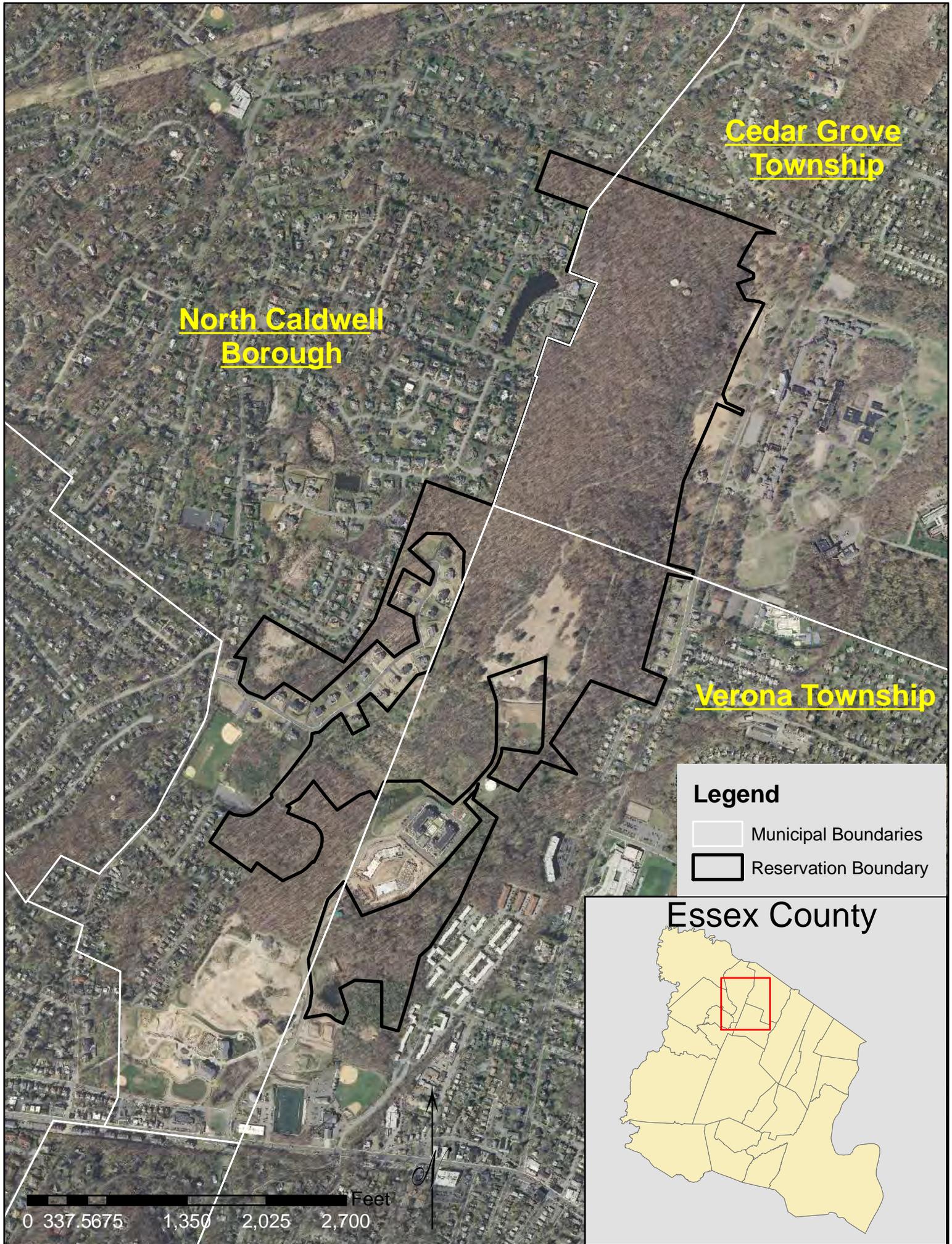


Appendix A

Aerial Map of Hilltop Reservation



Cedar Grove Township

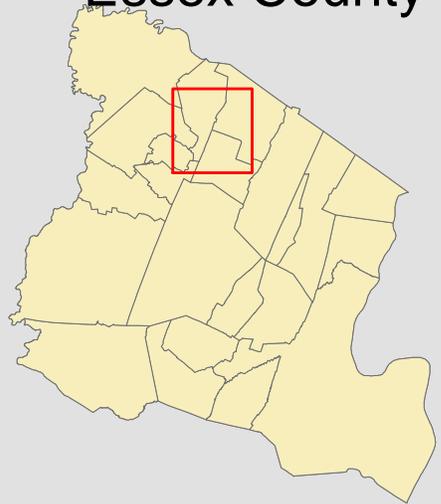
North Caldwell Borough

Verona Township

Legend

-  Municipal Boundaries
-  Reservation Boundary

Essex County



0 337.5675 1,350 2,025 2,700 Feet

Appendix B

Land Cover of Hilltop Reservation

Hilltop Reservation Land Cover



Legend

- Hilltop Reservation
- Forest - Upland
- Forest - Wetland
- Woodland - Upland
- Shrubland - Upland
- Shrubland - Wetland
- Meadow - Upland
- Meadow - Wetland
- Water

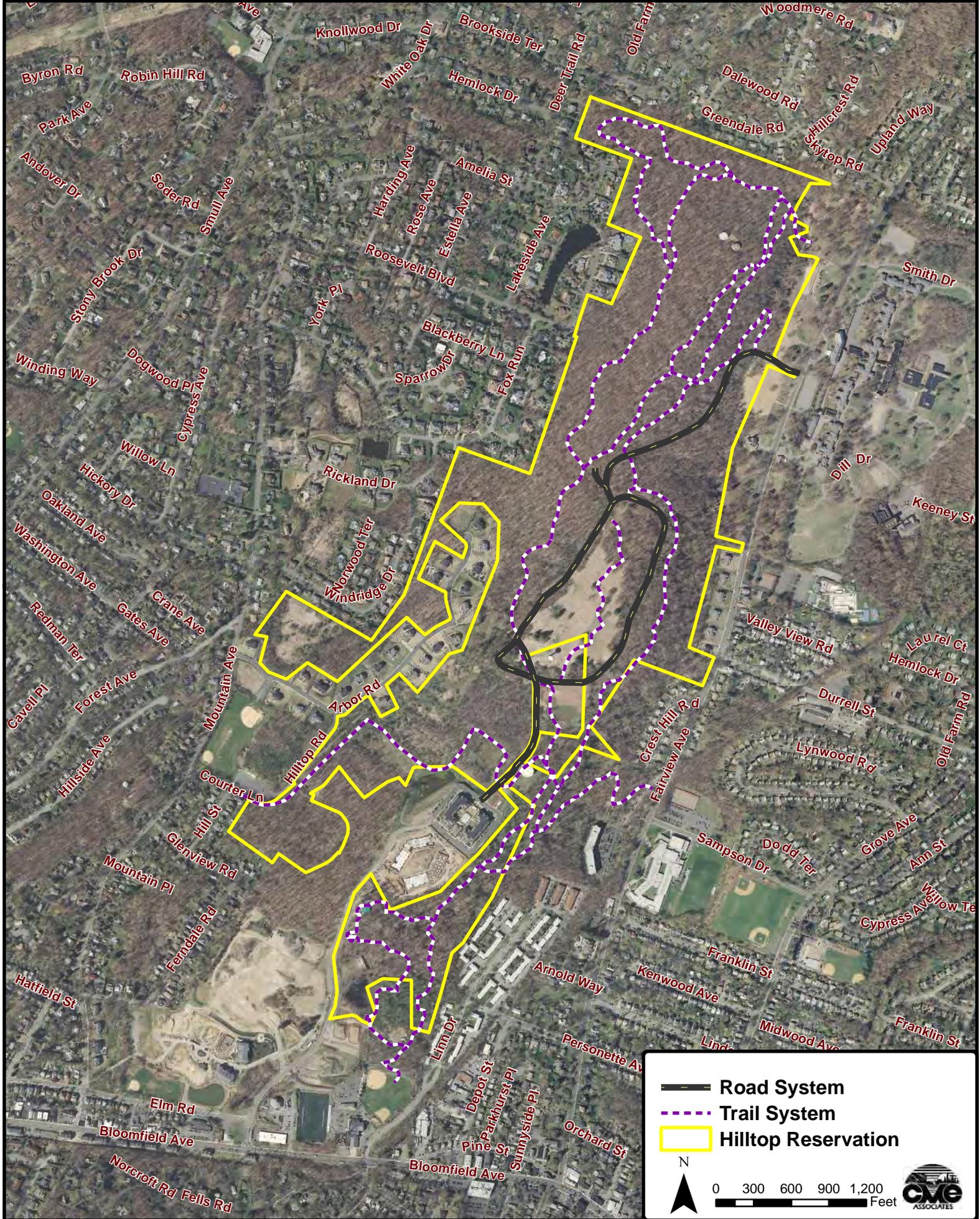
N

0 300 600 900 1,200 Feet

Appendix C

Human Circulation Map of Hilltop Reservation

Hilltop Reservation Human Circulation Network



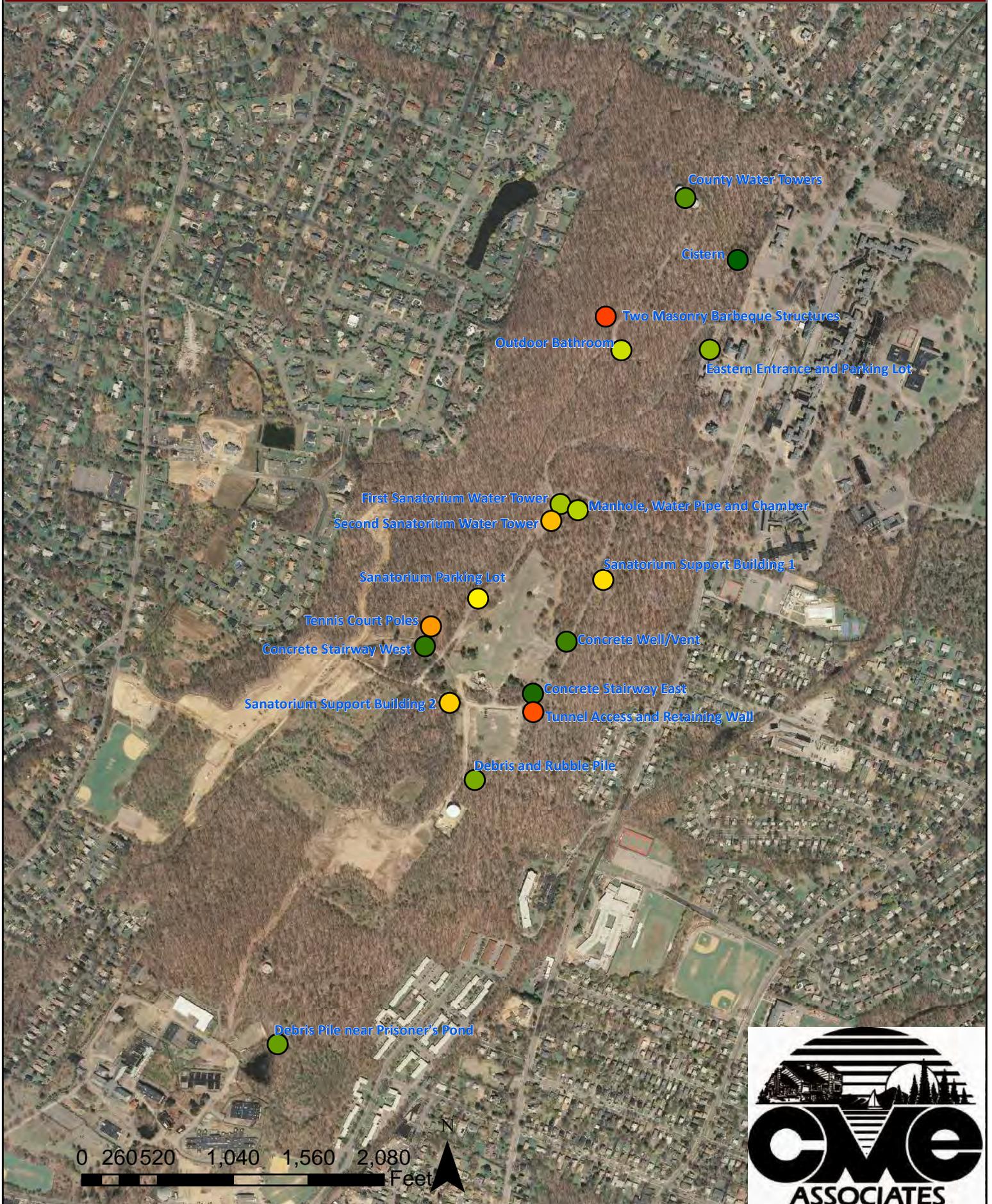
— Road System
- - - Trail System
▭ Hilltop Reservation

N
0 300 600 900 1,200 Feet

Appendix D

Existing Infrastructure Map of Hilltop Reservation

Current Infrastructure Locations



0 260 520 1,040 1,560 2,080 Feet

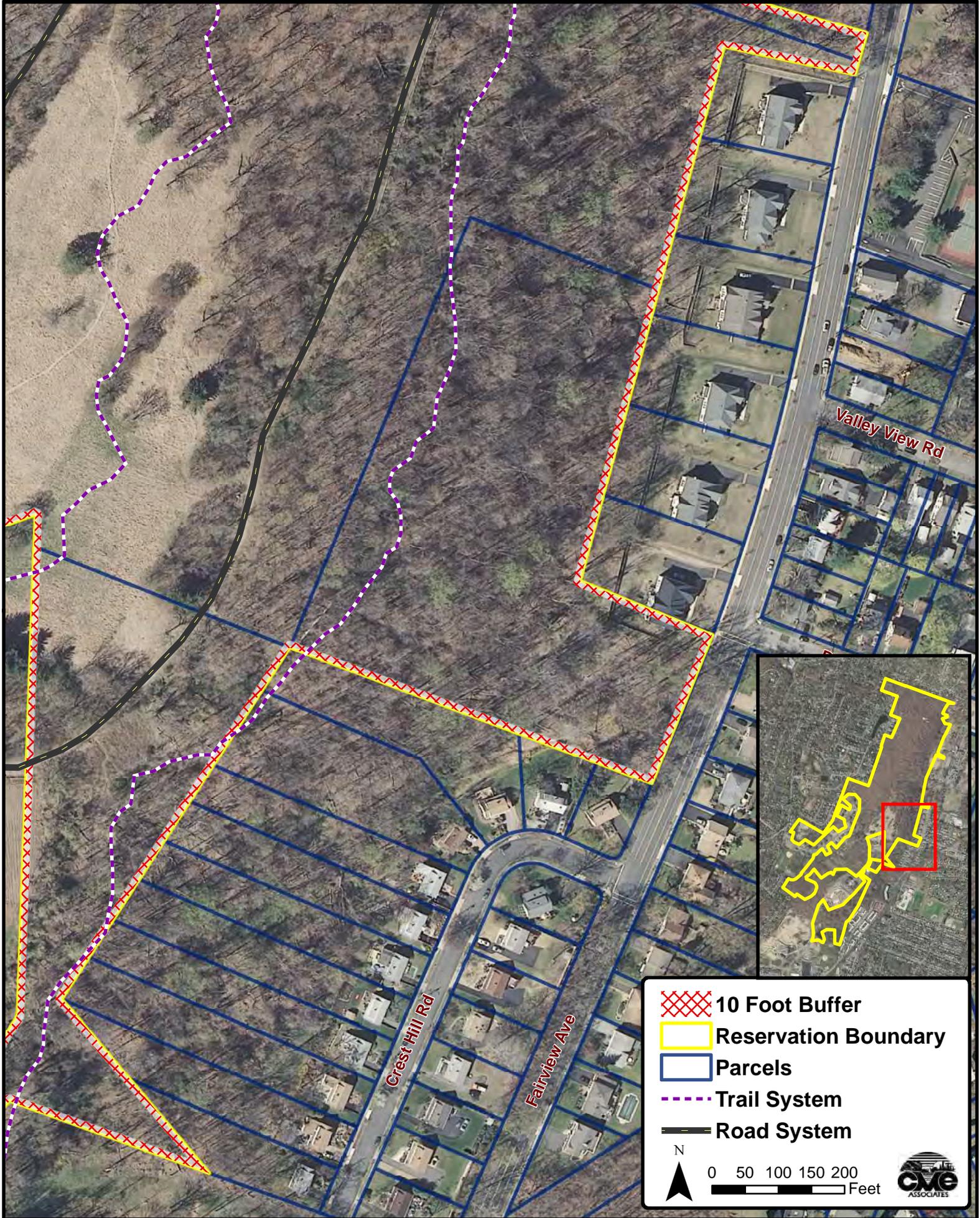
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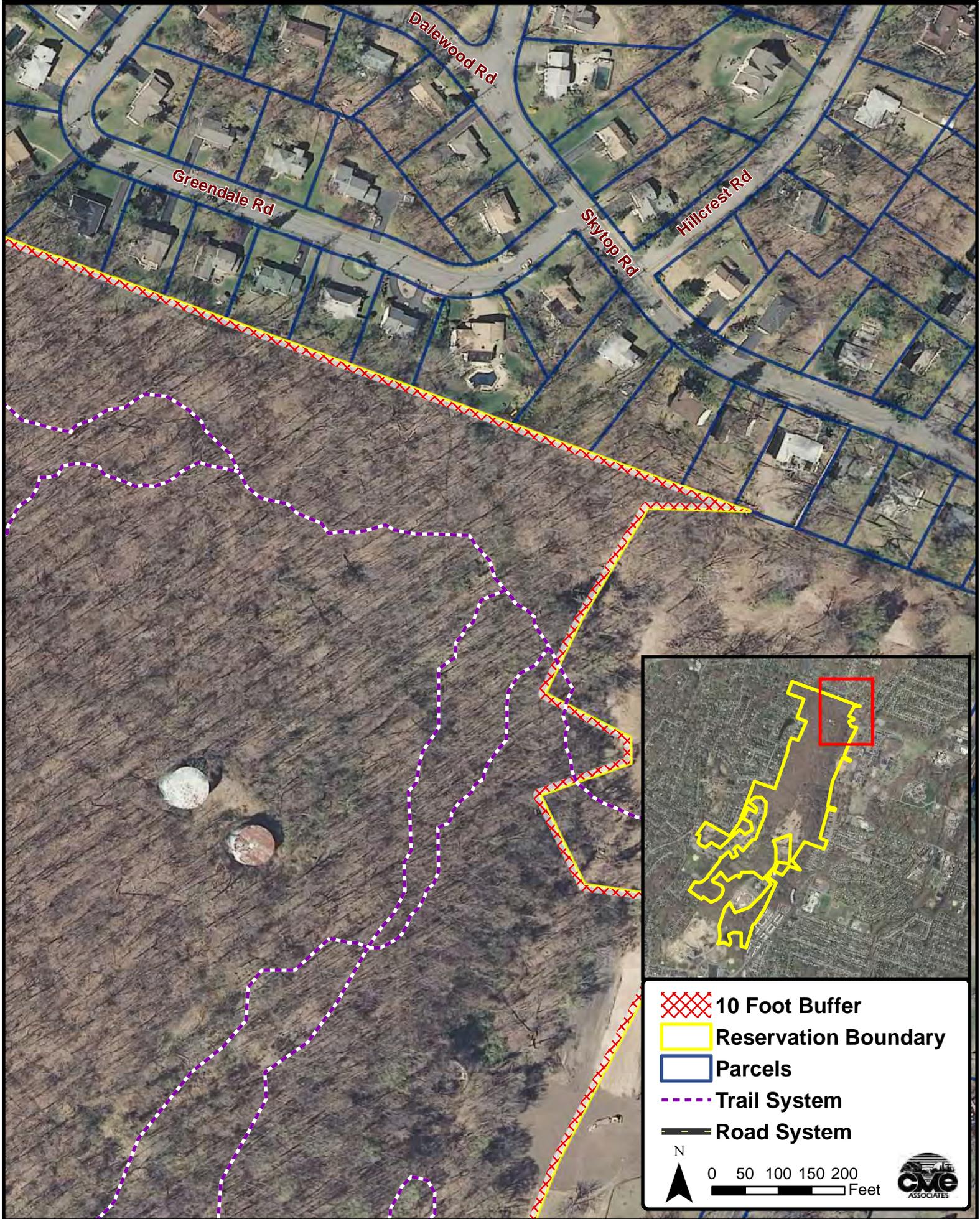
Appendix E

Border Maps of Hilltop Reservation

10 Foot Buffer from Adjacent Residential Parcels - East



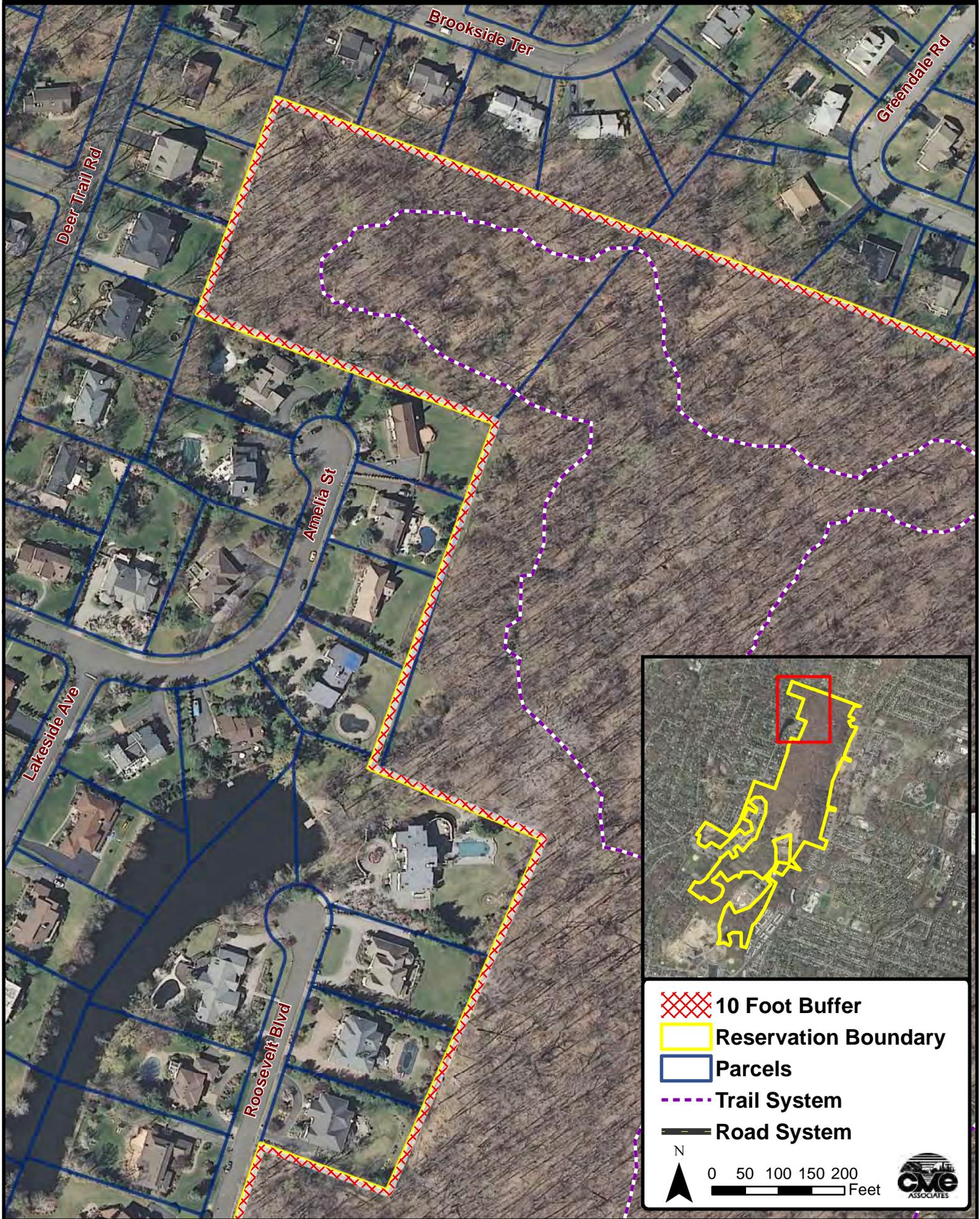
10 Foot Buffer from Adjacent Residential Parcels - Northeast



