.

The largest part of the Landscaped/Recreation Area is the 67-acre Parade Ground. Used in the early 1900s by the National Guard, this field now contains soccer, football, cricket and baseball fields, an exercise course, and part of the cross-country trail. Other recreational facilities include tennis, paddleball, handball, basketball and bocci courts, asphalt playgrounds, a swimming pool, a track-and-field stadium and various picnic sites. Included in this management area is the Van Cortlandt Visitors’ Center east of Broadway, the Parks Enforcement Patrol (PEP) station in the stadium, the Urban Park Ranger office in the Van Cortlandt Golf House, and all parking lots.

Besides the pin oak and Norway maple on the landscaped lawn (unit 1), there are several other groves of planted trees. Unit 24 contains a memorial Grove of pin, red, and willow oaks planted to honor WWII and Korean War soldiers and a Constitution Grove of 13 American linden. South of Van Cortlandt Mansion is a planted arbor of mulberry with an open understory. Two other areas of landscaped woodland have now become overgrown: unit 3 at the edge of the parking lot near Van Cortlandt Golf House contains
pin oak and white pine with black cherry regeneration; and unit 21 at the southeast corner of the Van Cortlandt Mansion is a woodland of mulberry, black cherry, and Norway maple.

The Landscaped/Recreation Area is generally well maintained. There is some trash and campfires on the Parade Ground, but nothing severe. The staircase south of the mansion (unit 25) is in a state of disrepair and the Van Cortlandt family vault has been vandalized. Both will be revamped in the future capital project. Memorial Grove (unit 24) is surrounded by unattractive hurricane fencing to protect it from trampling and from picnickers; some of the plaques at the bases of the trees are missing or vandalized. The soil in the mulberry arbor (unit 23) is compacted and eroded where it slopes; the only regeneration occurring is Norway maple. The paths in unit 21 near the mansion are poorly maintained, and the stone wall nearby is vandalized and falling apart. The parking lot south and west of the Van Cortlandt Golf House contains dumped debris and occasionally a vehicle is abandoned here.

**Primary Goal:** Designate and maintain the Landscaped Recreation Area as an Active Recreation Area.

**Priority Actions:**

1. Increase visibility of the PEP office in the stadium by placing signs more prominently.

2. Establish regular PEP and police patrols through the area to reduce the number of violations such as illegal parking and campfires.

**Management Recommendations**

1. Correct the erosion and compaction problem in the mulberry arbor (unit 23) by planting understory and/or groundcover vegetation.

2. Prevent further dumping in parking lots by locking the entrance from Van Cortlandt Park South at night and by patrolling the areas during the day.

3. Install more attractive fencing around the Memorial Grove or plant groundcover more resistant to trampling, such as ivy.

4. Repair stone wall and path in unit 21 and close off excess paths through barrier plantings such as hawthorns and viburnums.
APPENDIX G: List of Recommendations, 1996 Yale University study

Goal: To perpetuate the Croton Woods as a natural forest community where a diversity of native plants and wildlife can be found.

Actions:

1. Define future forest conditions that would be considered ideal for the Croton Woods in the future.
2. Divide up the Croton Woods into areas based on priority for intervention.
3. Continue to maintain habitat and forage for wildlife species known to inhabit the Croton Woods.
4. Involve outside parties in the process of managing for this goal through outside participation.

Goal: To continue control of invasive exotic species which threaten to dominate native vegetation.

Action:

1. Continue to remove and suppress exotics that threaten the establishment of a native dominated forest.
2. Incorporate volunteer labor for manual control of exotics and lessen the need for herbicides.
3. Promote a policy of planting only natives (or proven non-invasive exotics) in areas under the jurisdiction of Department of Parks and Recreation and outside its jurisdiction.
4. Design a system of monitoring the progress in exotic species control which allows participation and feedback from a variety of sources.

Goal: To promote the recreational uses of the Croton Woods that are consistent with the maintenance of a natural forest, such as fitness walking, jogging, walking of pets, relaxation and nature enjoyment.

Action:

1. Make the current access routes to the Croton Woods more appealing and known.
2. Improve the conditions of the existing trails.
3. Monitor use of the Croton Woods to control illegal uses of the park such as motorbiking.
Goal: To remove trash from the Croton Woods and to keep the forest relatively free of dumping.

Actions:

1. Continue to make the boundary of the Croton Woods resistant to car dumping.

2. Remove the trash along the Major Deegan Expressway.

3. Provide trash receptacles at strategic locations so users can throw away trash before entering or after leaving the woods.

4. Create program of composting among the local residents along northern edge of Croton Woods to eliminate the need for organic debris to be dumped.

Goal: To utilize the forest to educate the users of the park and neighborhood groups about management goals and build a foundation of support for management activities through community interaction and cooperation.

Actions:

1. Provide opportunities for neighborhood and city residents to learn about the ecology of this urban forest through guided field tours, community meetings and participation in management.
# APPENDIX H: Common Invasive Plant Species Found In Van Cortlandt Park

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree-of-heaven</td>
<td>Ailanthus altissima</td>
<td>tree</td>
</tr>
<tr>
<td>Akebia</td>
<td>Akebia quinata</td>
<td>vine</td>
</tr>
<tr>
<td>Asiatic bittersweet</td>
<td>Celastrus orbiculatus</td>
<td>vine</td>
</tr>
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<td>Asiatic dayflower</td>
<td>Commelina communis</td>
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<td>Bedstraw</td>
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<td>Black jetbead</td>
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<td>Bush honeysuckle</td>
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<td>Chicory</td>
<td>Cichorium intybus</td>
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<td>Chinese elm</td>
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<td>Common daylily</td>
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<td>Common reed</td>
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<tr>
<td>Corktree</td>
<td>Phellodendron spp.</td>
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<td>Crabgrass</td>
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<tr>
<td>Deadly nightshade</td>
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<td>English ivy</td>
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<td>Five-leaf aralia</td>
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<td>Purple loosestrife</td>
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<td>Rose-of-Sharon</td>
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<td>Smartweed</td>
<td><em>Polygonum cespitosum</em></td>
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<td>Trumpet creeper</td>
<td><em>Campsis radicans</em></td>
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<td>Water chestnut (potentially)</td>
<td><em>Trapa natans</em></td>
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<td>Weeping willow</td>
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<td>White mulberry</td>
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<td>Wineberry</td>
<td><em>Rubus phoenicolaius</em></td>
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