10 Foot Buffer
Reservation Boundary
Parcels
Trail System
Road System

N
0 50 100 150 200 Feet
CVE ASSOCIATES

10 Foot Buffer from Adjacent Residential Parcels - Northwest



 10 Foot Buffer

 Reservation Boundary

 Parcels

 Trail System

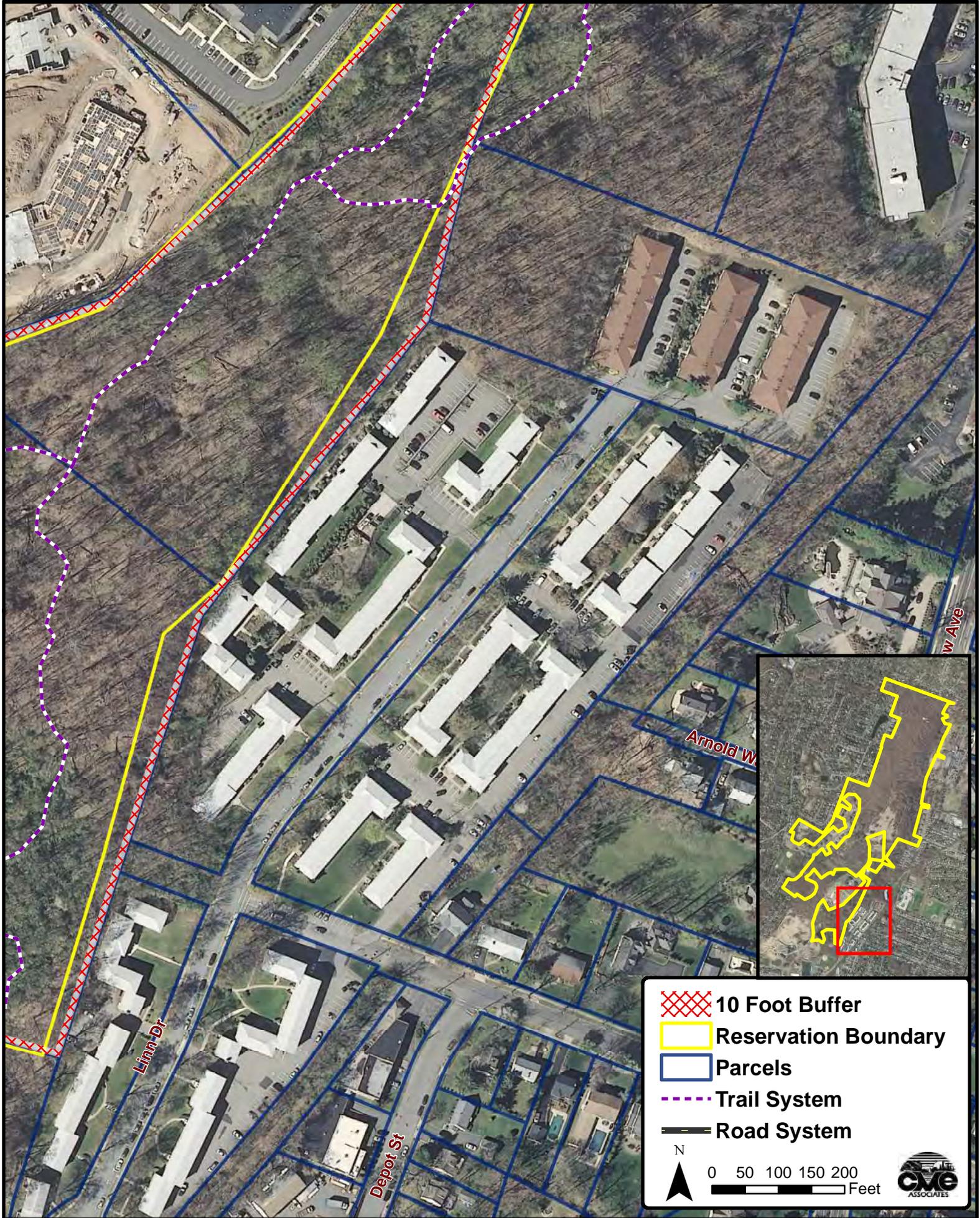
 Road System

N

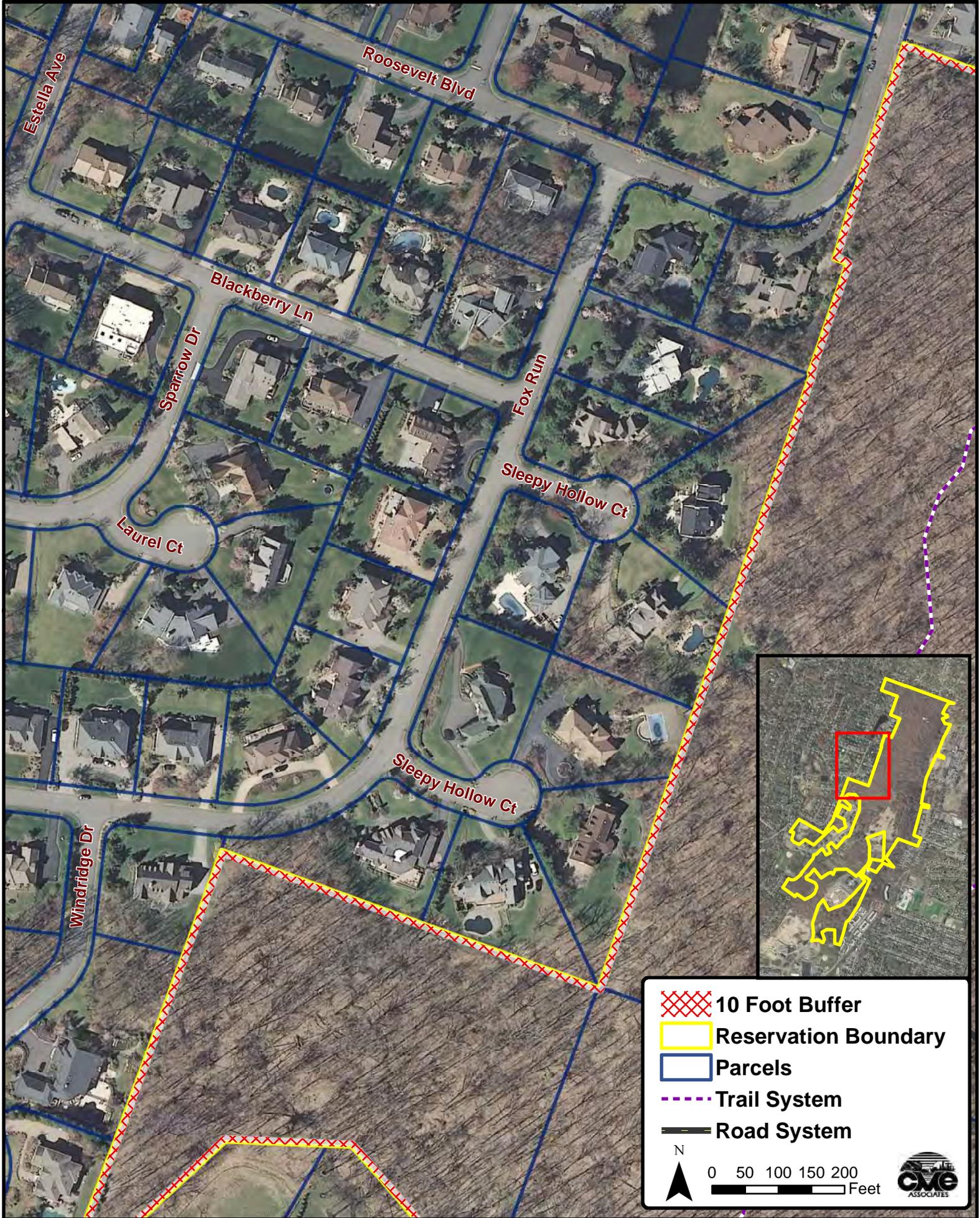
0 50 100 150 200 Feet



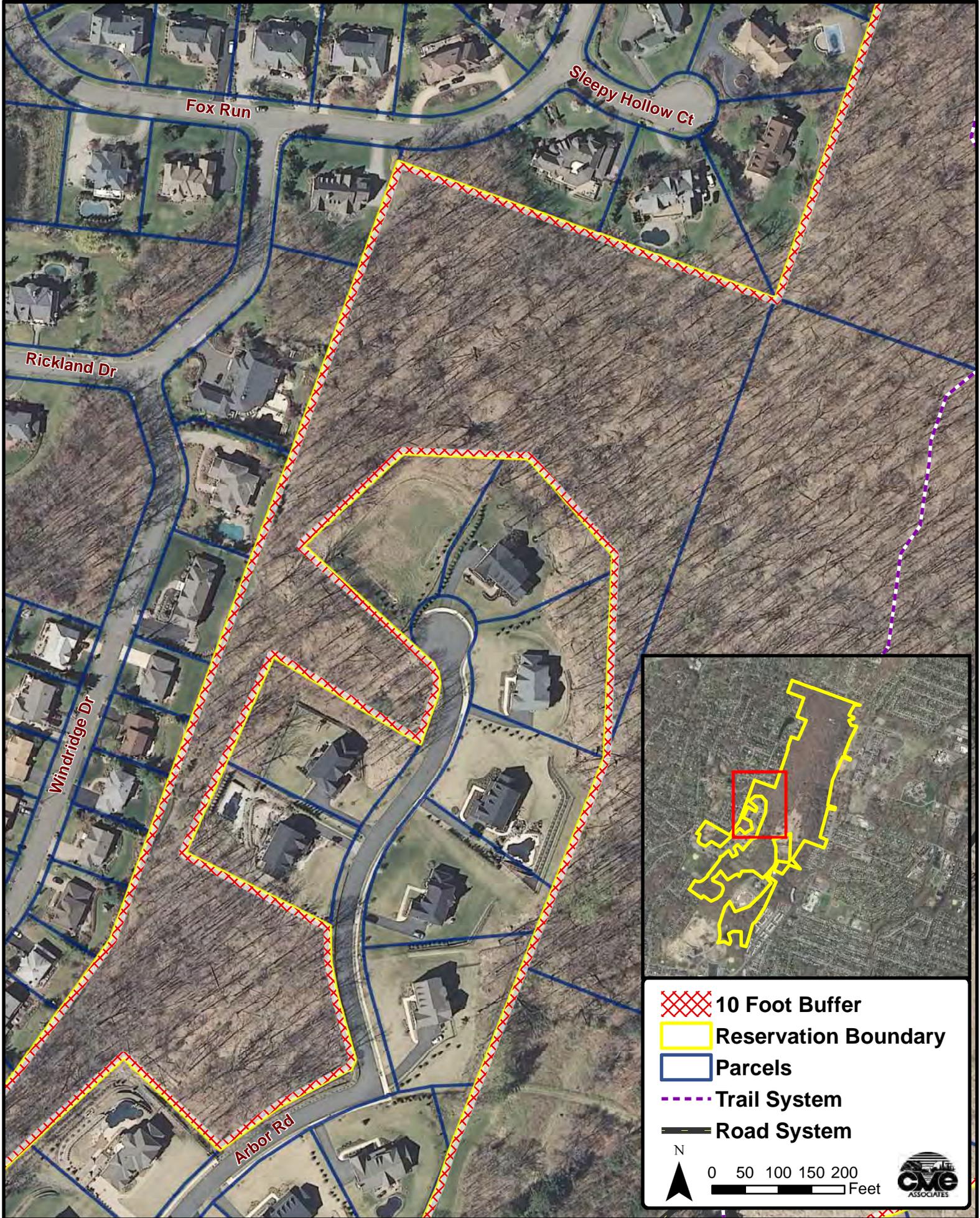
10 Foot Buffer from Adjacent Residential Parcels - Southeast



10 Foot Buffer from Adjacent Residential Parcels - Southeast



10 Foot Buffer from Adjacent Residential Parcels - West-2



Appendix F

**Hilltop Reservation Ecological Health Assessment
and Stewardship Recommendations**

Prepared by Michael Van Clef, Ph.D.

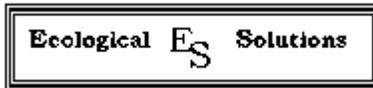
Ecological Solutions, LLC

Hilltop Reservation

Ecological Health Assessment and Stewardship Recommendations

Prepared for the Hilltop Conservancy
February 2014

Prepared by Michael Van Clef, Ph.D.
Ecological Solutions, LLC



Indian Grass flowers in the Hilltop's grassland restoration

Foreword

This report was commissioned by the Hilltop Conservancy to guide stewardship and wildlife habitat restoration efforts at the Hilltop Reservation.

This report was facilitated by work performed by M. Van Clef while conducting forest health evaluations under contract with the Essex County Department of Parks, Recreation and Cultural Affairs, which included six site visits from November 2009 through June 2013. Additionally, the author visited the site twice while performing surveys with the New Jersey Invasive Species Strike Team. These experiences significantly increased the author's familiarity with the Hilltop Reservation and contributed to the assessment and recommendations provided in this report.

Special thanks are provided to Theresa Trapp, Treasurer of the Hilltop Conservancy. Ms. Trapp accompanied the author on three site evaluation visits and provided detailed information regarding restoration projects and invasive species, along with insights regarding past land uses and current ecological conditions. Finally, Ms. Trapp provided numerous reference materials including past studies of the Hilltop area.

Introductory Information

Study Area:	Approximately 251 acres <u>Note:</u> the Hilltop Reservation is 284 acres in total. The 33 acres located east of Fairview Avenue in Cedar Grove were not included in this study.
Municipalities/County:	Cedar Grove Township, North Caldwell Borough, Verona Township / Essex County
NJDEP Watershed Management Areas:	Lower Passaic & Saddle River (WMA 4), Upper Passaic, Whippany & Rockaway Rivers (WMA 6)
Wildlife Action Plan Conservation Zone:	Northern Piedmont Plains (Zone 12)
Deer Management Zone:	36
Named Waterbodies:	Prisoner's Pond
Broad Habitat Types:	Upland Forest & Woodland - 203 acres (81% of Reservation) Wetland Forest & Woodland - 8 acres (3% of Reservation) Upland Shrubland - 11 acres (5% of Reservation) Wetland Shrubland - 2 acres (1% of Reservation) Upland Grassland/Meadow - 17 acres (7% of Reservation) Wetland Meadow - 4 acres (2% of Reservation) Open Water - 1 acre (< 1% of Reservation) All Natural Cover Types - 245 acres (98% of Reservation)

Rare Species and Habitats*:

Rare Animals and Habitat Located on Reservation:

Great Blue Heron (foraging habitat)
Vernal Pool (Potential, Not Confirmed): 2

Rare Animals and Habitat Located near Reservation:

Barred Owl (located two miles southeast of Reservation)
Wood Turtle (located one mile east of Reservation)
Veery (located two miles southeast of Reservation)

Landscape-scale Conservation Areas:

Garret Mountain Important Bird Area (located three miles northeast of Reservation)

*Animal species data from Landscape Project (version 3.1); NJ Natural Heritage grid data does not contain any rare plant or rare ecological community records for the Reservation or its vicinity

Executive Summary

The primary purpose of this report is to document ecological values and conditions and identify future stewardship projects that will maximize ecological health of the Hilltop Reservation.

The 284-acre Hilltop Reservation serves as an ecological oasis within an urban landscape – nearly 90% of the land within two miles is developed. Several types of forest habitat cover approximately 85% of the Reservation. Habitat types vary from dry oak-hickory forests with lowbush blueberry and black huckleberry to moist oak-hickory forests to densely shaded sugar maple forests to wetland forests with red maple and black tupelo. This variation in forest type can support a diversity of plants and animals. Early successional plant communities (i.e., meadows and shrublands), while covering many fewer acres than forest, provide critical habitat for a different set of flora and fauna.

Overabundant deer and invasive species are critical problems throughout New Jersey and significantly impact the Reservation. Deer have left forest habitat nearly devoid of understory shrubs and herbs. Canopy gaps, instead of producing the next generation of trees, are filled with infestations of unpalatable invasive species. Infestations tend to be most severe where past intense human land uses occurred such as agriculture, institutional medical treatment and correctional facilities, which will present challenges to the overall health of the Reservation well into the future. In addition to many ‘common’ invasive species, the Reservation has developed infestations of newly emerging invasive species that are still relatively uncommon in New Jersey.

Active stewardship of the Hilltop Reservation is justified by its ecological value and serious threats to its ecological health. Four primary stewardship recommendations are summarized on the following page and detailed in Section III of this report. They include: 1) Reduce Deer Population, 2) Control Invasive Species, 3) Restore and Maintain Forest Habitat, and 4) Restore and Maintain Early Successional Habitat.

Stewardship efforts at the Reservation have been initiated over the last several years by the Hilltop Conservancy. Essex County’s recently implemented deer management program appears to be reducing browse damage and early signs of recovery are visible. The deer program will need to be maintained in perpetuity to assure recovery from many decades of intense deer browse damage. The ultimate desired goal is ecological control of invasive species exerted through robust growth of native plants freed from excessive deer browse.

Invasive species control efforts have been initiated, but a long-term, comprehensive approach through the preparation and execution of an Invasive Species Management Plan will be essential. This should include field mapping of existing infestations and formulation of a 10-year implementation schedule with annual work plans, including funding and dedicated resources.

Specific strategies for the restoration of various habitats are required to reverse decades of degradation and to maximize diversity. Forest habitats should be fostered through installation of 16 acres of deer exclosures spread throughout the highest quality portions of all representative forest types, and all exclosed areas should be planted with native shrubs and herbs to speed recovery. Ecologically healthy early successional habitats are very uncommon in New Jersey, and the Reservation can serve as a refuge for plants and animals dependent upon these habitats. The juxtaposition of early successional lands with forest habitat represents the highest potential ecological value for the Hilltop – the Hilltop Conservancy and Essex County have already successfully restored 10 acres of meadow/grassland, and should continue their efforts to restore early successional habitats in appropriate locations.

In total, over 96 acres of restored habitat is recommended across 20 locations. This includes 44 acres of forest and savannah habitat and 52 acres of meadow habitat.

Summary of Primary Stewardship Recommendations (See Section III for Details)

GOAL #1: Reduce Deer Population

- Continue Community-based Deer Management Program to maximize deer herd reduction
 - Monitor and adjust harvest goals based upon direct measurements of forest health.

GOAL #2: Control Invasive Species

- Develop and implement a comprehensive Invasive Species Management Plan that identifies and prioritizes the most significant threats to the Reservation's ecological health
 - Perform field surveys to map existing invasive species cover.
 - Provide 10-year plan implementation schedule through annual work plans (with budgets) including the following elements:
 - In partnership with the New Jersey Invasive Species Strike Team, eradicate populations of newly emerging invasive species – Early Detection & Rapid Response (ED/RR) is an efficient and effective approach to prevent future infestations.
 - Control the most highly threatening common invasive species, beginning with those that currently have limited abundance at the Reservation.
 - Establish joint County / Conservancy program to reduce large invasive species infestations, and monitor potential future infestations.

GOAL #3: Restore and Maintain Forest Habitats

- Restore and maintain upland and wetland forest through use of deer exclosures, planting native species and control of invasive species
 - Install deer exclosures and plant native herbs and shrubs at six areas (16 acres) including areas that represent the highest quality portions of all representative forest types, and re-introduce woodland wildflowers and shrubs within those exclosures – species selection should utilize previous botanical surveys of the Reservation and knowledge of similar habitats elsewhere.
 - Restore an additional 28 acres of forest habitat, including savannah habitat (20 acres of upland and 8 acres of wetland). Perform invasive species control and selective native species planting.

GOAL #4: Restore and Maintain Early Successional Habitats

- Restore and maintain upland and wetland meadows and shrublands
 - Restore 42 acres of upland meadow and 10 acres of wetland meadow. Maintain meadow/grassland habitats through a combination of prescribed burning or dormant-season mowing, and selective invasive species control.

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Section I. Introduction

This section provides information on landscape context, past land use, conservation values and critical ecological threats for the Hilltop Reservation.

Landscape Context

The Hilltop Reservation is located on the Second Watchung Mountain, within three highly developed municipalities (Cedar Grove Township, North Caldwell Borough, Verona Township) of Essex County, New Jersey. Urban land uses within a two mile radius of the Reservation accounts for nearly 90% of the total land cover (See Table 1, Map 1). Most of the natural cover of the area occurs at the Reservation.

Table 1. Broad Land Cover Surrounding the Hilltop Reservation

Land Cover Type	Acres	Percent of Total
Natural Cover	789	10
Water	74	1
Urban / Barren Land	7178	89
Totals	8042	100

Past Land Use

There have been intense human uses of the Hilltop Reservation. During the late 1800's and early 1900's the southwestern portion of the Reservation (Area #2 depicted on Map 3), was utilized as pasture and tilled agricultural fields (see photo below).



Prisoner's Pond and White Rock circa 1914

A large County penitentiary occupied adjacent land for over a century until it was closed in 2004 and then demolished in 2011. Other past land uses included a tuberculosis treatment sanatorium and related agricultural fields (from 1900 through 1982) and subsequently, large-scale leaf composting (1980's). See photos below. A brief overview of the Hilltop area's history is provided by Johnson et al. (1999).



Essex Mountain Sanatorium complex circa 1950



Leaf composting windrows circa 1988 (with sanatorium buildings in background)

Over time, former agricultural lands were either developed or reverted to forest, and by 1930, approximately 157 acres of the Reservation had forest cover (ca. 63% of the total, see Maps 2 & 3).

At present, there remains some institutional land ‘use’ inside the borders of the Reservation – several municipal water storage facilities (water tanks and a watersphere) provide water to residential housing in Verona Township and North Caldwell Borough. These facilities are fenced and will continue to be maintained by the local water authority. All other areas of the Reservation are dedicated to passive recreational use in perpetuity.

Geology and Soils

The bedrock geology of the Hilltop Reservation consists of two types (see Map 4). Approximately 97% consists of Preakness Basalt with the remainder consisting of the Feltville Formation (isolated to the northeast corner of the Reservation). The topography of the Reservation ranges from approximately 500 to 700 feet above sea level (see Map 5). Very steep slopes occur along the eastern boundary of the Reservation, whereas other areas have relatively gradual topographic changes.

There are nine soil types at the Hilltop Reservation (see Table 2, Map 6). The majority of the Reservation (ca. 69%) consists of Boonton Loam ranging from 0 to 15% slope. A significant percentage (nearly 10%) is very steeply sloped Yalesville-Holyoke Complex, which is located along the eastern portion of the Reservation.

Table 2. Soil Types of the Hilltop Reservation

Soil Symbol	Soil Name	Acres	Percent of Total
BogCc	Boonton Loam, 8-15% Slope, Extremely Stony	85.6	34.1
BogBc	Boonton Loam, 0-8% Slope, Extremely Stony	82.2	32.8
YaohEh	Yalesville-Holyoke Complex, 35-60% Slope, Very Rocky	23.2	9.2
UdbonB	Udorthents, Boonton Substratum, 0-8% Slope	15.3	6.1
NazA	Natchaug Muck, 0-2% Slope	4.1	1.7
BouB	Boonton-Urban Land, Boonton Substratum Complex, 0-8% Slope	2.2	0.9
HanCc	Haledon Silt Loam, 8-15% Slope, Extremely Stony	0.7	0.3
HasB	Haledon-Urban Land, Haledon Substratum Complex, 0-8% Slope	0.7	0.3
BouC	Boonton-Urban Land, Boonton Substratum Complex, 8-15% Slope	0.2	0.1
Total		250.8	100.0

Water, Wetlands and Watersheds

The Hilltop Reservation is nearly evenly divided into two watersheds (see Map 7). The Lower Passaic & Saddle River watershed (WMA 4) accounts for approximately 53% of the Reservation. This watershed includes the northern and eastern portions of the Reservation. The Upper Passaic, Whippany and Rockaway River watershed (WMA 6) accounts for the remainder of the Reservation.

The Hilltop Reservation features several small streams totaling approximately 4,600 feet. These streams consist of unmapped and/or unnamed tributaries, some fed by run-off from the former sanatorium's storm water management system. Waterbodies located within WMA 4 eventually drain toward the Peckman River located to the east or Glen Brook located to the northwest of the Reservation. Waterbodies located within WMA 6 eventually drain toward Pine Brook located to the southwest.

According to the publically available NJDEP GIS (Geographical Information Systems) wetlands coverage data for New Jersey, the Hilltop Reservation has relatively few wetlands (ca. 13 acres or 5% of the total area – See Map 7). It is important to note that these are not considered officially delineated wetlands. The Letter of Interpretation prepared by Schoor DePalma delineated additional wetland acreage, but total acreage located specifically within the Hilltop Reservation was not tabulated – for example, there are forested wetlands located in the northwestern and southwestern portions of the Reservation. Additional small patches of wetland habitat are found within upland forest areas in the western portion of the Reservation, and a large marshy area is located just south of Windridge Drive in North Caldwell.

Conservation Values

The Hilltop Reservation is an oasis in a highly developed area of Essex County. The Reservation provides significant forest, shrubland and meadow habitats critical for New Jersey flora and fauna.

Forest communities serve as the basis for a broad range of common plant and animal species typical of the Eastern United States. Forest habitat also provides stopover feeding opportunities for Neotropical migrant birds and nesting habitat for many species. In general, meadows and shrublands (especially areas lacking infestations of invasive species) have become uncommon throughout New Jersey. Early successional habitat is required by many native species of plants and insects (e.g., numerous wildflowers, butterflies and native solitary bees).

Forest Habitat

The Reservation is primarily forest habitat (ca. 84% of the total cover, see Table 3). Habitat types vary from dry oak-hickory forests with lowbush blueberry and black huckleberry to moist oak-hickory forests to densely shaded sugar maple forests to wetland forests with red maple and black tupelo. This variation in forest type can support a diversity of plants and animals. Although the Hilltop's forest habitat is not large enough to support nesting of forest interior species (e.g., Kentucky Warbler, Hooded Warbler), it serves as important migratory bird stop-over habitat as well as nesting habitat for a variety of species requiring smaller forest patches.

Early Successional Habitat

The Reservation contains important wetland and upland early successional communities (shrubland and meadows/grasslands). These habitats significantly increase plant and animal diversity when coupled with existing forest habitats. The recent restoration of 10 acres of grassland/meadow on the site of the former sanatorium represents very high quality habitat at the Reservation. The remaining early successional habitats at the Reservation are in poor condition with dense infestations of invasive species.

Table 3. Land Cover Types within the Hilltop Reservation

Land Cover Type	Acres	Percent of Total
Forest & Woodland - Upland	203	81
Forest & Woodland - Wetland	8	3
Shrubland - Upland	11	5
Shrubland - Wetlands	2	1
Meadow - Upland	17	7
Meadow - Wetland	4	2
Water	1	0
Urban / Barren Land	6	2
Totals	251	100

Rare Species and Habitats

The Hilltop Reservation is located within the Northern Piedmont Plains (Zone 12) of the New Jersey Wildlife Action Plan, which utilizes information from the Landscape Project. The Landscape Project is a product of the New Jersey Department of Environmental Protection, Division of Fish & Wildlife, Endangered and Nongame Species Program (ENSP). The Landscape Project ranks sites based upon the biodiversity significance of animal species utilizing patches of habitat. Habitat patches are ranked from 1 (lowest) to 5 (highest). Patch ranks are based upon the level of rarity of the species found within the patch. A rank of '5' signifies patches containing federally endangered and threatened species, Rank 4 patches contain state endangered species, Rank 3 patches contain state threatened species, Rank 2 patches contain state species of concern and Rank 1 patches have suitable habitat for rare animals, but do not contain confirmed occurrences.

The Hilltop Reservation contains foraging habitat for Great Blue Heron (see Map 8). Additional rare animal species are documented within two miles of the reservation (including Barred Owl, Wood Turtle and Veery). The majority of the Reservation is considered "Suitable Habitat" without documented occurrences of rare animals (Rank 1).

The Reservation also includes two unconfirmed occurrences of vernal pool habitat (identified by the NJDEP – Endangered and Nongame Species Program). In addition, field observations suggest the potential for vernal pool habitat located just east of the trail that begins at the Courter Lane parking area in North Caldwell. All of these areas would require additional field surveys to document use by species known to require vernal pools to complete their life cycles (e.g., certain salamanders and frogs).

The New Jersey Natural Heritage Program (NJNHP) is part of the New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management. The NJNHP produces two GIS products that allow rapid assessment of any area. The first product provides locations of important sites that harbor imperiled plants and ecological communities throughout the state. The second product provides generalized locations of imperiled plants and ecological communities that fall within a predefined grid system that covers the entire state.

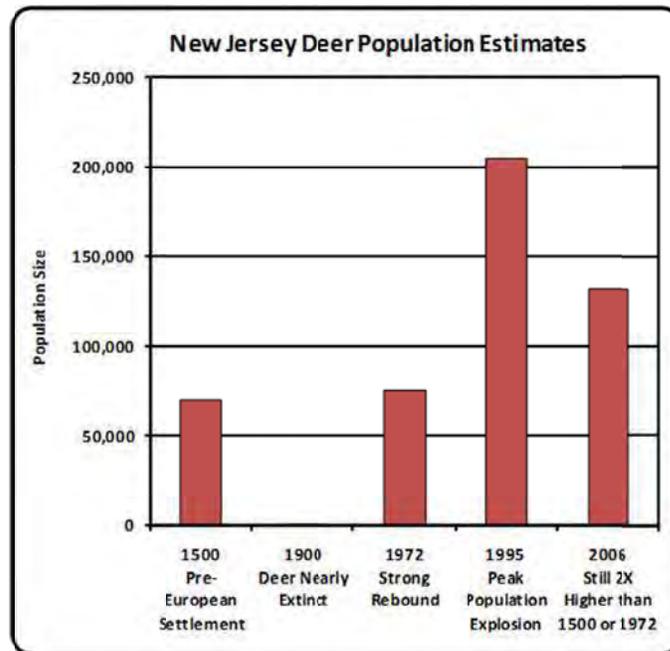
There are no other NJNHP priority sites or records of rare plants or ecological communities located at the Hilltop Reservation.

Critical Ecological Threats

The two major threats to most conservation targets in New Jersey are overabundant white-tailed deer and invasive species. Historic land use is also a critical factor in determining current ecological health. This section provides a brief overview of each major problem, including their interactions, as well as a brief discussion of additional, less immediate issues.

Deer Overabundance

Statewide deer population size has varied significantly over the last 100 years (see chart below). Historical analyses estimate the pre-European colonization deer herd to be about 70,000 in New Jersey (McCabe and McCabe 1984). Unregulated hunting throughout the 1800's nearly drove deer to extinction and conservation efforts supported by new regulations allowed a rebound to historic population sizes by 1972. However, subsequently the deer population grew to 3X its historic level by 1995 and serious declines in the health of forests were observed during that same time period. More recent measures show a reduction in total deer numbers, but current levels are still 2X greater than pre-European estimates.



New Jersey's forests cannot support the current deer population and remain healthy, particularly with no large predators (mountain lions or wolves) to keep their numbers in check. A healthy forest consists of a canopy of tall, mature trees, a sub-canopy of smaller tree species and an understory of tree saplings and seedlings, shrubs and herbs. Deer prefer to eat native plants over non-native invasives, leading to further degradation of our forests by allowing invasive species to proliferate. The combination of elevated deer numbers, their preference for native plants and lack of predators has degraded our forests by eliminating native understory growth and also reducing the abundance of animals that require those plants for their survival. Although the 'correct' number of deer may vary depending upon site and regional conditions, the goal of healthy forest communities that support a diversity of plants and animals is universal.

Invasive Species

Humans have introduced plant species, both intentionally and unintentionally, to parts of the world outside of their natural range. Only a small percentage of these introduced species become invasive, which is formally defined by the National Invasive Species Council as “a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health” (NISC 2001). The financial impacts of invasive species are enormous. Pimentel et al. (2005) estimate an annual cost of \$120 billion to agriculture, forestry and recreation. In addition, invasive species are considered the greatest threat to global biodiversity after outright habitat destruction (Wilcove et al. 1998).

Unfortunately, the rate of new invasive plant introduction continues to rise. Snyder and Kaufman (2004) estimate 50 new plant introductions to New Jersey over the last 25 years (these are species with individuals growing in natural or semi-natural areas outside of human cultivation). There are over 1,000 non-native plant species in New Jersey. Currently, there are approximately 30 widespread invasive plant species in New Jersey, but there are up to 70 additional species considered invasive or potentially invasive. There are no estimates of the total area infested by invasive species in New Jersey, but it is likely that hundreds of thousands of acres are negatively impacted.

Historic Land Use

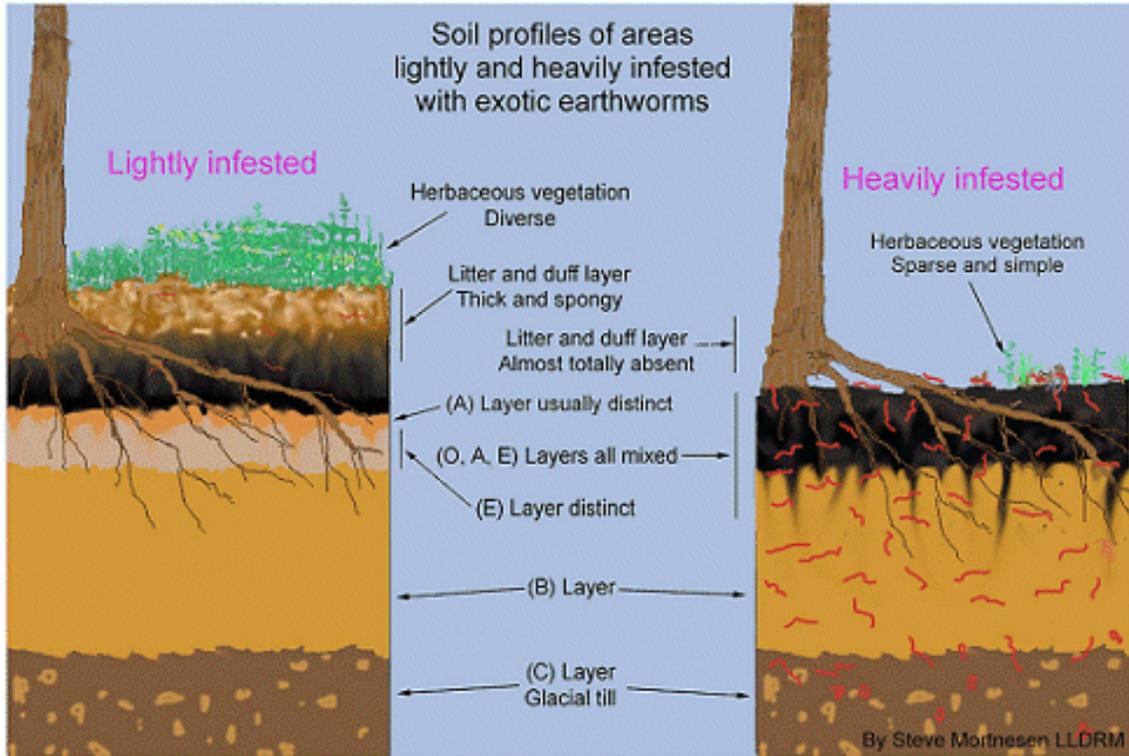
Natural plant communities growing on former agricultural areas are often beset with infestations of invasive plants due to alteration of soils. It is not uncommon to find clear demarcations of infestations in forest habitat (e.g., one side of a stone wall or stream is severely infested while the other side is minimally infested). Anecdotally, these demarcations are correlated with former agricultural areas as shown in 1930 historical aerial photography. Presumably, areas showing forest cover in 1930 had never been plowed. It is reasonable to assume that formerly tilled areas are much more susceptible to invasion than untilled areas. However, land uses occurring between 1930 and present day should also be considered (e.g., intense forestry activities in the context of an overabundant deer population).

Native forest soils consist of a series of layers. The “O Horizon” is the top layer and consists of fresh and incompletely decomposed organic matter (i.e., leaves and humus). The next layer is the “A Horizon”, which consists of mineral soil mixed with organic material leached down from the O Horizon. The remaining horizons (E, B and C) are defined by chemical leaching and accumulation of minerals over time and contain little or no organic material. Bedrock is located under the C Horizon.

Formerly tilled agricultural soils are quite different than native (undisturbed) soils. In general, all soil horizons within one foot of the surface have been mixed into a uniform and unnatural soil horizon. In addition, traditional agricultural activities (e.g., repeated tilling, application of lime and phosphorous, utilization of heavy machinery) create long-term soil changes including loss of organic matter, elevated pH, increased amounts of calcium and phosphorous, and compaction from machinery causing poor water infiltration. These changes also induce fundamental alteration of nitrogen cycles and composition of soil microorganisms. All of these changes have implications for seed germination and root growth. Although many common native species can grow on these altered soils, it appears that weedy invasive species are most aggressive under these altered conditions.

The impact of exotic earthworms is also associated with former agricultural activity, but adjacent unplowed forest soils are often infested as well. Over time, these Asian and/or European earthworms mix and eliminate the top soil horizons and virtually eliminate the O Horizon and change soil microorganism species composition. In addition to changing physical properties of the soil (i.e., removing the O

Horizon), earthworms change the natural nitrogen cycle. The result is the conversion of nitrogen into a form more readily used by plants, but this increased availability also increases leaching of nitrogen out of the soils. In addition, this change in nitrogen availability causes a shift in soil microorganisms from being dominated by fungi to being dominated by bacteria. This may impact the roots of many native plants that need to be physically connected to particular soil fungi (called mycorrhizal fungi) in a symbiotic relationship to allow those plants to absorb particular nutrients from the soil. See illustration below.



Depiction of invasive earthworm impacts in forest soils.
 Source: http://www.nrri.umn.edu/worms/forest/soil_layers.html

The combined impacts of past agricultural tilling, alone or in concert with changes induced by exotic earthworms, are profound. However, it is important to note that even though impacted forests may not achieve perfect health, substantial improvements in most New Jersey forests can be obtained (primarily by reducing deer browse pressure on native plants that have the ability to thrive in these altered soil conditions).

Section II. Ecological Assessment

A rapid, visual ecological assessment was conducted at the Hilltop Reservation. Site visits were conducted on June 6 and September 17, 2012 and on March 22, 2013, and focused primarily on impacts of deer browse and invasive plants.

Rapid Assessment of Deer Impacts

White-tailed deer are having a significant negative impact on the ecological health of the Hilltop. The deer population remains too high – continued elimination of forest cover should be expected as mature native trees naturally fall due to various factors such as storms and disease. The forest currently contains little or no understory vegetation (e.g., native shrubs and herbs) that would provide vital habitat for a variety of animals. Native tree regeneration in natural forest canopy gaps is not occurring. Instead, less palatable invasive shrubs, herbs and vines such as Japanese Aralia, Wineberry, Japanese Stiltgrass and Japanese Honeysuckle are filling the gaps.

Ecological Solutions conducted a quantitative rapid assessment of forest health in 2010 and 2012 (Van Clef 2010, Van Clef 2012), using the “Sentinel Seedling Protocol” and “Forest Secchi Protocol” to measure deer browse damage and impacts on the forest understory (See [Ecological Solutions website for description of protocols](#)).

In 2010, 98% of native woody plants on the Hilltop had visible deer browse damage, and approximately 70% had severe damage. Van Clef (2011) reported that 65% of red oak seedlings planted through the Sentinel Seedling Protocol (commissioned by Essex County) were browsed – whereas no more than 10% is the level of browse thought to be conducive to forest health. This study also reported results from the Forest Secchi Protocol – native plants had just 5% cover (compared to the goal of 70%) and non-native species had 12% cover (compared to the goal of < 5%).

Measurements using the same protocols were collected in June 2013. Based upon the results, the County’s deer management program has provided significant improvements. In 2012, the proportion of native plants with browse damage dropped to 76% and the proportion with severe browse dropped to 5%. However, the density of native woody stems remains extremely low (2010: 0.08 per square meter; 2012: 0.05 / m² – measurements of 1.1 / m² were observed within an enclosure at the Hartshorne Arboretum). Importantly, natural forest canopy gaps that are expected to produce the next generation of native trees and shrubs continue to be dominated by less palatable invasive species on the Hilltop.

Even after five years of the County’s deer management program, the number of deer in the Hilltop Reservation remains very high relative to target (Bernier 2013). Annual harvest numbers since 2010 are reported below.

Table 4. Annual Deer Harvest Totals

Harvest Numbers by Year					Cumulative Harvest Total
2010	2011	2012	2013	2014	
97	120	102	61	56	436

In 2013, the Hilltop's deer density was estimated at 90 per square mile (density, or the number of deer per square mile, is used by wildlife managers to assess and compare across properties of different sizes). Although great progress has been made, the Hilltop still contains an unsustainably high deer population. Full recovery will likely require a density of approximately 10 deer per square mile for an extended period of time (a decade, if not longer). Photos below demonstrate current conditions in the Reservation.



Canopy gap invaded by unpalatable non-native shrubs instead of being filled by the next generation of native trees. This unfortunate situation highlights the relationship between deer overabundance and invasive species.



A healthy forest would resemble the photo on the left, with a dense native understory providing ecological control of invasive species. The photo on the right from Hilltop Reservation shows an understory almost completely devoid of plants due to severe deer browse. If deer numbers were low enough, the downed trees from Hurricane Sandy would result in a rejuvenation of native plant growth including new canopy trees and shrubs.



The “crew cut” effect on native shrubs. Deer continually browse new stems that must replace older stems in order for the plant to survive. Very short crew cuts at Hilltop Reservation can still be observed (above), but taller crew cuts (below) suggest that deer browse pressure is lessening.



Rapid Assessment of Invasive Species Impacts

The Hilltop Reservation contains a host of invasive species that threaten the ecological health of its forest and early successional communities. A total of 33 invasive species were documented at the Reservation (see Table 5).

Seventeen of these species are considered to be widespread throughout New Jersey. This includes species found in abundance in the Hilltop such as Bush Honeysuckles, Common Mugwort, Privet, Wineberry, Norway Maple, Japanese Stiltgrass, Tree-of-Heaven and Japanese Barberry. There are many other widespread species that are not yet abundant at the Reservation, including Winged Burning Bush, Autumn Olive and Multiflora Rose. Asiatic Bittersweet is common in all previously-disturbed areas and in adjacent woodland edges, but is not yet widespread.

The remaining 16 invasive species observed at the Reservation are considered emerging in New Jersey. Documented populations are being tracked by the [New Jersey Invasive Species Strike Team](#) and can be viewed on an interactive map. Some of these species are very abundant, including Japanese Aralia and Glossy Buckthorn. A number of other emerging species threatening the Reservation include Chinese Bushclover, Japanese Wisteria, Boston Ivy, Chinese Silvergrass, English Ivy, Porcelainberry, Five-leaf Akebia, Japanese Hops, Jetbead and Wintercreeper. Siebold's Viburnum and Linden Viburnum are found in relatively low numbers, but are particularly threatening to forest habitats.



Linden Viburnum

A sample of densely infested areas is summarized in Table 5 and depicted on Map 9. These areas are often associated with historic agricultural activity or other past intense human land uses. Additional areas are associated with “ash die-back” regardless of past land uses (although the presence of ash may signify past clear-cutting of more typical mature forests). Ash die-back is a general description for a complex of pests and pathogens causing the death of ash trees throughout the region (see photo below). An overview of this complex can be found at the [Missouri Botanical Garden Website](#). Where many canopy-level ash trees have been killed, invasive species have become very abundant.



Ash die-back has affected a number of areas within the Reservation, opening up the forest canopy and further increasing the Hilltop’s susceptibility to invasive species infestations.

Table 5. Species-level Invasive Species Concerns and Broad Recommendations

Common Name	Statewide Status	Hilltop Reservation Status	Treatment Priority	Hilltop Reservation Notes
Asiatic Bittersweet	Widespread	Uncommon	High	isolated patches and individuals within open areas and edges
Autumn Olive	Widespread	Uncommon	High	isolated individuals within open areas and edges
Black Locust	Widespread	Uncommon	High - Restoration Areas, Low elsewhere	isolated patches and individuals in open areas and edges
Boston Ivy	Emerging	Uncommon	High	isolated patches and individuals
Bush Honeysuckle	Widespread	Abundant	Low	forest clearings and areas with less dense tree canopy
Chinese Bushclover	Emerging	Uncommon	High	isolated patches within open areas and edges
Chinese Silvergrass	Emerging	Uncommon	High	isolated individuals throughout
Common Mugwort	Widespread	Abundant	High - Restoration Areas, Low elsewhere	disturbed open areas and edges
English Ivy	Emerging	Uncommon	High	isolated patches and individuals
Five-leaf Akebia	Emerging	Uncommon	High	isolated patches and individuals
Garlic Mustard	Widespread	Abundant	Moderate	throughout Reservation
Glossy Buckthorn	Emerging	Common	High	large infestation isolated within loop road, but seedlings occur throughout Reservation
Japanese Aralia	Emerging	Abundant	High	primarily in disturbed areas, edges, and forest openings but seedlings occur throughout
Japanese Barberry	Widespread	Common	High	isolated patches and individuals throughout
Japanese Hops	Emerging	Uncommon	High	primarily wet, disturbed open areas and edges
Japanese Knotweed	Widespread	Uncommon	High - Restoration Areas, Low elsewhere	isolated patches within open areas and edges
Japanese Stiltgrass	Widespread	Abundant	Low	primarily in wet forest and isolated moist patches; virtually absent in upland forest without agricultural history
Japanese Wisteria	Emerging	Uncommon	High	isolated patches (some large), especially on west side of Fairview Avenue
Jetbead	Emerging	Uncommon	High	isolated patches and individuals
Linden Viburnum	Emerging	Uncommon	High	isolated patches and individuals throughout
Mile-a-Minute	Emerging	Common	High - Restoration Areas, Low elsewhere	isolated patches (some large) and individuals throughout
Multiflora Rose	Widespread	Uncommon	High	isolated patches and individuals throughout
Northern Catalpa	Widespread	Uncommon	High - Restoration Areas, Low elsewhere	isolated patches and individuals in open areas and edges
Norway Maple	Widespread	Common	Moderate	isolated patches (some large) and individuals throughout
Phragmites	Widespread	Uncommon	High - Restoration Areas, Low elsewhere	isolated patches (some large) in disturbed wetlands
Porcelainberry	Emerging	Uncommon	High	isolated patches throughout
Privet	Widespread	Abundant	Low	primarily wet forests and edge areas
Siebold's Viburnum	Emerging	Uncommon	High	isolated patches and individuals
Tree-of-Heaven	Widespread	Common	High - Restoration Areas, Low elsewhere	patches and individuals in open areas and edges
Weeping Cherry	Emerging	Uncommon	High	isolated patches and individuals
Wineberry	Widespread	Abundant	Low	areas with less dense tree canopy, but individuals throughout
Winged Burning Bush	Widespread	Uncommon	High	isolated patches and individuals throughout
Wintercreeper	Emerging	Uncommon	High	isolated patches and individuals

Table 6. Sample of Dense Invasive Species Infestations

Identification Number	Description
1	Ash Die-Back Area; Siebold's Viburnum, Mile-a-Minute, Chinese Silvergrass, Japanese Stiltgrass, Winged Burning Bush, Wineberry
2	Seep forest with Japanese Stiltgrass, Japanese Barberry, Wineberry, Winged Burning Bush
3	Open forest with Wineberry, Asiatic Bittersweet, Tree-of-Heaven, Black Locust
4	Norway Maple dominated forest with virtually absent native shrubs and herbs. Other invasive species such as Hybrid Basswood and Privet are common.
5	Demolition debris area with Common Mugwort, Porcelainberry and Japanese Knotweed
6	Forest canopy gap with variety of invasive species including Porcelainberry
7	Heavy Japanese Aralia infestation
8	Forest canopy gap dominated by Mile-a-Minute and Wineberry
9	Ash Die-Back Area; Thin forest dominated by Japanese Knotweed, Multiflora Rose, Shrub Honeysuckle, Norway Maple, Tree-of-Heaven, Black Locust
10	Ash Die-Back Area; Thin forest dominated by Shrub Honeysuckle -- Tree-of-Heaven die-back significant

Rapid Assessment of Historic Land Use Impacts

The impacts of former agricultural activities must be considered as a critical factor in stewardship planning for the Hilltop Reservation (See Map 3). An explanation of impacts is provided in Section I. Observations at the Reservation appear to fit the general pattern found throughout New Jersey, but a more comprehensive mapping of invasive species would be required to confirm/quantify the causal relationship between past land use and current invasive species infestations.

Section III. Stewardship Recommendations

A significant and persistent effort will be required to address the impacts of white-tailed deer and invasive species across the Hilltop Reservation. In the short-term (≤ 10 years), discrete strategies include:

- 1) Reduce Deer Population
- 2) Control Invasive Species
- 3) Restore and Maintain Forest Habitats
- 4) Restore and Maintain Early Successional Habitats

Descriptions of each strategy are provided below. Table 7 summarizes potential deer exclosure restoration areas and Table 8 summarizes potential restoration projects (in addition to those already underway or in the planning phase). All of these areas are depicted on Map 10.

Long-term strategies (> 10 years) should primarily focus on lower-level maintenance activities (i.e., continued deer management, strategic invasive species control and regular maintenance of early successional communities). In general, ecological control of invasive species exerted through the growth of native plants is the desired ultimate condition (as opposed to perpetual, high-intensity mechanical and/or chemical control methods).

Goal #1: Reduce Deer Population

The current Deer Management Program is beginning to show early signs of success and should be continued with the goal of attaining and maintaining a deer density of 10 per square mile. The program should continue to be guided by the results of Sentinel Seedling and Forest Secchi protocols that quantify potential for native tree regeneration and existence of dense native shrubs and tree sapling cover within the deer browse zone. These standardized methods allow assessment of improvements at the Reservation over time as well as comparison across other County properties.

Additional quantified measurements should also be considered. These include measurements for forest and early successional habitats developed by M. Van Clef to determine the abundance of native herbaceous species. The Bowman's Hill [Plant Stewardship Index](#) may be utilized alone or as a complement to other measurements, in order to assess the presence and abundance of all plant species, especially native herbs. The response of the herbaceous community represents a higher threshold for measuring ecological health than the methods mentioned above, which focus specifically on woody plant responses (and not on more sensitive / less resilient herbaceous species).

In addition, the County should make every effort to encourage the surrounding communities to control their own deer herds, in order to minimize re-immigration back into the Hilltop. Verona, Cedar Grove and North Caldwell together cover an area of almost 10 square miles – more than 20 times the size of the Reservation – and even casual observations reveal there are hundreds of deer living just outside the park's borders. Up until last year, none of those towns were doing anything to manage their resident herds (North Caldwell held its first bow hunt in fall 2013). Given the sheer number of deer 'next door' and the Hilltop's relatively small size and elongated shape, re-immigration will continue to be a significant threat to the Reservation's ecological health.

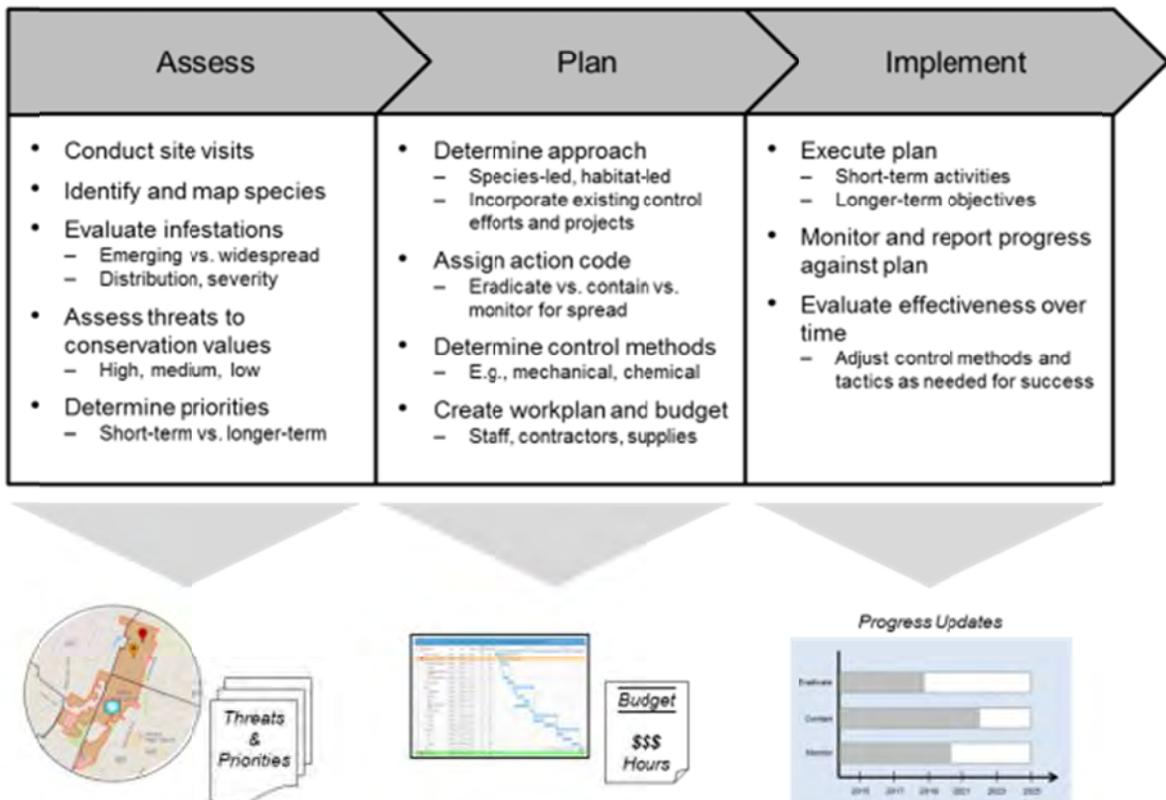


Goal #2: Control Invasive Species

The Hilltop Conservancy and Essex County have already taken vital steps toward the control of emerging invasive species through their partnerships with the New Jersey Invasive Species Strike Team (NJISST). The Strike Team’s strategy – known as “Early Detection & Rapid Response” – represents the most cost effective and efficient invasive species control strategy to prevent further degradation of ecological health (see [NJISST article](#)). However, the current level of effort cannot prevent further degradation of the Reservation – there remain large numbers of both emerging and widespread species found in varying abundances throughout the Reservation (See Section II above). A more focused approach and a funded plan are needed to improve habitat quality.

The development of a detailed Invasive Species Management Plan is essential to strategically control invasive species at the Hilltop Reservation. The Plan should include identification and mapping of existing infestations by species, which provides a clear understanding of the scope of work and allows for prioritization and sequencing of control activities. This enables an efficient and realistic approach to invasive species control, and incorporates the conservation values to be fostered at the Reservation. The Plan should include a 10-year timeline as well as the estimated costs and professional and volunteer manpower required to achieve long-term control objectives for the Reservation. The image below illustrates the activities involved in defining and implementing a strategic invasives management plan.

Strategic Approach to Managing Invasive Species



Goal #3: Restore and Maintain Forest Habitats

The primary recommendation to foster forest health is reduction of the deer population, which is already being undertaken (see above).

Restoration Areas #1 through #6

The installation of deer exclosures should be seriously considered because of the severe degradation that has occurred at the Reservation over several decades of extremely high deer densities. A total of six potential areas are provided in Table 7 and depicted on Map 10. These areas represent the best examples of a variety of forest types found at the Hilltop. These recommendations coincide with areas that have not been subjected to past agricultural tilling or institutional use (e.g., sanatorium, penitentiary).

The deer exclosures should be of similar type and sturdiness to the ones already installed by Essex County at the Eagle Rock and South Mountain Reservations (see photo below).



Deer exclosure at the South Mountain Reservation

Specific areas should be carefully vetted prior to installation of fencing to maximize protection of existing conservation values (e.g., presence of forest wildflowers). Species additions, primarily herbs, within deer exclosures should be considered following careful review of past inventories (e.g., Radis 1987, Crow 1995, Wander and Wander 1995). It is important to select the most appropriate species for reintroduction (if they no longer occur at the Reservation) or as candidates for off-site propagation of existing species to boost their populations (if they are currently present in low numbers at the Reservation).



Shinleaf (left), Yellow-eyed Grass (right) and Sessile Bellwort (below) are all present in low numbers. Most individuals are non-flowering, but protection from deer browse could allow for seed production, subsequent off-site propagation and re-introduction to boost wildflower populations.

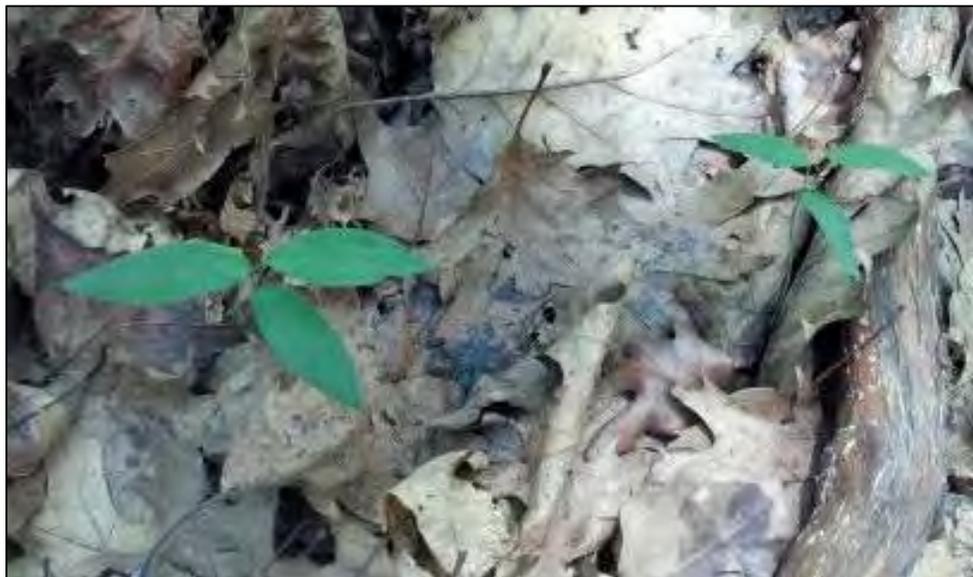


Table 7. Potential Forest Enclosure Restoration Areas at Hilltop Reservation

Restoration Area Number - See Map 10	Perimeter (Feet)	Acreage	Broad Habitat Type	Description
1	2019	4.4	Sugar Maple Forest grading into wetter forest types	<u>Trees</u> : Sugar Maple, Tulip Poplar, Red Maple, Black Tupelo, Ironwood; <u>Shrubs</u> (sparse, heavily browsed): Witch-hazel, Spicebush; <u>Herbs</u> (sparse): Jack-in-the-Pulpit; <u>Invasives</u> : Japanese Stiltgrass (abundant in wetter areas), Japanese Barberry (sparse)
2	1588	2.2	Moist Oak Forest	<u>Trees</u> : Red Oak, White Oak, Sweet Birch, Red Maple; <u>Shrubs</u> (virtually absent): N/A; <u>Herbs</u> (very sparse, heavily browsed): White Wood Aster, False Solomon Seal, Wreath Goldenrod, Jack-in-the-Pulpit, Pennsylvania Sedge, Yellow-eyed Grass, Wood Anemone, Prenanthes species; <u>Invasives</u> : Japanese Stiltgrass (very sparse), Japanese Barberry
3	1066	1.6	Open Wetland Seep	Very sparse native shrubs, herbs and graminoids of wetlands (includes Highbush Blueberry and several native rushes & sedges); <u>Invasives</u> abundant (primarily Japanese Stiltgrass)
4	1916	3.8	Dry Oak Forest	<u>Trees</u> : Oaks and Hickories; <u>Shrubs</u> (moderate to dense): Lowbush Blueberry (heavily browsed), Black Huckleberry, Deerberry, Carolina Rose; <u>Herbs</u> : Pennsylvania Sedge, Partridgeberry; <u>Invasives</u> (variable from dense to absent): Japanese Barberry, Japanese Aralia, Japanese Stiltgrass
5	1301	2.2	Wet Forest	<u>Trees</u> : Red Maple, Slippery Elm, Black Tupelo; <u>Shrubs</u> (very sparse): Spicebush, Witch-hazel; <u>Herbs</u> (moderate to dense): Tussock Sedge, Wood Reed, White Snakeroot; <u>Invasives</u> (dense): Privet, Wineberry, Multiflora Rose, Japanese Stiltgrass
6	1240	2.1	Moist Oak Forest	<u>Trees</u> : Red Oak, White Oak, Black Oak, Shagbark Hickory, American Beech, Sweet Birch, Sugar Maple, Tulip Poplar; <u>Shrubs</u> (very sparse): Witch-hazel; <u>Herbs</u> (very sparse, heavily browsed): White Wood Aster, False Solomon Seal, Wreath Goldenrod, Jack-in-the-Pulpit, ; <u>Invasives</u> (sparse to moderate): Japanese Stiltgrass (very sparse), Norway Maple, Japanese Barberry
Totals	9130	16		

Restoration Area #7

This 4.8-acre area is located on the southeastern slope of the Reservation where openings in the tree canopy have filled with invasive species such as Tree-of-Heaven, Japanese Aralia and Wineberry (see photo below). Where there is sufficient sun exposure at ground level, there are also thick mats of the invasive Mile-a-Minute vine.



Eastern slope canopy gap showing heavy infestations of Japanese Aralia, Tree-of-Heaven and Wineberry (with few native species present) Winter 2013

Whether the canopy openings are natural or man-made is unclear, but given the extent of the infestations, the openings have existed for a number of years.

This slope's steep grade makes it inappropriate for deer exclosures. However, wildlife habitat can be significantly improved by selectively controlling Tree-of-Heaven and Japanese Aralia, and planting native canopy and smaller understory tree species appropriate for the soil type and moisture level. Planted trees should be a minimum of 5-6 feet tall to avoid being browsed by deer – wrapping or other protection of stems should be considered to avoid 'buck rub' that might ultimately kill planted trees.

Control of the Tree-of-Heaven, Japanese Aralia and other invasive species (being careful not to harm newly-planted specimens), should be conducted to allow rapid growth free of smothering from surrounding vegetation. Mile-a-Minute vine adjacent to plantings should be controlled, but eradicating it from the surrounding areas may not be necessary – per a 2012 site visit from Mark Mayer, Supervising Entomologist at the New Jersey State Department of Agriculture, the Mile-a-Minute weevils (biocontrol agents) they have released elsewhere in the state are present in the Reservation (but may require another three to five years before they are numerous enough to be reducing the infestation).

See images below and New Jersey Department of Agriculture's [report on biological control of mile-a-minute](#) for more information.



Eastern slope canopy gap showing heavy infestation of Mile-a-Minute Summer 2013 (above) and close-ups of the Mile-a-Minute weevil and its impact on this invasive vine (below)



Restoration Area #8

This 7.9-acre area of wet forest surrounds the Reservation's western route. It contains signs of significant past disturbance, including manmade drainage channels, large dirt mounds and partially-buried debris. Parts of these same areas contain heavy infestations of Tree-of-Heaven, Multiflora Rose, Privet and Japanese Stiltgrass. The canopy layer is primarily composed of White Ash, which like other areas of the Hilltop shows significant die-back (see photo below).



Western route forest canopy Fall 2013

In a healthy forest environment, these dead ash trees would be replaced by other native forest species – however, this natural process is being hampered by excessive deer browse. This has allowed non-palatable invasive species to become very dense in response to the increased sunlight, further limiting the possibility of native tree regeneration. The existing tree canopy does contain natives such as Sweetgum, Red Maple and Sycamore, but they are not numerous enough to keep the infestations from increasing. The habitat quality of these woods will continue to degrade if the canopy layer is not augmented with native trees to replace the dead and dying white ash.

Planting of native trees and control of invasive species should be conducted as described above under Restoration Area #7. The project would require outside assistance from the US Fish & Wildlife Service and/or skilled contractors, but the Conservancy might be able to leverage funds from the Green Acres and Open Space Trust Fund grants it has received for upgrading the Hilltop's western route and restoring surrounding areas.

Restoration Area #9

This 0.7-acre area is located at the westernmost edge of the former sanatorium complex, where buildings and subsequent demolition activity created a small clearing in the surrounding woodland. The clearing still contains rubble and debris, and is rapidly filling in with invasives like Common Mugwort and Japanese Wisteria.

This area can be restored by first removing the demolition debris (including the remains of the former tennis courts immediately north of the clearing) and then applying herbicide to the most threatening invasive species. Subsequent planting of native shrubs and understory trees will greatly improve the ecological health of this forest clearing. As discussed above, all planted specimens should be at least 5-6 feet tall and protected to avoid damage by deer.



Western side of former sanatorium complex Winter 2013

Restoration Area #10

This 0.5-acre area located near the northern end of the Reservation contains two water tanks that used to supply water to the now-abandoned Essex County Hospital complex located between Fairview and Grove Avenues in Cedar Grove. One of the tanks has been decommissioned, but the other will remain active until all of the remaining hospital buildings have been demolished (to serve as an emergency water source in case of fire).

This area can be restored after the tanks have been scrapped and all debris removed. The disturbed area would first require topsoil replacement and control of invasive species like Phragmites, Common Mugwort, Wineberry and Japanese Honeysuckle. The area could then be planted with native species appropriate for a woodland clearing, and allowed to revert to forest habitat over time. There are some patches of native herbaceous species present at this site (e.g., Narrowleaf Mountain Mint, Grass-leaved Goldenrod, Intermediate Dogbane) – if possible they should be preserved and incorporated into the restoration plan.



Decommissioned water tanks Winter 2012

Goal #4: Restore and Maintain Early Successional Habitats

Ecologically healthy early successional habitats are very uncommon throughout New Jersey. The Hilltop Reservation could serve as a refuge for native plants and animals associated with these habitat types.

Restoration Area #11

The Hilltop Conservancy and US Fish & Wildlife Service have already established a 10-acre native grassland on the ground formerly occupied by the sanatorium (see Map 10 and photo below). Ongoing stewardship via removal of invasive woody plants will ultimately expand this area to 16.6 acres to form contiguous habitat between the paved roads on the east and west sides. The results of this restoration are nothing short of phenomenal – the project has converted barren wasteland filled with rubble and asphalt to valuable habitat for plants and animals. Native grasses and wildflowers provide aesthetic beauty while attracting native bees and butterflies. In winter, the grassland attracts large quantities of birds that feed upon the seeds. Long-term maintenance of this restoration should involve prescribed burning or mowing. Prescribed burning is preferred – it is a cost effective, efficient and low-risk maintenance tool that removes fire-intolerant species (e.g., woody plant seedlings and fire-sensitive invasives), and can be conducted at no cost by professionals from the New Jersey Forest Fire Service.

A combination of prescribed fire (e.g., late winter burning every two to three years) and selective herbicide treatment of patches of more resilient invasive species (e.g., Common Mugwort) should be used as necessary to maintain the grassland. To date, the Hilltop Conservancy has only used manual and chemical removal methods – adding prescribed burning to the maintenance program will greatly reduce the cost, time and herbicide required, in addition to rejuvenating the native grasses and wildflowers.



Upland grassland restoration by the Hilltop Conservancy in partnership with US Fish & Wildlife Service

Maintaining the ‘edges’ of the grassland is also important to the long-term success of this project. The Conservancy has been selectively removing invasive species from narrow strips of trees growing between the current restoration site and the surrounding service road. These species include Tree-of-Heaven, Glossy Buckthorn, Privet, Bush Honeysuckle, Wineberry, Multiflora Rose and an unidentified (but highly invasive) Basswood hybrid used in landscaping around the former sanatorium. The western edge of the site has been addressed and the cleared areas have been re-seeded with natives (see photo below).



The eastern and southern edges will require similar efforts over the next few years. If the invasives within these adjacent areas are not addressed, they will continue to pose a threat to the long-term success of the grassland restoration.

The Conservancy and the County have also been gradually removing sanatorium-related debris and other items from the site (e.g., rubble, concrete steps / sidewalks, lampposts, rebar), as well as filling in pedestrian hazards (sinkholes, pits, open storm drains). As these ‘leftovers’ are addressed, any resulting disturbed areas should be re-vegetated with native species to prevent invasives from moving back in.

Additional early successional habitat restoration projects are already in the planning or initiation phases through continuing partnerships between the Hilltop Conservancy and the US Fish & Wildlife Service or the Township of Verona. These projects focus on establishing another upland meadow immediately south of the larger meadow and restoring open wetlands in the southwestern portion of the Reservation (along and adjacent to the Reservation’s western route). These projects are outlined below.

Restoration Area #12

This area comprises a 3.2-acre upland meadow restoration located immediately south of Restoration Area #11. Significant soil amendment has been required to create viable growing medium on this former demolition site, which was accomplished with the assistance of Verona Township (see photos below).



Once the new growing medium has stabilized, and invasives like Common Mugwort and Phragmites have been controlled, this site will be seeded with native upland grasses and wildflowers (approximately Spring 2015, with the assistance of the US Fish & Wildlife Service).



Volunteer seeding event Spring 2012 (above) and growth status Summer 2013 (below)



Restoration Area #13

This area includes approximately 4.9 acres of open woodland just north of the large meadow restoration. This area appears to have been maintained as part of the former sanatorium grounds – the soil is unnaturally smooth and level with very few rocks on the surface, and most of the trees are mature, evenly-spaced specimens of similar age that show evidence of past trimming and limbing-up. The understory contains a heavy infestation of Glossy Buckthorn and smaller infestations of Privet and Winged Burning Bush, which likely invaded after the sanatorium was closed.

This area could be restored to savanna in order to increase habitat diversity at the Reservation. Once all remaining sanatorium debris is removed, the project would require funding from outside sources to eradicate the Glossy Buckthorn (and other invasive species), and to perform selective girdling of trees to increase sunlight availability at ground level (the existing tree canopy density should be further reduced to 30-50%). Large, fruiting individuals of Glossy Buckthorn have already been removed by the Hilltop Conservancy, but a thick 'carpet' of smaller seedlings remains. The use of prescribed fire to assist with the creation and maintenance of this savannah habitat is strongly recommended. Successful restoration may attract rare species such as Red-headed Woodpecker (see Appendix A for a species fact sheet).

Within this same area, the Hilltop Conservancy has planted 10 sites with native understory trees and shrubs, and enclosed them with poly mesh netting supported by metal stakes to deter deer browse (see photo below). Although a good way to generate public interest in habitat restoration, the scope, scale and longevity of these enclosures are insufficient to generate material improvements to overall habitat quality. The plantings do not include herbaceous species, and their scale (plot size and number) is too small and concentrated to significantly benefit the surrounding area. Future restoration efforts for this area should follow the recommendations made above.



Volunteer woodland planting event Spring 2013

Restoration Areas #14, #15 and #16

These three areas comprise 4.7 acres of relatively open wetland along the western route through the Reservation (Area #14 = 2.2 acres, Area #15 = 1.5 acres, Area #16 = 1.0 acres). These areas have a history of intense human disturbance and contain heavy infestations of invasive species (e.g., Common Mugwort, Phragmites). Per grants from Green Acres and the County's Open Space Trust Fund, the western route will be upgraded to improve public access to the Hilltop, and the open wetland areas will be restored. The wetland restoration will be accomplished via a pending agreement with the US Fish & Wildlife Service (See Appendix B), which will include selective invasive species control and re-seeding with native species. The agreement also calls for light excavation of Areas #14 and #16 to create vernal pool habitat for amphibians, as well as planting of Area #14 with groupings of native wetland shrubs to promote what the FWS calls "scrub-shrub habitat".



Western route open wetland Spring 2010

Restoration Area #17

This area consists of a 4.2-acre open wetland a few yards northwest of the intersection of Mountain Avenue and Arbor Road in North Caldwell. It is heavily disturbed and almost completely infested with invasive Phragmites, but native trees surround the edges (primarily Red Maple with some Box Elder and Tulip Poplar). On the south and west edges the ground under the trees is heavily infested with Multiflora Rose, but on the eastern edge natives like Spicebush, Witch Hazel and Skunk Cabbage are abundant, with fewer invasives present. See representative photos below.

This area is not currently within the scope of the above-mentioned USFWS restoration agreement, but similar techniques could restore this site to a healthy wetland that provides habitat for a number of species of butterflies and birds. The surrounding private homes and the Borough of North Caldwell might also be willing to assist with this restoration, for both aesthetic and mosquito management reasons.

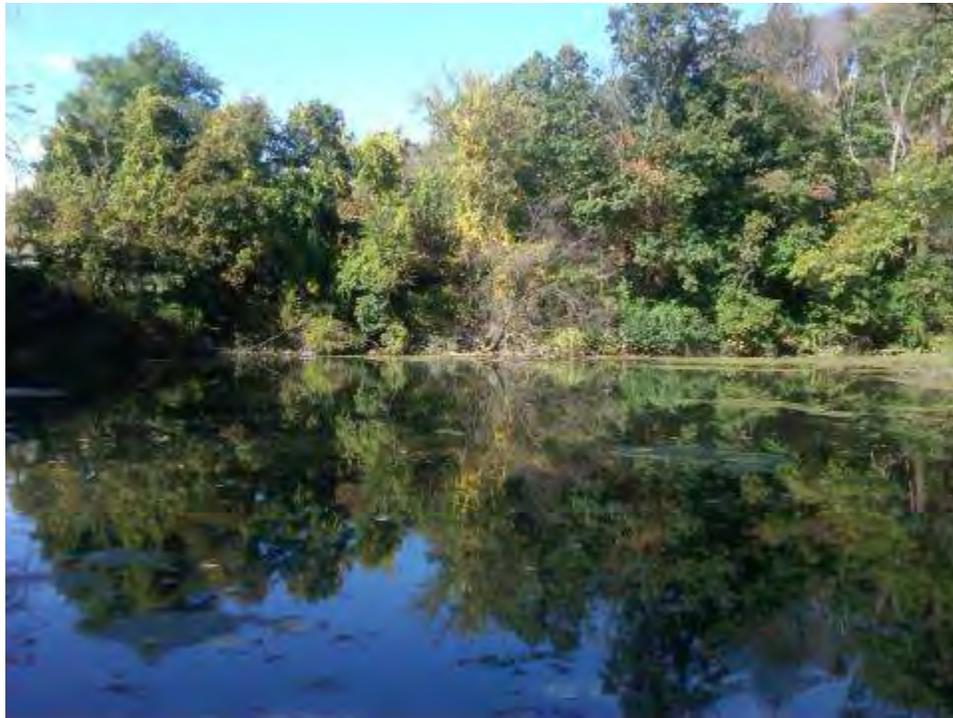


Additional Recommended Restorations for Neighboring Lands

Three additional areas are considered below. Restoration Area #18 currently lies within the Hilltop Reservation, but may be transferred to Verona Township in the future. Restoration Areas #19 and #20 are currently located outside, but immediately adjacent to the Reservation borders. The fact that these areas are outside the Reservation does not diminish the potential benefits of restoration, however, the projects would require approval and long-term commitment from the landowners.

Restoration Area #18

This 9.7-acre area contains the only known year-round water feature inside the Reservation (the small streams and wetlands mentioned earlier tend to dry out in July and August). Known locally as “Prisoner’s Pond”, it supports small fish species and provides foraging habitat for Great Blue Heron. A century ago, the pond was completely open and surrounded by pasture (as seen in the photo on page 1). Today, the area is thickly wooded and no longer actively used (see photo below).



Prisoner’s Pond Fall 2013

Restoring this area will require removing debris from the northern and eastern sides of the pond, repairing a dike breach and the nearby overflow management mechanism, controlling invasives and re-vegetating the site with native trees, shrubs and wildflowers.

For many years, the pond area was used as a dumping ground by the former County penitentiary – tires, office furniture, broken machinery, kitchen supplies, etc. were apparently disposed of ‘out the back door’ and left to decay on the shores of the pond. Volunteer clean-up efforts have been successful (see photo below), but there remain large partially-buried items that will require heavy machinery to remove. There

is also a former shooting range a few yards upslope of the pond, which will require additional debris removal (and possibly remediation).



Prisoner's Pond clean-up event Spring 2011

The land surrounding the pond is heavily infested with Tree-of-Heaven, Norway Maple, Bush Honeysuckle, Privet, Wineberry and Japanese Knotweed. Few native species are present. Reestablishing healthy and stable wildlife habitat will require persistence and patience – several successive years of targeted eradication efforts using experienced contractors may be needed, with re-planting of native species conducted in tandem.

A high-level plan for this project would include:

- Year One:
 - Remove remaining debris on northern and eastern edges of pond, repair dike breach
 - Control Tree-of-Heaven and largest Bush Honeysuckle and Privet shrubs
 - Plant native canopy species (e.g., hickories, Sweetgum, Sycamore, Tupelo, maples)
- Year Two:
 - Complete eradication of remaining invasive trees and large shrubs
 - Begin eradication of Japanese Knotweed and Wineberry
 - Plant native small tree and shrub species (e.g., Flowering Dogwood, Ironwood, Serviceberry, Witch Hazel, Spicebush, chokeberries, viburnums, Winterberry)
- Year Three:
 - Complete eradication of Japanese Knotweed and Wineberry
 - Control invasive species at ground level (e.g., Garlic Mustard, Japanese Honeysuckle)
 - Plant native herbaceous species (e.g., Spring Beauty, Cardinal Flower, Virgin's Bower Clematis and other deer-resistant and shade-tolerant woodland grasses and wildflowers)

Restoration Area #19

This area comprises 22.2 acres located along the western side of Fairview Avenue in Cedar Grove where former County Hospital buildings were recently demolished. It is currently owned by K. Hovnanian. Plans for the area are in flux – proposals by K. Hovnanian to Cedar Grove have varied between high-density housing, single-family homes and open parkland. If the land is set aside for passive recreation, it could be restored to a native meadow – similar to the 10-acre grassland further up the hill – without significant cost or effort. If so, the project should be initiated as soon as possible before invasive species like Common Mugwort gain a foothold (see photo below).



West side of Fairview Avenue in Cedar Grove Fall 2012

Restoration Area #20

This area contains a 1.4-acre detention basin southwest of and downhill from the recently completed “Highlands at Hilltop” apartment complex in Verona. The basin was constructed by K. Hovnanian, and is owned and managed by CenRose/Century21. Unfortunately, it is not operating as designed – the basin is supposed to empty out within three days of a rain event, but has been almost constantly filled with 6-12” of stagnant water and thick mats of algae throughout the past four years. Fertilizer and other nutrients draining from the lawns and landscaping uphill further contribute to algae growth. See photo below.



Highlands at Hilltop detention basin Summer 2011

The basin’s wildlife habitat quality could be significantly improved if the landowner ceased mowing the basin banks, and then planted the area with native herbaceous species. This would promote mosquito predators such as frogs and dragonflies while enhancing aesthetics and reducing long-term maintenance costs. Additional benefit could be obtained by either increasing outflow (so the basin dries out periodically) or by dredging out one side to increase water depth (thereby helping to retain oxygen and retard algae growth).

Per research and a proposal made by the Conservancy, a project to re-vegetate the sides of the basin with native transplants could be implemented at low cost – approximately \$1 per square foot – with a payback period of less than two years (via reduced mowing/labor requirements). See Appendix C for details.

Table 8. Potential Restoration Projects for the Hilltop Reservation

Restoration Area Number - See Map 10	Current Condition	Proposed Restoration	Acres
7	Open forest infested with a variety of invasive species	Restore forest through installation of canopy tree species to reduce invasive species through shading. Selective invasive species control.	4.8
8	Open wetland forest infested with a variety of invasive species	Restore wetland forest through installation of canopy tree species to reduce invasive species through shading. Selective invasive species control.	7.9
9	Heavily disturbed area containing invasive species (especially Common Mugwort) growing through pavement	Remove debris and restore to forest through planting of early successional trees, shrubs and wildflower species. Allow natural succession to convert to forest cover over time.	0.7
10	Two water towers with heavily disturbed surrounding land	Remove debris and restore to forest through planting of early successional trees, shrubs and wildflower species. Allow natural succession to convert to forest cover over time.	0.4
11	Restored grassland with heavily infested woodland edges.	Maintain existing restoration. Remove woody invasive species and expand restored grassland habitat.	16.3
12	Heavily disturbed area in process of grassland restoration	Continue restoration and maintain grassland habitat.	3.2
13	Woodland dominated by invasive species (especially Glossy Buckthorn)	Restore to savanna habitat to increase plant and animal diversity. Continue removal of invasive shrubs and reduce tree canopy to 30-50%. Savanna habitat may attract the state threatened Red-headed Woodpecker.	4.9
14	Heavily disturbed area containing invasive species (especially Phragmites and Common Mugwort)	Restore to wet meadow with patches of native shrubs.	2.2
15	Wet meadow containing patches of Phragmites and Common Mugwort, also contains significant amount of native wildflowers, rushes and sedges	Restore to wet meadow. Perform selective treatment of invasive species patches.	1.5
16	Heavily disturbed area containing invasive species (especially Common Mugwort)	Restore to wet meadow.	1.0
17	Heavily disturbed open wetland containing invasive species (especially Phragmites). Channelized water drainage occurs throughout.	Restore to wet meadow with patches of native shrubs	4.2
18	Prisoner's Pond - Heavily degraded pond/riparian area containing invasive species infestations. Surrounding forest heavily infested.	Optimize water levels and restore wetland shrubland around pond borders. Restore surrounding forest.	9.7
19	Recently cleared building complex along Fairview Avenue seeded with non-native grasses	<u>Important:</u> This area is not part of the Hilltop Reservation. Restore to upland grassland.	22.2
20	Retention/Detention basin adjacent to Hilltop Reservation	<u>Important:</u> This area is not part of the Hilltop Reservation. Restoration through partnership with landowner to improve hydrology and installation of native species surrounding basin.	1.4
Total			80.4

Listing of Previously Completed Reports on the Hilltop Reservation

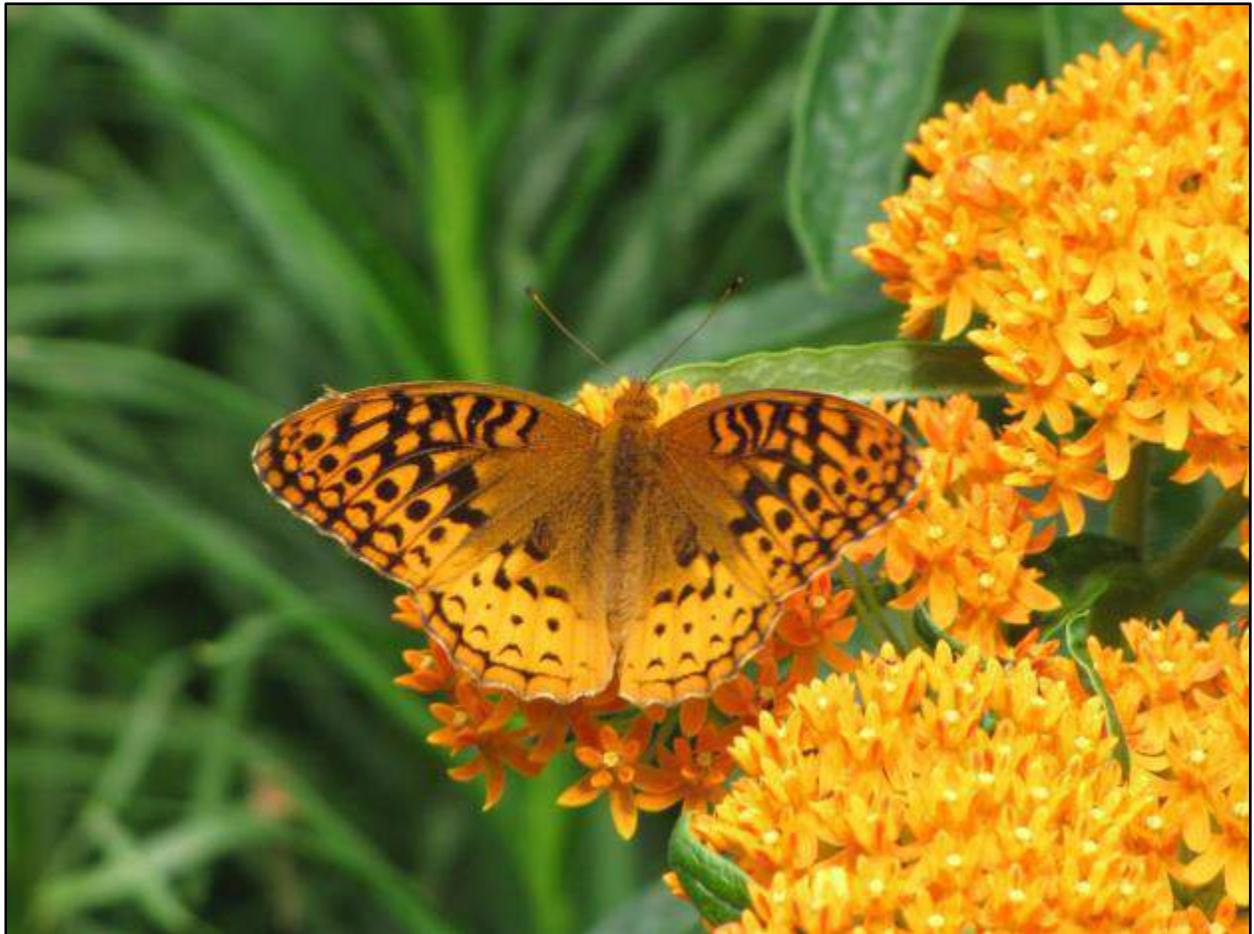
- Bernier, D.J. 2013. Final report – 2013 deer management program for Essex County, NJ – South Mountain Reservation, Eagle Rock Reservation, Hilltop Reservation.
Annotation: Includes detailed deer management program results and recommendations for 2014 based upon 2013 deer census data for South Mountain, Eagle Rock and Hilltop Reservations.
- Crow, J.H. 1995. The Hilltop Natural Area, Cedar Grove, NJ. C&H Environmental, Inc., Hackettstown, NJ.
Annotation: Includes descriptions of topography/drainage, geology/soils, flora/fauna, and plant communities.
- EcolSciences, Inc. 1996. Technical wetland memorandum for Hilltop Property, Township of Cedar Grove, Township of Verona, and Borough of North Caldwell, Essex County, NJ. Prepared for Essex County Improvement Authority.
Annotation: Includes wetland delineation including description of soils, hydrology and vegetation.
- Hall, D. and D. German. 2011. Hilltop bird checklist. Hilltop Conservancy, Verona, NJ.
Annotation: Includes listing of observed bird species by seasonal abundance and nesting observations.
- Hilltop Conservancy, Inc. 2013. Hilltop butterfly listing. Hilltop Conservancy, Verona, NJ.
Annotation: Includes listing of observed butterfly species.
- Johnson, A., C. Poole, and J. Grebe. 1999. The Hilltop Property, its history and its future. Save The Mountains Committee, Verona, NJ.
Annotation: Includes a review of land use history, previously completed reports for the property and newspaper articles. Includes comments provided for the Essex County Improvement Authority Hilltop Master Plan Study from John J. Lynch to the Township of Verona.
- Radis, R. 1987. Untitled botanical survey of Hilltop Tract. Parsippany, NJ.
Annotation: Includes listing of observed plant species.
- Schoor Depalma. 2004. NJDEP Letter of interpretation for Hilltop at Essex County. Schoor Depalma Engineers and Consultants, Parsippany, NJ.
Annotation: Includes detailed wetland delineation maps of the property.
- Van Clef, M. 2010. Hilltop Reservation rapid forest health assessment, November 2010. Great Meadows, NJ.
Annotation: Includes quantified deer browse measurements of existing woody vegetation of the forest understory.
- Van Clef, M. 2011. Hilltop Reservation forest health report, June 2011. Great Meadows, NJ.
Annotation: Includes quantified measurements of browse on planted tree seedlings (Sentinel Seedling Protocol) and woody forest understory cover (Forest Secchi Protocol).
- Van Clef, M. 2012. Deer browse evaluation report, South Mountain Reservation and Hilltop Reservation, November 2012. Great Meadows, NJ.
Annotation: Includes quantified deer browse measurements of existing woody vegetation of the forest understory. This repeats measurements recorded in November 2010 (see above).

Van Olden, G. 1984. Environmental resource inventory, Hilltop site, Essex County, NJ. Hudson-Essex-Passaic Soil Conservation District, North Caldwell, NJ.

Annotation: Includes site description including soils, topography, geology, plants & wildlife, woodlands and environmental concerns.

Wander, S. and W. Wander. 1995. Ecological evaluation of the Hilltop Tract. Township of Cedar Grove, Essex County, New Jersey. Newton, NJ.

Annotation: Includes general site description, geology and waterways. Includes documentation of observed plant communities and species (plants, birds, mammals, reptiles, amphibians, butterflies). Includes potential additional species that may occur (including threatened/endangered species).



Great Spangled Fritillary on Butterfly Weed



In Reply Refer to

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
<http://www.fws.gov/northeast/njfieldoffice>



Dan Salvante, Executive Director
Essex County Parks Department
115 Clifton Avenue
Newark, NJ 07104

Dear Mr. Salvante:

This letter regards the proposed restoration project at the Hilltop Reservation in Verona and North Caldwell, Essex County, New Jersey. The site is an open space park that has undergone several habitat restoration projects some of which have been assisted by the U.S. Fish and Wildlife Service (Service). Approximately 7 acres of the site can be restored and enhanced for wildlife habitat and passive recreation. This project will be conducted with assistance from the Service *Partners for Fish and Wildlife* program.

As you are aware, one of the requirements of the *Partners for Fish and Wildlife* program is that the landowner must sign an agreement to maintain the restoration measures for at least 10 years. While the Service only requires a 10-year agreement, we are interested in establishing longer term agreements (such as 15, 25, or 50-year agreements). Please review the enclosed Fish and Wildlife Habitat Restoration Agreement (Agreement), including appendices (Enclosure 1), and Habitat Restoration Site Plan Forms (Enclosure 2), which describe the proposed project and estimated costs. If you agree to the proposed project, please sign the original Agreement on Page Two above the heading "Cooperator." Additionally, on Page One, provide the number of years (minimum of 10) that you agree to maintain the area in its restored condition. Please forward the original agreement to our office after the requested information is filled out and the agreement is signed.

As the majority of work associated with this restoration project cannot be initiated until the Agreement is signed, your timely attention to this matter is much appreciated. Please contact myself at (609) 646-9310, extension 46 if you have any questions on the proposed project or the Agreement. Thank you for your interest in fish and wildlife conservation.

Sincerely,

Eric Schradig
Acting Field Supervisor

Enclosure

ENCLOSURE 1

FISH AND WILDLIFE HABITAT RESTORATION AGREEMENT

FWS Agreement No: 1448-0000-_____
DCN: _____
Charge Code: _____
Amount Obligated: \$ _____

WILDLIFE COOPERATIVE EXTENSION AGREEMENT

This cooperative agreement between ___Essex County_____ ("the Cooperator(s)"), and the U.S. Fish and Wildlife Service (" the Service") is authorized by the Fish and Wildlife Coordination Act, 16 U.S.C. Sections 661-666c and the Fish and Wildlife Act of 1956, 16 U.S.C. 742a-j. The Service and the Cooperator(s) agree to carry out certain wildlife management practices and habitat developments on approximately ___7___ acres of land owned by the Cooperator(s) as described in the Project Plan and on the map and/or legal description, attached.

The Service agrees to provide at least partial payment (or reimbursement) of the actual costs, and/or technical and material assistance, as detailed in the Project Plan. In return, the Cooperator(s) agree:

1. To perform the work in accordance with the Project Plan if the Cooperator(s) do the work themselves or through their contractors. After partial or final completion to the satisfaction of the Service, Cooperator(s) may submit a bill (with receipts attached) to the Service and be reimbursed for actual and reasonable costs not exceeding the Amount Obligated shown above.
2. To assume responsibility for securing any permits needed to carry out this project.
3. To allow the habitat developments as described in the Project Plan to remain in place without interference for a period of _____ years from the date of the last signature on this agreement.
4. To allow the Service or its representatives reasonable access to the described property for the period of this agreement in order to make the agreed developments or to make periodic inspections of the developments.
5. To notify the Service's Project Manager in writing at least 30 days before closing of any planned sale or other change in the ownership of the described property.
6. To sign the standard certifications (DI-2010) and assurances (SF-424B or SF-424D) attached as exhibits B and C.

The Service assumes no authority over the described property for purposes of controlling trespass, for controlling noxious weeds, for identifying or removing pre-existing hazards including waste materials, for granting rights of way, or for any other incidents of ownership. The Service also assumes no liability for property damage or injuries to people not caused by its own negligence, and any claims shall be processed in accordance with the Federal Tort Claims Act. Cooperator(s) shall own all of the completed or installed developments and shall be solely responsible for paying all taxes and assessments on the described property.

This agreement may be modified at any time by mutual written consent of the parties. It may be terminated by either party upon 30 days advance written notice to the other party(ies). However, if the Cooperator(s) terminates the agreement before its expiration, or if the Cooperator(s) should materially default on these commitments, then Cooperator(s) agrees to reimburse the U.S. Fish and Wildlife Service prior to final termination for the prorated costs of all habitat developments placed on the land through this agreement. For these purposes, the total cost of the developments to the United States are agreed to be \$ ___8,000_____.

Spatial Information Sharing: In accordance with the Privacy Act of 1974, permission must be obtained from the cooperator before any personal information can be released. The only information that can be shared is payment information which is authorized by law. Therefore, your consent is requested to allow for sharing of spatial information about this project with conservation cooperators.

_____ I consent to having spatial information about this project shared with other conservation cooperators.

_____ I do not wish to have any spatial information about this project shared with other conservation cooperators.

The relevant portions of title 43, subpart 12 of the Code of Federal Regulations (Including subparts D and E for individual Cooperators) are incorporated by this reference. The full text of these regulations will be made available upon request. It is also understood that this agreement does not create the kind of legal partnership or joint venture which would allow any one party to speak or act for or to obligate any other party on this or other matters.

Buy American notice: It is the sense of the Congress that recipients of federal assistance should give preference to domestic equipment and products when buying such items with federal funds.

COOPERATOR(S)

U.S. FISH AND WILDLIFE SERVICE

1. _____
(Signature) Owner

(Signature)

(Typed Name)

Eric Schmitt

(Typed Name) *APRIL* Project Manager

(Address)

JULY 24, 20 *13*
Tel. (609) *383-3938* x*46*

_____, 20__

-----[Regional Option]-----

2. _____
(Signature) Owner

(Signature)

(Typed Name)

Warrant # _____

(Typed Name) Contracting Officer

(Address)

Tel. () _____

_____, 20__

APPENDIX A

**RESTORATION PLAN,
TOPO MAP,
SITE PLAN DRAWINGS**

RESTORATION PLAN

The proposed restoration project is at the Hilltop Reservation in Verona and North Caldwell, Essex County, New Jersey. The site includes large areas of forested upland and wetland habitat and is surrounded by areas of residential and commercial development. Within the Hilltop Reservation are three areas of potential restoration totaling approximately 7 acres. This project would be done in conjunction with a Green Acres grant of \$275,000 that was provided to Hilltop Conservancy to improve public access by upgrading old roadbeds and to plant native trees and shrubs. The Service's restoration project will create several vernal ponds, and plant native trees and shrubs to improve wildlife habitat at Hilltop Reservation. In addition, the project will incorporate invasive species control which can often take two full growing seasons or more to be successful. This invasive species control effort could be initiated in fall 2013.

There are at least three existing open wetland areas totaling about 7 acres within the Hilltop Reservation that could be restored to improve wildlife habitat. These areas are identified on the attached project map as Wetlands 1, 2, and 3. Restoration at Wetland 1 would include control of invasive plants including common reed (*Phragmites australis*) and mugwort (*Artemisia vulgaris*) using herbicides, specifically glyphosate in fall 2013 and follow-up applications in fall 2014. Wetland 1 would also include excavation of approximately 1 acre of vernal wetlands using a small excavator and skid steer. Excavated material would be placed and spread on adjacent upland areas. These vernal ponds are ephemeral and will provide high quality reptile and amphibian breeding habitat. The Service would excavate several deeper areas within the vernal pools to diversify the microtopography within the vernal pools and provide some additional refuge for amphibian breeding during drier springs. The Service will use its equipment to accomplish this restoration. Finally all disturbed areas would be replanted using a native wetland seed mix in the spring to provide beneficial wetland vegetated cover including plants that provide pollen sources.

Wetland 2 would have the same prescription as Wetland 1, but the excavated area would be slightly larger (between 2-3 acres) and would include a small berm at the lower end of the hillside. Additionally trees and shrubs would be planted along the upper slope of the wetland to provide some woody vegetation habitat. Shrubs and trees, may include, but are not limited to, red osier dogwood (*Cornus sericea*), silky dogwood (*C. amomum*), buttonbush (*Cephalanthus occidentalis*), red chokeberry (*Aronia arbutifolia*), arrowwood (*Viburnum dentatum*), elderberry (*Sambucus canadensis*), and winterberry (*Ilex verticillata*), serviceberry (*Amelanchier canadensis*), black chokeberry (*Aronia melanocarpa*), river birch (*Betula nigra*), hackberry (*Celtis occidentalis*), redbud (*Cercis canadensis*), sweet pepperbush (*Clethra alnifolia*), flowering dogwood (*Cornus florida*), eastern red cedar (*Juniperus virginiana*), spicebush (*Lindera benzoin*), wild cherry (*Prunus serotina*), pin oak (*Quercus palustris*), and fragrant sumac (*Rhus aromatica*). The Service can provide approximately 500 trees and shrubs of these species depending on availability. The Service will provide the trees and shrubs as a mix of containerized plants and bare root plants that community volunteers can plant. Additionally tree guards will be provided to prevent young plants from being browsed by deer. The Service recommends that the Hilltop Conservancy organize the planting.

Wetland 3 provides very good open field/wetland habitat currently and the only proposal within this wetland is to control common reed using herbicides within the fall of 2013 and 2014. In and around the three wetland areas there are a number of invasive trees and shrubs including tree-of-heaven (*Ailanthus altissima*) catalpa (*Catalpa bignonioides*), common privet (*Ligustrum vulgare*), and shrub honeysuckles (*Lonicera maackii* and *L. morrowii*). The Service recommends that these invasive trees and shrubs be controlled using appropriate methods, including herbicide application. The Hilltop Conservancy could implement these actions to reduce the spread of these invasive plants.

Passive Recreation

The County can develop passive recreation within the project area including wildlife viewing platforms, and walking trails. The Service can assist in identifying other partners that can assist with these efforts. However, the Service can also assist with interpretive signage for the project site to identify to the general public the restoration activities and valuable wildlife habitat that is within the project area.

APPENDIX B

**COST ESTIMATES,
SERVICE / PARTNER CONTRIBUTIONS,
SPECIAL PROVISIONS**

PARTNERS FOR FISH AND WILDLIFE
HABITAT RESTORATION PROJECT COSTS

Cooperator / Landowner: Essex County
County: Essex
Drainage: Rahway River

Wetland seed mix (Cash) Cooperator = \$ 1,500
Seeding (In-kind) Hilltop Conservancy = \$ 1,000
Technical Assistance (In-kind) Service = \$ 500

Tree and Shrub Plantings
 Trees and shrubs (Cash) Service = \$ 2,500
 Tree tubes (Cash) Service = \$ 1,000
 Planting (In-kind) Hilltop Conservancy = \$ 500

Vernal Pond Excavation (In-kind) Service = \$ 4,000

Site preparation (e.g., herbicide and application)
 Mowing (In-kind) Cooperator = \$ 300
 Herbicide and application (Cash and In-kind) Hilltop Conservancy = \$ 1,000

Totals: (Cash and In-kind) Service = \$ 8,000
(Cash and In-kind) Cooperator = \$ 1,800
(Cash and In-kind) Hilltop Conservancy = \$ 2,500

TOTAL PROJECT COST: \$ 12,300

PARTNERS FOR FISH AND WILDLIFE

SERVICE / PARTNERS CONTRIBUTIONS AND SPECIAL PROVISIONS

Service Contributions

The Service will purchase trees, shrubs, tree tubes, nest boxes and other items associated with this restoration project and implement many project activities, not to exceed \$8,000. The Service will provide technical support with project implementation and monitoring. The materials and technical assistance costs provided by the Service is equivalent to a 65% cost-share.

Cooperator Contributions

The Cooperator will complete all work associated with purchasing native wetland seed mix and mowing. The value of these cash and in-kind services areas is estimated at \$1,800, which is equivalent to a 15% cost-share. The Cooperator will also be responsible for routine maintenance of seeded areas for the life of the project. Maintenance mowing or herbicide application shall not occur between April 15 and October 1 of any year to prevent disturbance to migratory birds.

Hilltop Conservancy Contributions

The Hilltop Conservancy will complete all work associated with planting trees and shrubs, seeding the wetland seed mix, and applying herbicide. The value of these cash and in-kind services areas is estimated at \$2,500, which is equivalent to a 20% cost-share.

Special Provisions

The Cooperator will notify the Service and other partners if project plans significantly change from those outlined above. Significant changes will require written modification to this Agreement.

Date: July 8, 2013

To: Tim Narvell, Vice President of Maintenance, Roseland Management Services
Juan Lent, Regional Director of Operations, Roseland Management Services
Dana Sente, Director of Operations, Highlands at Hilltop

From: Theresa Trapp, Treasurer, Hilltop Conservancy

Re: Naturalizing the Highlands Detention Basin

The Hilltop Conservancy is a non-profit group of local volunteers who assist Essex County with caring for the Hilltop Reservation, the nature preserve that surrounds the Highlands apartment complex. Our primary mission is to preserve wildlife habitat in and around the Hilltop, including restoring balanced eco-systems to previously-disturbed areas.

We would like to discuss ways to both improve wildlife habitat and reduce maintenance requirements for the detention basin located northwest of the Highlands complex. The basin abuts a corner of the route that provides public access from the western side of the Reservation, and we will be implementing a Green Acres grant to upgrade that same route and restore the surrounding wetlands beginning next year / 2014.

As you know, the Highlands basin was constructed in 2008 to manage storm water and sediment from the developed areas upslope. Unfortunately the basin is not draining as intended – we are aware that there are ongoing discussions with the original builder, but in the meantime the basin is almost constantly filled with stagnant water and thick mats of algae that regularly clog the outlets. See sample pictures on page 3 – this situation has unfortunately created an eyesore as well as a breeding ground for mosquitos.

From the Conservancy's discussions and site visits with wildlife biologists and other subject matter experts, an easy, low-cost way to enhance the function and the appearance of the basin would be to "naturalize" it. This would involve designating a "no-mow" buffer zone on the interior banks of the basin, and then planting those banks with native wetland species. Three major benefits to creating vegetative buffers are:

1. They provide necessary habitat for wildlife like insects, amphibians, birds and small mammals, including mosquito predators
2. They filter the water as it enters the basin, removing nutrients such as nitrogen and phosphorus, which in turn helps reduce algae growth
3. They lower basin maintenance costs via less frequent mowing

Photos of sample restored basins are featured on page 4 – the results are aesthetically pleasing, functional and relatively low-cost to obtain. Per our experience, the Highlands basin can be naturalized for as little as 10 cents per square foot using seed mixes, or \$1 per square foot using plant plugs (if faster results are desired).

Highlands Detention Basin

Estimated costs and projected savings for naturalizing the basin are shown on page 5 – with a one-time \$3,000 investment Roseland Management Services can simultaneously improve the basin’s appearance and reduce annual mowing costs by \$2,400 (for a payback period of 1.25 years). This will also reduce the number of times staff are required to manually unclog the basin outlets (currently estimated at 4-5 times per year).

Planting materials are readily available from commercial sources like Pinelands Nursery and Ernst Conservation Seeds. The Hilltop Conservancy can advise on plant species to use (including those unpalatable to deer), as well as provide volunteers to assist with the initial planting effort.

We believe the Highlands basin can easily be transformed into a natural eco-system that supports wildlife, improves water quality and has aesthetic value – and one that also happens to reduce maintenance requirements. There is potential public relations value in such a restoration project, and Roseland Management Services could use best practices from its implementation to improve storm water basins on other properties.

If you are interested in naturalizing the Highlands basin, we would like to meet with you to discuss the proposal and potential approaches in more detail – our contact information is below. Thank you for your time, and we look forward to hearing from you.

Sincerely,

Theresa Trapp, Treasurer
Hilltop Conservancy, Inc.
34 Depot Street
Verona, NJ 07044
theresa_trapp@yahoo.com
973 239-3331 (h)

Highlands Detention Basin

Highlands at Hilltop Detention Basin – Current Status

Significant long-term algae infestation; basin banks mown frequently and closely



Source: Hilltop Conservancy

Clogged basin outlets must be manually cleared multiple times per year



Source: Hilltop Conservancy

Highlands Detention Basin

Naturalized Detention Basins – Sample Photos

Naturalizing a detention basin enhances wildlife habitat and aesthetics



Source: Mike Fiely, Ernst Conservation Seeds

Replacing turf grass with native species reduces nutrient and sediment run-off



Source: www.FXBrowne.com

Highlands Detention Basin

Estimated Costs and Projected Savings

Naturalizing the Highlands basin can reduce maintenance costs (primarily mowing) by 50%. Payback period on the initial investment is estimated at 1.25 years.

Current Maintenance Costs *

Total mowing area	20,000	sq ft
Cost to mow / trim per visit	400	8-10 man-hours
Mowing frequency	<u>12</u>	per yr
Annual mowing cost	\$4,800	

Naturalization Costs

Site marking	0	Conservancy (via spot herbicide)
Planting materials	2,000	Native grass & wildflower plugs, seed, bagged soil, mulch
Site digging, planting	1,000	Landscaper (3 guys, 1 full day)
Site monitoring	<u>0</u>	Conservancy (for foreign invasives during 1st season)
One-time naturalization costs	\$3,000	

Future Maintenance Costs

Total mowing area	10,000	sq ft (top of basin and access ramp)
Cost to mow / trim per visit	200	50% reduction
Mowing frequency	<u>12</u>	per yr
Annual mowing cost	\$2,400	

Naturalization Savings

Reduced mowing costs	<u><u>\$2,400</u></u>	per yr
Payback period	<u><u>1.25</u></u>	yrs

* Rutgers University has detailed basin maintenance, retro-fitting and other information available, including presentations like this:
<http://www.water.rutgers.edu/Projects/Sussex/Detention%20Basin%20Retrofits%20and%20Maintenance.pdf>

Highlands Detention Basin

Subject Matter Expert Recommendations (per site visits)

Eric Schrading, Private Lands Biologist – U.S. Fish & Wildlife Service

“Currently the Highlands detention basin provides limited wildlife habitat and is negatively impacted by high nutrient content (probably from upstream lawn areas), high summer water temperature (due to lack of shade), and regular mowing of the banks. To improve the area for wildlife and reduce maintenance costs without impacting the function of the detention basin we recommend the following: 1. Limit mowing to just those areas required to provide access (ramp and top of basin walls). 2. Plant as much of the basin banks as possible with native grasses and forbs – generally this should be from the water’s edge to 20-30 feet up the bank (more is better). 3. Create small pools up to 2’ deep (currently the basin is at a uniform depth) to increase diversity within the pond. Excavating multiple pools will not adversely affect the function or value of the detention basin, and will provide refuge for predators that consume mosquito larvae (e.g., frogs, tadpoles, water beetles and other invertebrates).”

Dr. Michael Van Clef, Ecologist – Ecological Solutions, LLC (also Science Director for the New Jersey Invasive Species Strike Team)

“Storm water management basins, while typically ecologically sterile, have great potential for providing habitat for attractive and beneficial native plants. Species such as rose mallow, blue flag iris and Joe-Pye weed – just to name a few – can thrive in such conditions. These species produce flowers that are attractive to butterflies and other wildlife (and people too!). Re-vegetating with native species would create excellent wildlife habitat that complements the basic utility of the Highlands basin.”

Dr. Richard Pardi – specialist in aquatic and isotopic geochemistry, retired chair of the Department of Environmental Science at William Paterson University, current technical advisor for NJ Watershed Management Area #4 (Lower Passaic and Saddle Rivers)

*“While the Highlands property owner and the original basin builder are working out their disagreement over the basin’s performance, they could use integrated pest management strategies to better control mosquito breeding in the basin. Planting native species to provide shade and then stocking *Gambusia affinis* (mosquitofish) in the spring to prey on mosquito larvae can be effective short-term solutions. Enzyme treatments are available, but depend on a minimum level of oxygen in the water – given the basin’s shallow depth, lack of shade, and algal blooms observed, the current oxygen levels are likely quite low. Longer-term, the owner will probably need to retro-fit the basin in order to fulfill the goals of removing silt and providing ecological support.”*

Highlands Detention Basin



Hilltop Conservancy, Inc.

The Hilltop Conservancy is a non-profit organization of local volunteers dedicated to preserving wildlife habitat in the Hilltop Reservation, a 280+-acre nature preserve in Essex County straddling the borders of Verona, Cedar Grove and the Caldwells. We are an official partner of Essex County, and assist the County with caring for the Reservation and helping provide neighbors and park visitors with a site for respite, enjoyment and nature-based learning activities.

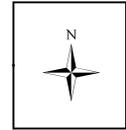
In addition to annual park clean-ups, the Conservancy organizes hikes, bike rides and wildlife observation events. We also implement major habitat restoration projects, including:

- 10-acre upland grassland (completed – see photo below)
- 3-acre native meadow (in progress)
- 7-acre forest regeneration (in progress)
- 6-acre wetland restoration (beginning spring 2014, via western route grant)



Essex County Hilltop Reservation

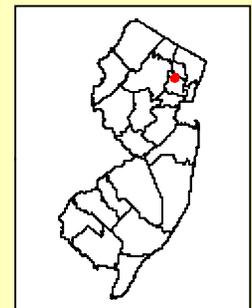
Map 1. Land Cover - 2007



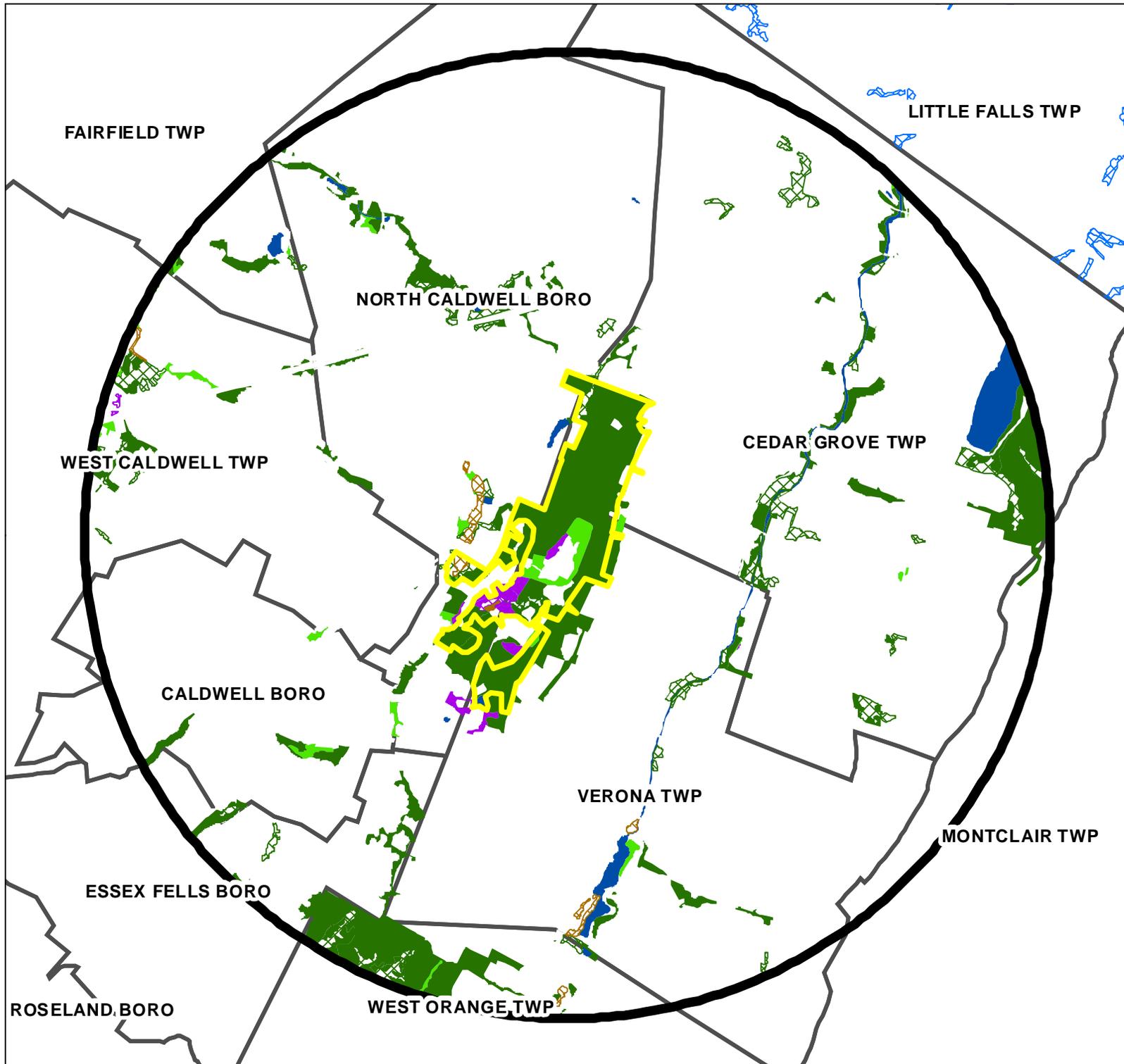
Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

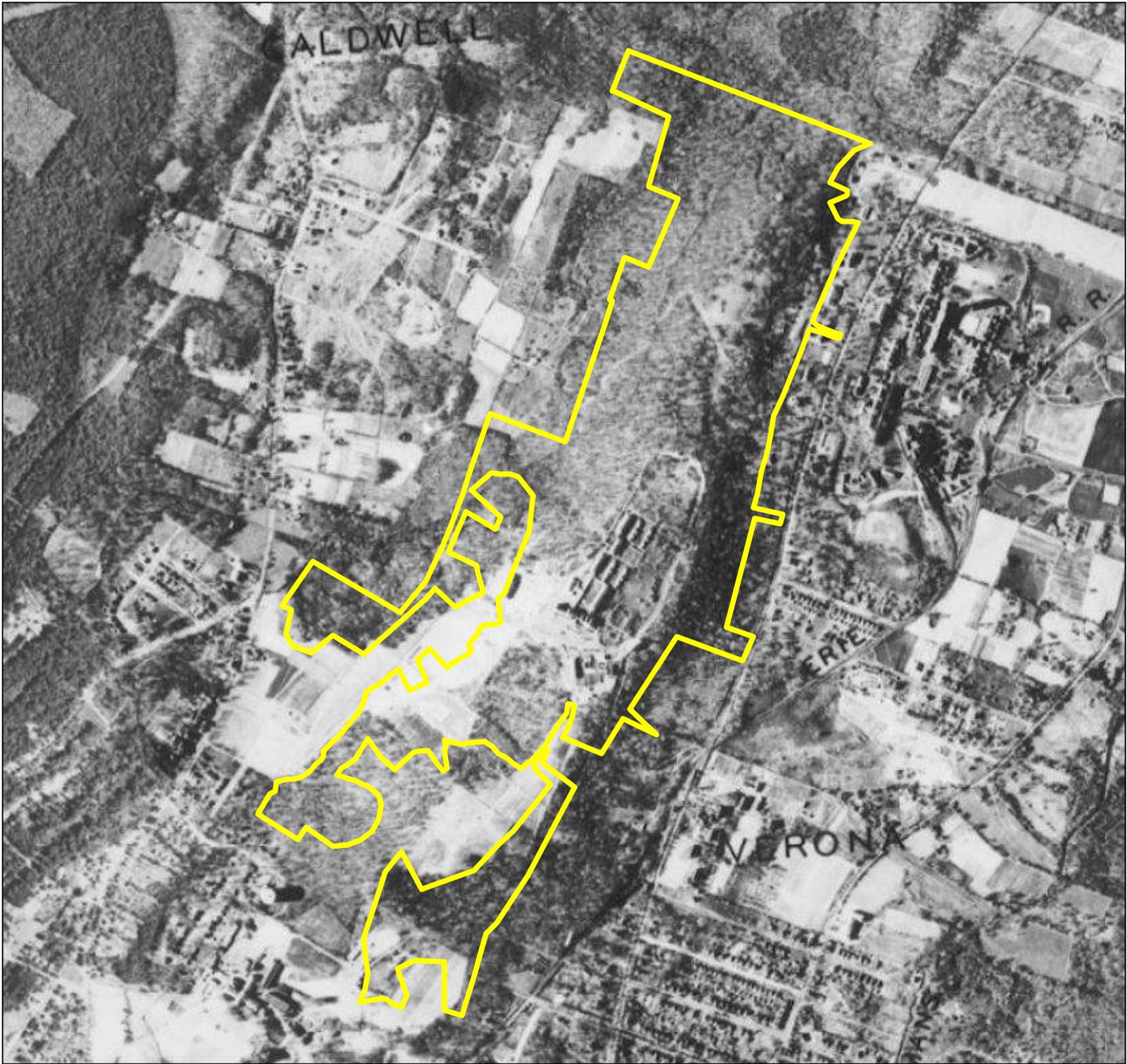
Legend

-  Reservation Boundary
-  Two Mile Radius
- Land Cover - 2007
 -  Forest - Upland
 -  Forest - Wetland
 -  Woodland - Upland
 -  Shrubland - Upland
 -  Shrubland - Wetland
 -  Meadow - Upland
 -  Meadow - Wetland
 -  Water
 -  Urban



0 0.25 0.5 Miles





**Essex County
Hilltop Reservation**

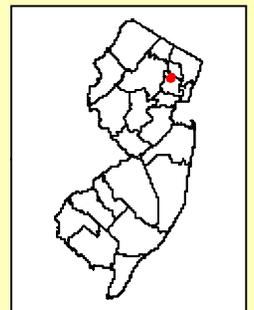
**Map 2.
Aerial Photography - 1930**



Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

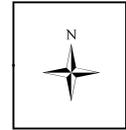
 Reservation Boundary



0 250 500 750 1,000 Feet


Essex County Hilltop Reservation

Map 3. Aerial Photography - 2012 w/Past Land Use Areas



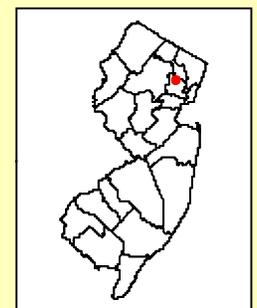
Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

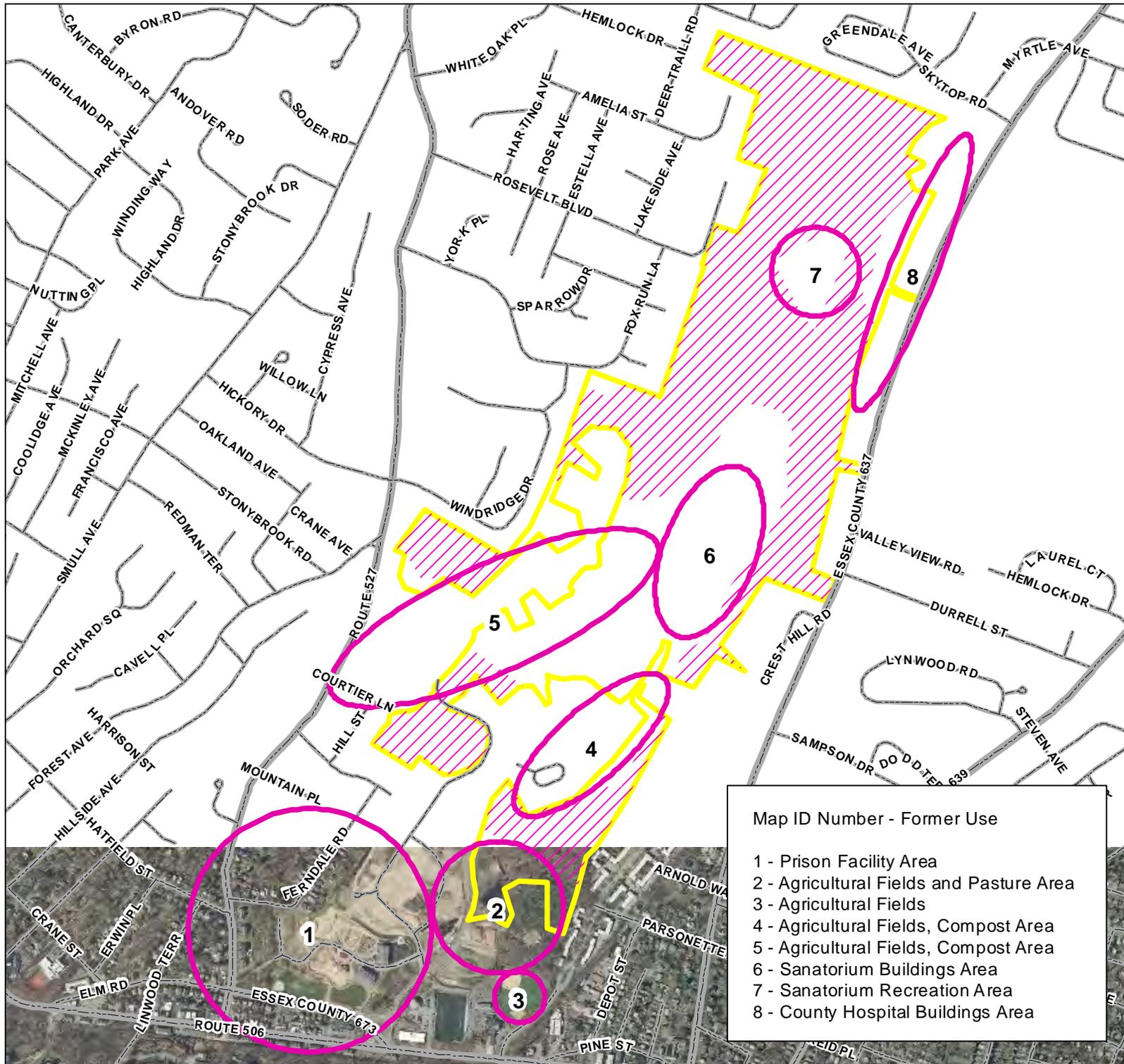
- Reservation Boundary
- Forest Areas - 1930
- Past Land Use Areas

Map ID Number - Former Use

- 1 - Prison Facility Area
- 2 - Agricultural Fields and Pasture Area
- 3 - Agricultural Fields
- 4 - Agricultural Fields, Compost Area
- 5 - Agricultural Fields, Compost Area
- 6 - Sanatorium Buildings Area
- 7 - Sanatorium Recreation Area
- 8 - County Hospital Buildings Area

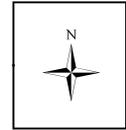


0 250 500 750 1,000 Feet



Essex County Hilltop Reservation

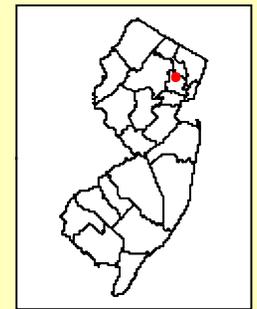
Map 4. Bedrock Geology



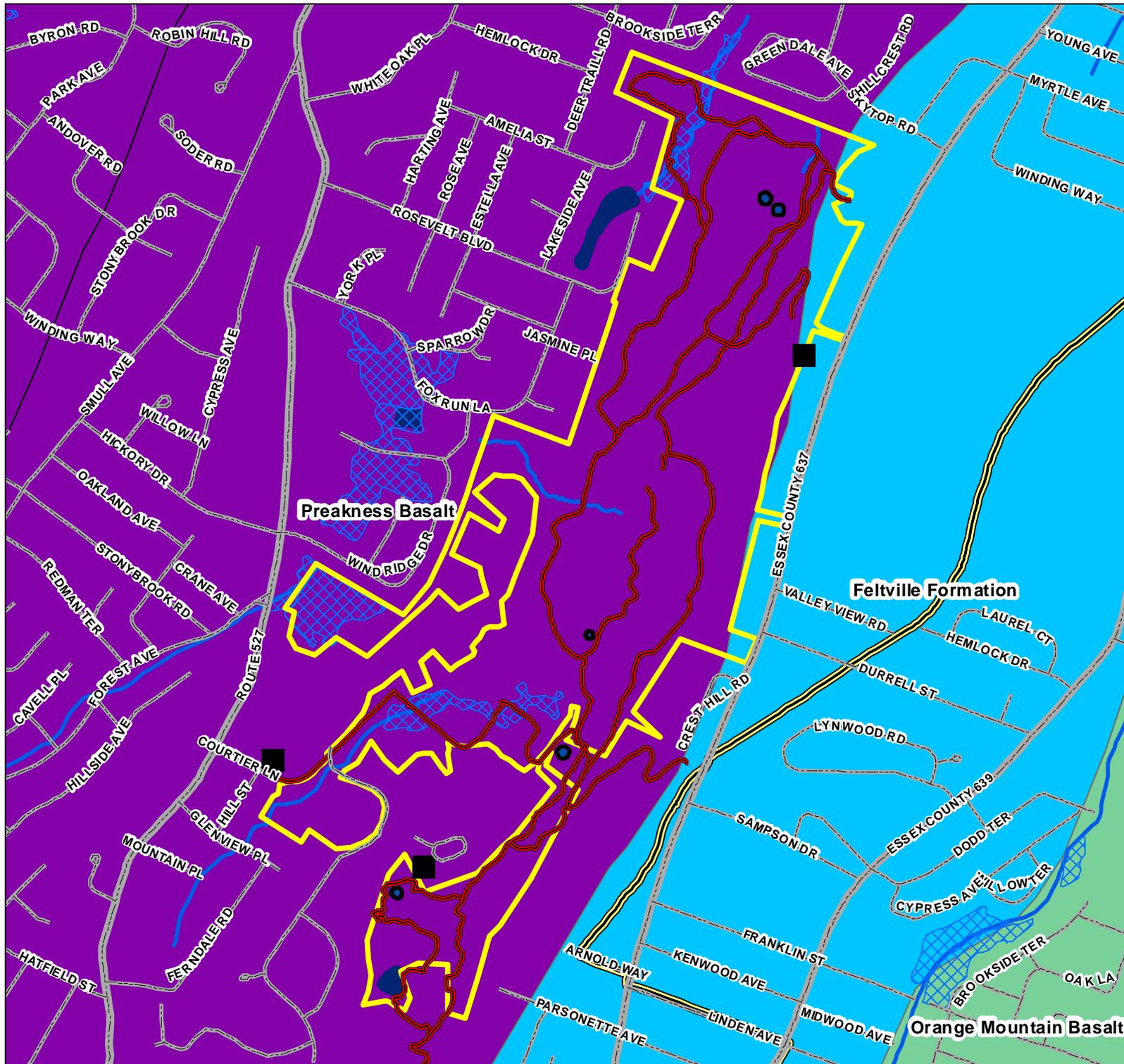
Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

- Reservation Boundary
- Hilltop Trails
- Lenape Trail
- Parking Areas
- Water Towers
- NJDEP Wetlands
- Lakes
- Streams

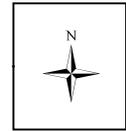


0 250 500 750 1,000 Feet



Essex County Hilltop Reservation

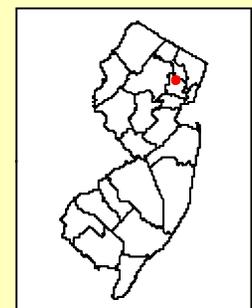
Map 7. Water, Wetlands and Watersheds



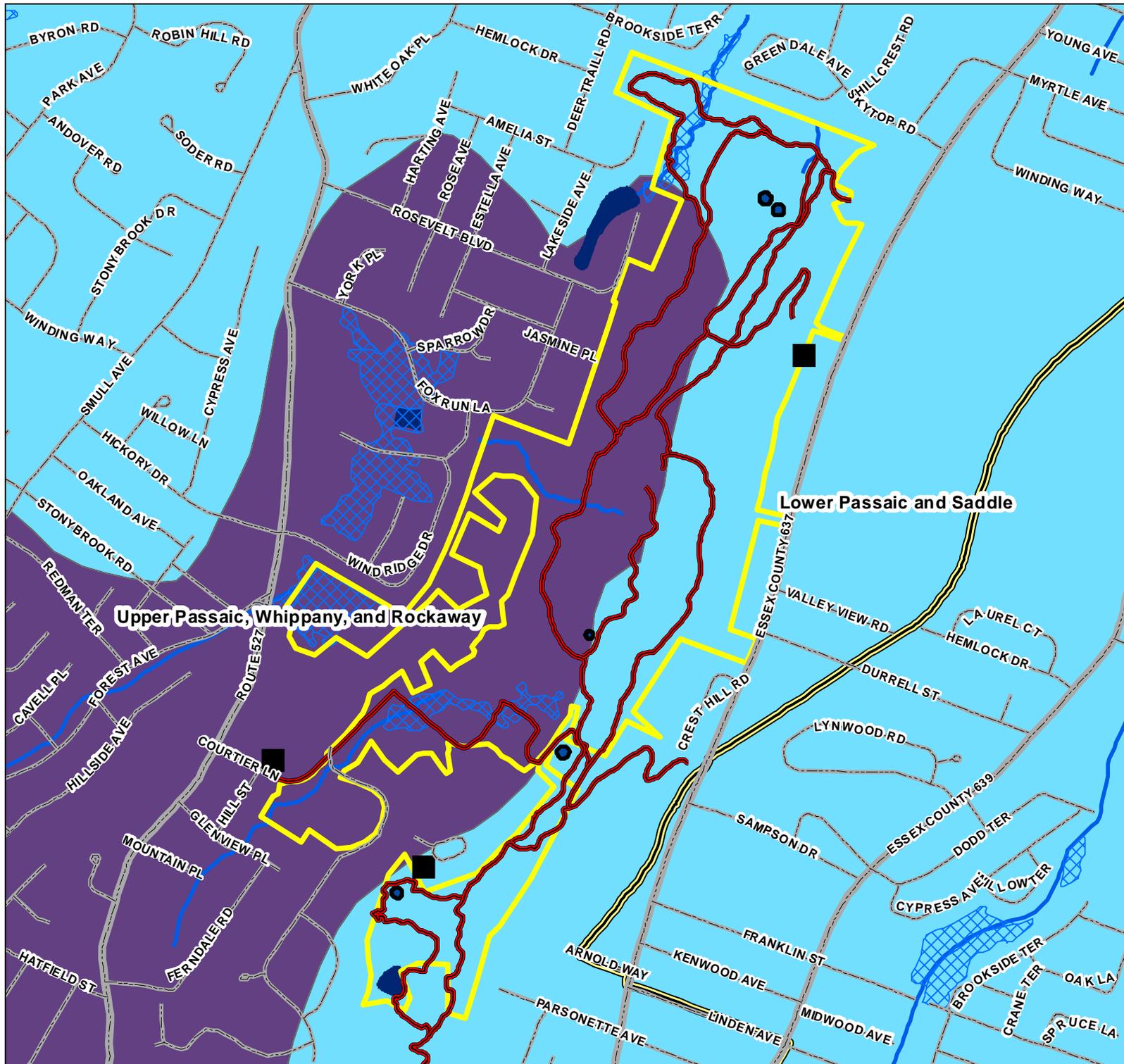
Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

-  Reservation Boundary
-  Hilltop Trails
-  Lenape Trail
-  Parking Areas
-  Water Towers
-  NJDEP Wetlands
-  Lakes
-  Streams

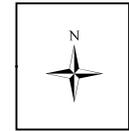


0 250 500 750 1,000 Feet



Essex County Hilltop Reservation

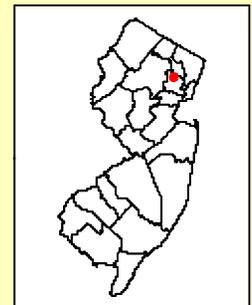
Map 8. Rare Animals, Habitats and Landscape Project Patch Ranks



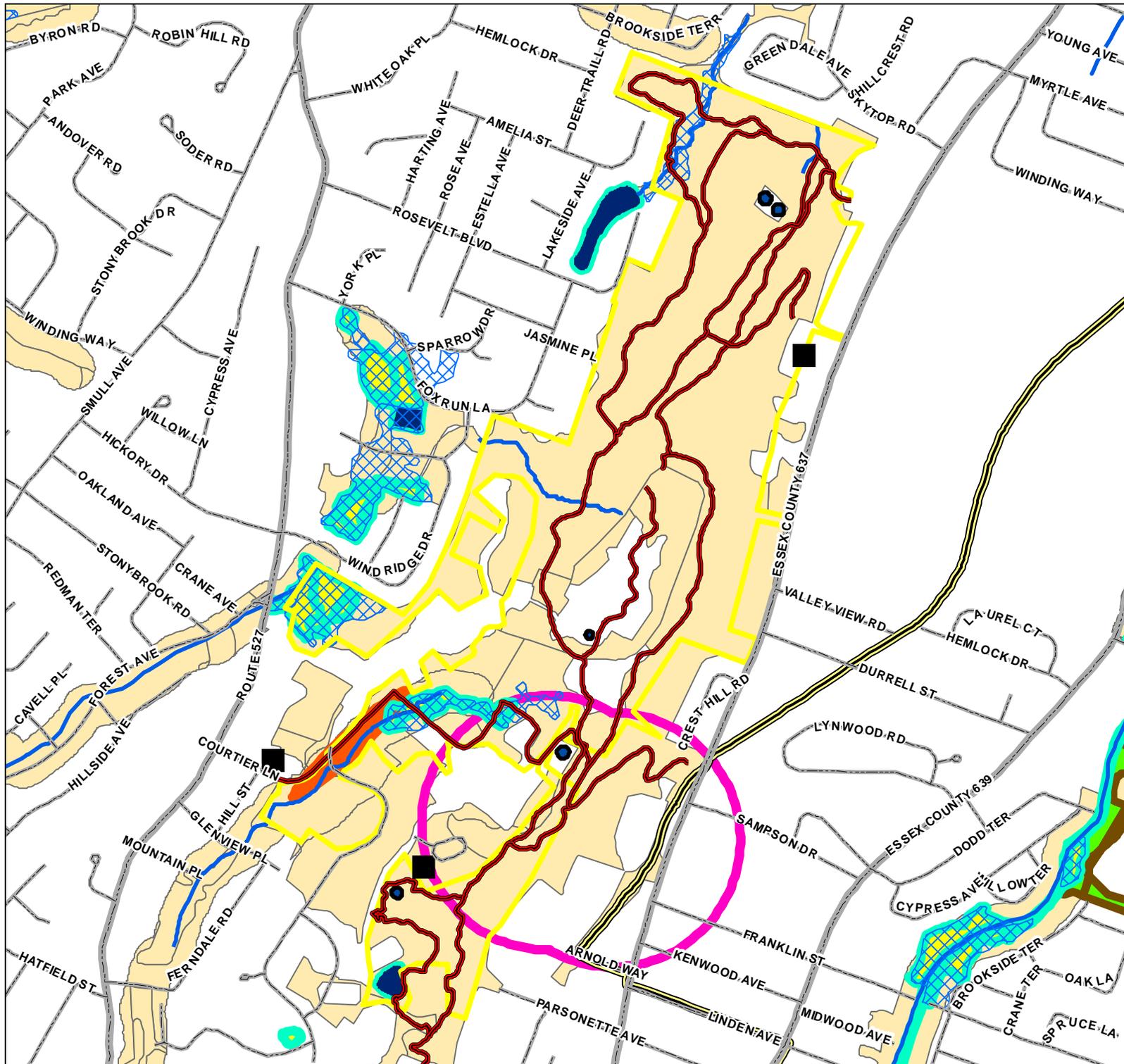
Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

- Reservation Boundary
- Hilltop Trails
- Lenape Trail
- Parking Areas
- Water Towers
- NJDEP Wetlands
- Lakes
- Streams
- Great Blue Heron - Foraging
- Wood Turtle
- Field Observed Potential Vernal Pool Area
- Potential Area
- Confirmed Area
- Landscape Project Patch Ranks
 - 1 - Suitable Habitat
 - 2 - Special Concern Species
 - 3 - Threatened Species
 - 4 - Endangered Species
 - 5 - Federally Listed Species



0 250 500 750 1,000 Feet



Essex County Hilltop Reservation

Map 9. Sample of Dense Invasive Species Infestations

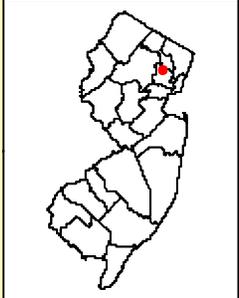


Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

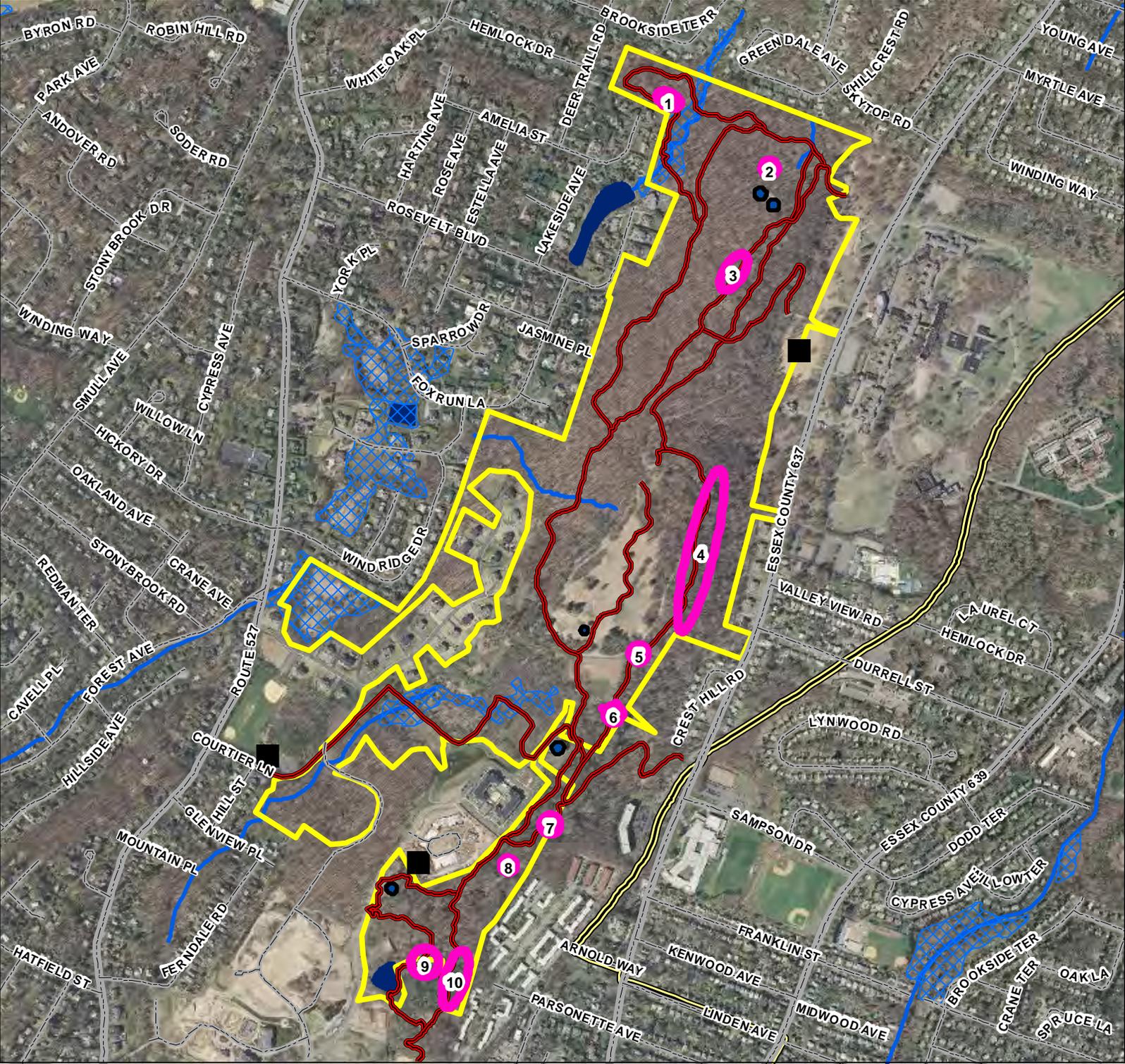
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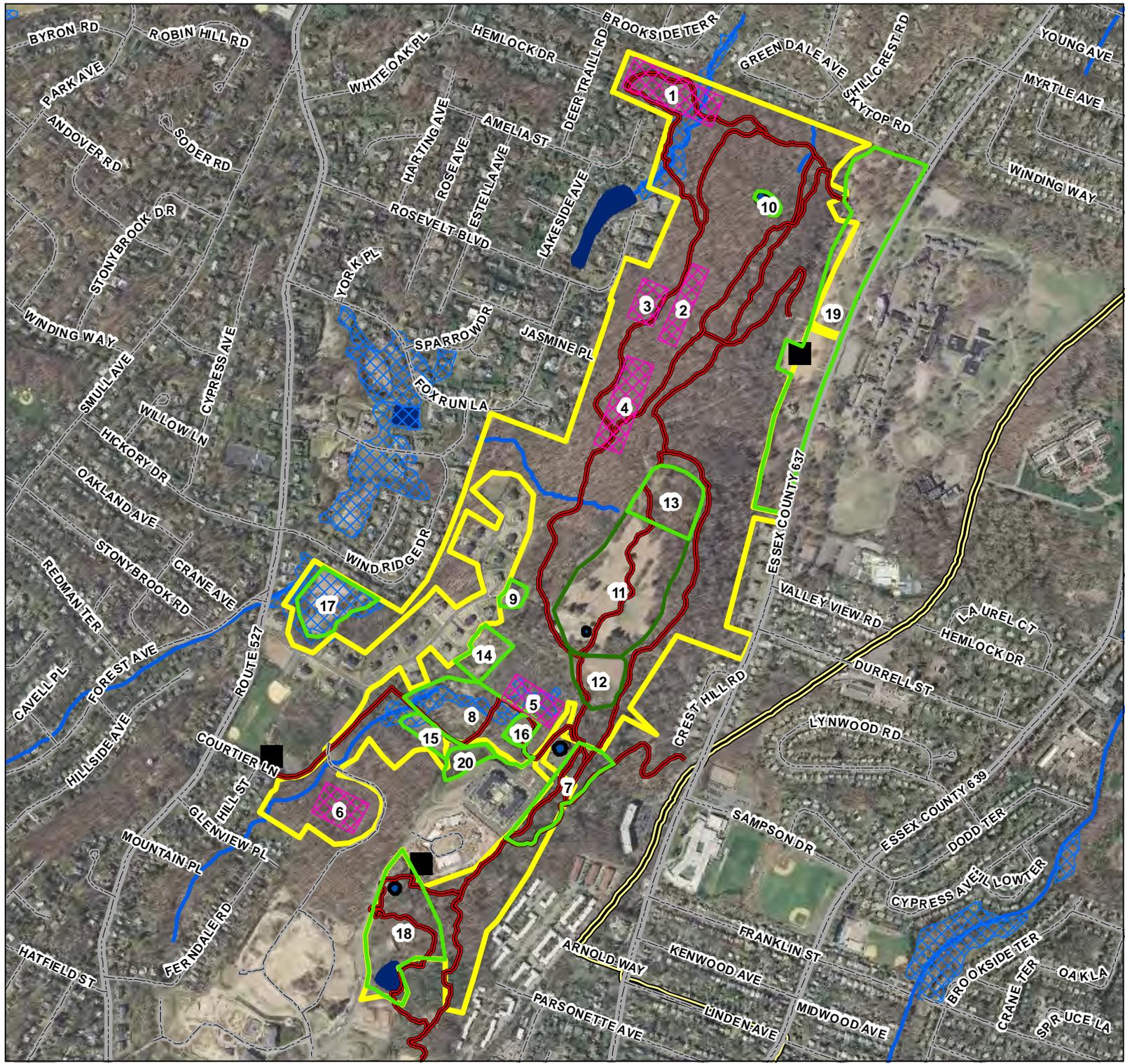
- Reservation Boundary
- Dense Infestation Area
- Hilltop Trails
- Lenape Trail
- Parking Areas
- Water Towers
- NJDEP Wetlands
- Lakes
- Streams

See Table 6 of Plan text for descriptions by numbered infestation area.



0 250 500 750 1,000 Feet





Essex County Hilltop Reservation

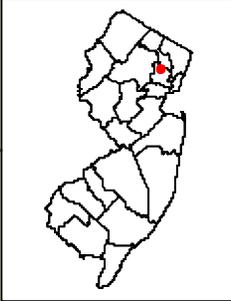
Map 10. Restoration Project Areas



Map prepared by Michael Van Clef, Ph.D.
Ecological Solutions LLC

Legend

- Reservation Boundary
- Hilltop Trails
- Lenape Trail
- Parking Areas
- Water Towers
- NJDEP Wetlands
- Lakes
- Streams
- Restoration Areas**
- Completed/Ongoing
- Potential
- Potential - Forest Enclosure



0 250 500 750 1,000 Feet

Appendix G
Western Route Grant

Nonprofit Assistance Application Form

Complete and submit with all required attachments to:
NJDEP Green Acres Program
P.O. Box 412
Trenton, NJ 08625-0412
Contact: (609) 984-0500

For G.A. Use Only

Date Rec'd: _____

Application No. _____

PROJECT INFORMATION

Project Title Hilltop Reservation Improvements

Location of site Mountain Avenue in North Caldwell

Municipality(ies) North Caldwell, Verona County(ies) Essex

Street(s) Mountain Avenue, Courter Lane

Block(s) and Lot(s) North Caldwell: Block 2, Portion of Lot 17; Block 10, Portion of Lot 1, Block 11, Portion of Lot 2; Block 605, Lot 2.01, Block 802, Lot 21A. Verona: Block 128, Portion of Lots 21.02; 30, 31, 32 and 33. Cedar Grove: Block 62, Portion of Block 1; Block 80, Portion of Lot 1; Block 100, Portion of Lot 3; Block 101, Portion of Lot 1; Block 110, Portion of Lot 1. Caldwell: Block 7, Portion of Lot 4.

State Legislative District 27, 40 Congressional District (of project site) 8, 11

Type of Application:

Acquisition: Will land be acquired *in fee simple* or *easement*?

Development: Is land *owned by* No or *leased to** No Nonprofit?

(*Copy of minimum 25-year lease must be provided)

Size of site to be acquired or developed: 284.16 acres

Total Estimated Cost of Project:

Land Acquisition:

Land	\$	_____
Survey	\$	_____
Appraisal	\$	_____
Prelim. site assess.	\$	_____
Title	\$	_____

Demolition*	\$	_____
Other related costs (itemized)	\$	_____
Total project cost	\$	_____

Park Development:

Construction	\$	<u>1,419,000.00</u>
Professional services (13% of const.)	\$	<u>184,470.00</u>
Prelim. site assess.	\$	_____
Other costs) -	\$	<u>283,800.00</u>

Contingency (attach itemized list)		
Total project cost	\$	<u>1,887,270.00</u>

Total request this round ** \$ _____ Total request this round** \$ 943,635.00

* Demolition and incidental costs will be limited to established caps.

** Please indicate cost of project that can be accomplished within one year.

Profile of municipality and county in which project is located:

Municipality: North Caldwell Area 3.0 (in sq. mi.) Population 7,071 (Year 2008 - US Census estimate)

Population per square mile: 2,357

Municipality: Verona Area 2.8 (in sq. mi.) Population 12,493 (Year 2008 - US Census estimate)

Population per square mile: 4,462

County: Essex Area 127.44 (in sq. mi.) Population 769,644 (Year 2009 US Census est.)
Population per square mile: 6,039

Estimated yearly operating expenses after acquisition or development \$ Site will continue to be maintained by the County of Essex as part of its Department of Parks, Recreation and Cultural Affairs.

Describe the proposed source(s) of the organization's matching funds _____

Essex County Open Space Trust Fund

APPLICANT INFORMATION

Name of applicant organization The Hilltop Conservancy, Inc.

a.k.a. N/A

Address 34 Depot Street

City Verona State New Jersey Zip 07044

Telephone number (973) 239-3331 Fax number () _____

Chief Executive Officer Anne Stires

Does the organization qualify as a Charitable Conservancy for the purposes of P.L. 1979, c. 378 (C. 13:8B-1 et seq.)? Yes No

(Please attach a letter from the organization's attorney certifying compliance.)

Nonprofit must be registered and in full compliance with the Charities Registration and Investigation Act of 1994. (N.J.S.A. 45:17-A-18 et. seq.) Please submit confirmation. (See Section 15.)

State major purposes, activities, and membership policies of the organization: The mission of the Hilltop Conservancy is to keep the Hilltop Reservation as a nature preserve that provides habitat for native wildlife and plant species; and a site that provides respite, enjoyment and learning activities to the community. The Conservancy conducts restoration, trail-building and other activities to preserve, maintain and improve the Hilltop Reservation, and recreational and educational activities for visitors. Membership is open to any persons who have an interest in the preservation, maintenance and improvement of Hilltop Reservation.

Please attach the bylaws.

USE AND PUBLIC ACCESS INFORMATION

Please describe the project in detail, including physical characteristics of site, existing land use, and intended short and long-term use of the project site.

See attached pages immediately following this application form.

Describe the proposed public access to the site.

The Hilltop's proposed western entrance is located at the end of Courter Lane, just off of Mountain Avenue in North Caldwell. The new western entrance and route would not only provide public access to visitors from North Caldwell, but also to those from the neighboring towns on the western side, including Caldwell, West Caldwell, Essex Fells and Fairfield – more than 34,000 residents. The site is accessible by bus by disembarking at the intersection of Bloomfield Avenue and Mountain Avenue in North Caldwell, and walking north 10 minutes. It can be easily reached by car, and there is ample parking in a large city lot within a few feet of the beginning of the proposed route. The site can also be reached by walking and bicycling on public streets. If implemented, this project will greatly improve the condition and attractiveness of the western entrance and route, making it and the Reservation accessible by members of the public who would not or could not otherwise negotiate the pathway.

If applicable, describe any possibility of transferring ownership of the site to any government agency or another qualifying nonprofit organization.

N/A

For acquisition projects, has the project site been identified by a municipality or otherwise designated for use in meeting municipal fair share low and moderate income housing obligations under the Fair Housing Act of 1985 (N.J.S.A. 52:27D-301)?

 Yes No If yes, please describe the coordination with the Council on Affordable Housing (COAH) regarding an alternative to meeting such obligations, if known:

N/A

Person having day to day responsibility for this application

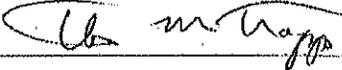
Name Theresa Trapp Title Treasurer

Address 34 Depot Street

City Verona State New Jersey Zip 07044

Telephone Number (973) 239-3331 extension Fax Number ()

E-mail address, if applicable: theresa_trapp@yahoo.com

Signature  Date 7/6/10

I, Theresa Trapp (name of authorized official) hereby certify that the information provided within this Green Acres Nonprofit application is complete and true.

7/6/10
Date


Signature of official authorized to submit application as per attached
Enabling Resolution

Application Form continued:

USE AND PUBLIC ACCESS INFORMATION

The Hilltop Reservation is a 284-acre nature preserve situated along the ridgetop of the Second Watchung Mountain, straddling the towns of Cedar Grove, North Caldwell, Caldwell and Verona. The Hilltop Conservancy's mission is to preserve and promote the Reservation for public use, which includes improving the public's awareness of and access to the park.

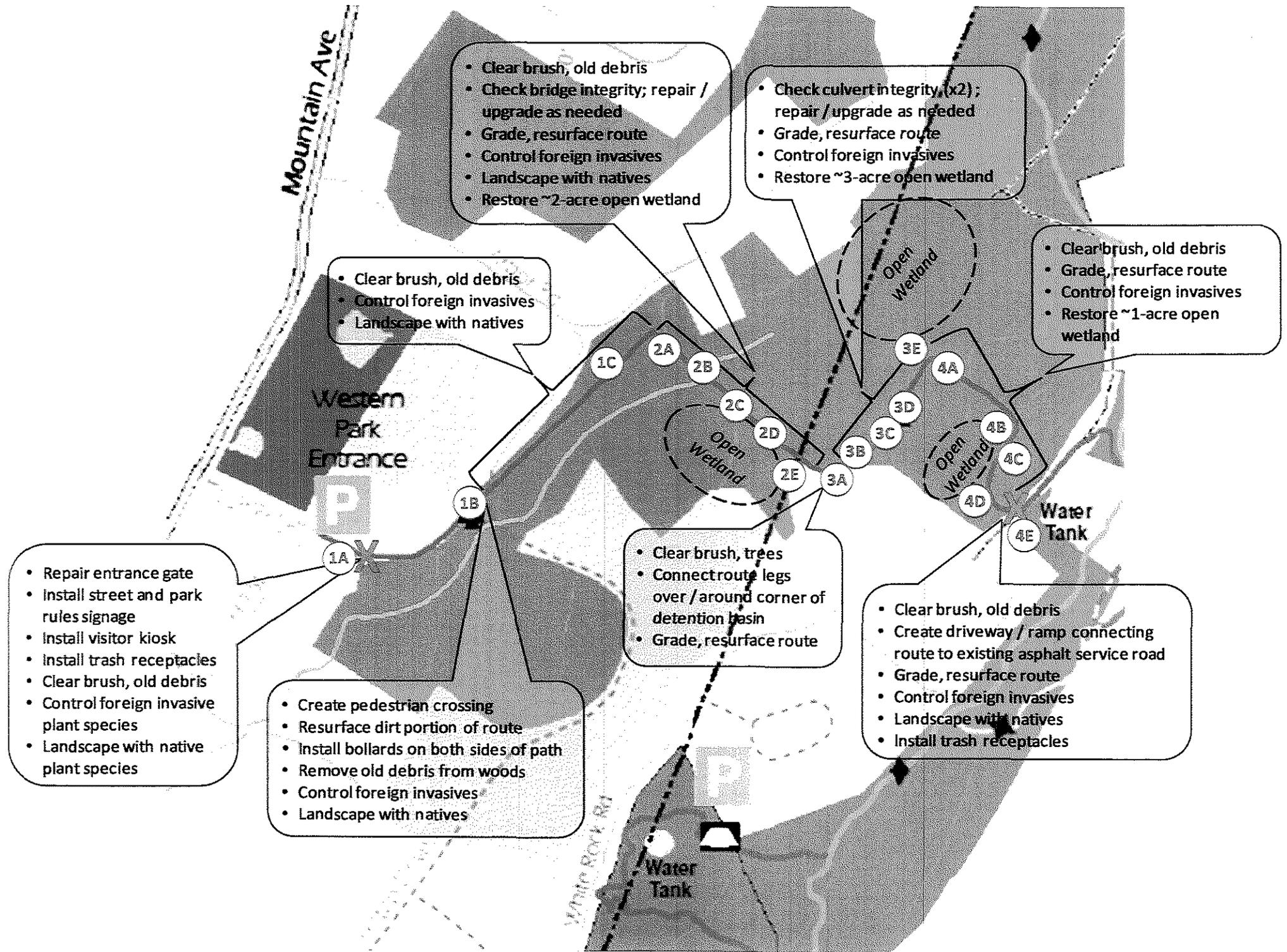
Public access to the preserve is somewhat restricted due to topography. The eastern side of the ridge has a steep grade which is negotiable only by able-bodied hikers, and the western side, which has a much more gradual slope, can only be traversed via an overgrown set of gravel and dirt paths in poor condition.

Local residents and visitors currently have only one official entrance to the Reservation, on its eastern side, off Fairview Avenue in Cedar Grove. This entrance and the paved route leading up from it ultimately meet an old service road at the top of the ridge / center of the park, which encircles the former site of the Essex Mountain Sanatorium. However, due to its steep slope the eastern entrance is not suitable for a broad spectrum of the public, including casual cyclists, families using strollers, or those with some physical limitation.

Rather than driving several miles around the mountain to the eastern entrance, then parking and biking all the way up the steep slope, residents of towns on the western side of the park such as the Caldwells, Essex Fells and Fairfield have been making their way into the preserve via a combination of muddy paths and vestiges of old gravel roads. These intrepid explorers start at the end of Courter Lane in North Caldwell, traverse wooded and open wetlands, skirt housing developments and other private property to finally reach the center of the park and the service road. Able-bodied hikers enjoy this second route's lovely views and its long low grade, but its gullies and poor condition dissuade those who find it unsuitable, unattractive and / or intimidating.

Creating an official entrance and hard-surface route from the western side is essential to making the Hilltop Reservation a truly public park, one that is easily accessed by all local residents and other visitors, including small children and the elderly. An upgraded western route would increase usage by the public, as well as enable Essex County Parks Department vehicles to service that area. To date, Conservancy volunteers have made the route slightly more navigable through a combination of unskilled manual labor and donated supplies, but those efforts are only temporary fixes – funds, skilled labor and heavy equipment are needed to repair, resurface and landscape the route, and to permanently improve public access.

This application contains the Hilltop Conservancy's proposal to improve public access to the Hilltop Reservation by creating a western entrance and route along existing gravel and dirt paths, and to improve the park's wildlife habitat by removing foreign invasive plants, re-landscaping with native shrubs and trees, and restoring approximately 4-6 acres of open wetland along the route.



- Clear brush, old debris
- Check bridge integrity; repair / upgrade as needed
- Grade, resurface route
- Control foreign invasives
- Landscape with natives
- Restore ~2-acre open wetland

- Check culvert integrity, (x2); repair / upgrade as needed
- Grade, resurface route
- Control foreign invasives
- Restore ~3-acre open wetland

- Clear brush, old debris
- Control foreign invasives
- Landscape with natives

- Clear brush, old debris
- Grade, resurface route
- Control foreign invasives
- Restore ~1-acre open wetland

- Repair entrance gate
- Install street and park rules signage
- Install visitor kiosk
- Install trash receptacles
- Clear brush, old debris
- Control foreign invasive plant species
- Landscape with native plant species

- Create pedestrian crossing
- Resurface dirt portion of route
- Install bollards on both sides of path
- Remove old debris from woods
- Control foreign invasives
- Landscape with natives

- Clear brush, trees
- Connect route legs over / around corner of detention basin
- Grade, resurface route

- Clear brush, old debris
- Create driveway / ramp connecting route to existing asphalt service road
- Grade, resurface route
- Control foreign invasives
- Landscape with natives
- Install trash receptacles

NJDEP Green Acres Program
 Nonprofit Assistance Program/Park Development Application
HILLTOP RESERVATION IMPROVEMENTS
 July 30, 2010

COST ESTIMATE

ITEM	Original Est.	%	Budget	NOTES
Repair entrance gate at western park entrance	\$2,000.00	0.11%	583	(already done)
Install entrance signage and amenities (visitor kiosk, park rules, street signs, trash cans)	\$5,000.00	0.26%	1,457	Includes trash cans at end of route.
Resurface approximately 40' of asphalt segment of pathway on both sides of the pedestrian crossing over White Rock Road	\$5,000.00	0.26%	1,457	
Create pedestrian crossing on asphalt segment of pathway at Hilltop Drive.	\$2,000.00	0.11%	583	
Install movable bollards across pathway	\$5,000.00	0.26%	1,457	To prevent access by unauthorized vehicles
Repair of western pathway gravel roadbed, including connecting route legs over/around detention basin (raising, grading and resurfacing with hard material, e.g., crushed stone, and edging with metal strips to retain resurfacing material in roadbed)	\$250,000.00	13.25%	72,857	Roadbed is 12-15' wide and 1/2 mile long. Must be sturdy and wide enough to support a 5-yard truck and/or a small loader, other Parks Department equipment.
Repair/upgrade bridge and two culverts as needed	\$500,000.00	26.49%	145,713	Need to support maintenance vehicles
Create driveway/ramp connecting route to existing asphalt service road at end of route.	\$100,000.00	5.30%	29,143	For access for Parks Department and emergency vehicles.
Clear and remove brush and debris along entire route	\$50,000.00	2.65%	14,571	Includes debris dumped in woods at entrance.
Foreign invasive plant species control	\$50,000.00	2.65%	14,571	Along western entrance and pathway.
Planting of native trees, shrubs and plants	\$150,000.00	7.95%	43,714	Along western entrance and pathway.
Restore three wetland areas bordering the route.	\$300,000.00	15.90%	87,428	4-6 acres total. Includes foreign invasive plant species control and planting of native trees, shrubs and plants in these areas.
Subtotal	\$1,419,000.00	75.19%	413,534	
Contingency 20%	\$283,800.00	15.04%	82,707	
A&E 13%	\$184,470.00	9.77%	53,759	
TOTAL	\$1,887,270.00	100.00%	550,000	

Green Acres grant award #07-10-22 275,000
 Open Space Trust Fund match 275,000
 Total funds for western route improvements \$ 550,000

Appendix H

Existing Landscape Structure Table

Existing Landscape Structures		
Infrastructure Item	Status	Potential Action
Cistern	Abandoned, lots of debris, stability unknown	Structural geo-tech and environmental evaluation may be required; potential to collapse the Cistern and push dirt in and fill with dirt to eliminate large hole.
Outdoor Restroom	Boarded up, potential debris hazard	Demolish structure and clear all debris.
Two Masonry Barbecue Structures	Crumbling, debris scattered around	Demolish structures and clear all debris.
County Water Towers	One is decommissioned, unused, gate does not prevent intruders. Other is still in use.	Structural geo-tech and environmental evaluation may be required; Demolish structure and salvage scrap metal and clear debris.
Concrete foundations for Sanatorium's two water towers (4 foundations per tower) including nearby water pipe, chamber, and manhole	Concrete foundations, water pipe, chamber, and manhole are still intact	Demolish concrete foundations, water pipe, chamber, and any nearby debris. Investigate hydrologic activity and interaction with wetlands area for manhole; Address safety issues
Sanatorium Outbuilding ("Gas House")	Structure still intact. Potential debris hazard inside.	Structural geo-tech and environmental evaluation may be required; Demolish structure
Concrete Stairway	In good condition	Demolish stairway, sidewalk, and associated concrete.
Concrete Foundation Remnant	In good condition	Demolish foundation remnant
Tunnel Access	Unknown condition	Structural geo-tech and environmental evaluation may be required; Fill tunnels with suitable fill material
Sanatorium Decorative Retaining Wall	Good condition, some parts are damaged	Repair any damaged areas of wall.
Debris and Rubble Pile	Scattered debris	Remove and possibly salvage reusable materials
Sanatorium Outbuilding #2	Structure still intact. Debris Hazard inside building.	Demolish structure and nearby debris.
Small Concrete Stairway	Stairway in good condition	Demolish stairway and associated concrete.
Tennis Court Poles	Bad condition	Remove tennis pipes and other structure.
West side kitchen parking lot	Asphalt covered by tree branches and mulch	Remove asphalt and nearby steel cable.
Debris Pile near Prisoner's Pond	Scattered metal and other debris	Remove all debris