A 2013 SURVEY OF POTENTIAL VERNAL POOLS IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

Prepared for the Township of Hamilton

by

Deborah J. Kratzer
Kratzer Environmental Services

and

Jill S. Dodds
Biostar Associates, Inc.

December 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

At the request of the Township of Hamilton, scientists from Kratzer Environmental Services and Biostar Associates conducted field surveys of 30 locations within the township that had previously been identified as potential vernal pools. The sites were initially selected by computer-aided analysis conducted at the Center for Remote Sensing and Spatial Analyses lab at Cook College, Rutgers University. The process combines layers of geologic, hydrologic, topographic and photographic data and uses computer-based models to predict the location of specific habitats. Using this technology, 88 potential vernal pools were identified within Hamilton Township. Eleven of these sites were certified vernal pools prior to this project (Appendix I – Map 1).

Vernal pools are small, temporary wetlands that provide critical breeding habitat for many amphibians. Because they are typically less than a quarter of an acre in size and are frequently isolated from other wetlands, the pools were not covered under New Jersey's original Freshwater Wetlands Protection Act in 1989. New state regulations adopted in 2001 extended protection to these fragile systems. In order to determine whether a site identified as a potential vernal pool is subject to regulatory protection, field visits must be conducted to establish whether or not it meets a specific set of criteria. If it does, then the site may be certified as a vernal pool by the New Jersey Department of Environmental Protection. The presence of vernal pools is one of many factors taken into consideration by the state's Land Use Regulation Program when reviewing permit applications.

In 2012, Hamilton Township received a grant from the Association of New Jersey Environmental Commissions (ANJEC) to examine the potential vernal pools within the township and determine which ones are eligible for certification. Landowners were contacted by the Township Planner in December of that year to request access to the property in order to conduct the surveys. Responses were gathered over the winter months, and the fieldwork was initiated during the spring of 2013.

2.0 METHODS

The GIS data (latitude and longitude coordinates) of potential vernal pool locations was obtained from NJDEP. A handheld GPS unit was used to find and confirm locations during field visits. Appendix I – Map 1 shows an overview of Hamilton Township with all vernal pool habitats, including those surveyed for this project and those that were not. Appendix I – Maps 2-19 illustrate the sites surveyed, on a base map of aerial photography from 2012, as well as roads, streams and parcels. Metadata for the GIS data and terms of agreement for use of the data (required by NJDEP) are provided in Appendix II.

Field surveys were conducted between March and October of 2013. Each site was examined in accordance with the Vernal Pool Protocol approved by the New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program (Appendix III). Multiple visits were made to each potential vernal pool in order to assess the physical characteristics and hydrologic regime of the site as well as the resident fauna. Observations were recorded on standardized data sheets (Appendix IV) and photographs were taken for additional documentation. Methods employed to document aquatic life included visual and auditory observations, searching for egg masses, dip netting, examination of leaf litter from pond bottoms, turning of logs and other debris in the vicinity, and nocturnal visits to listen for choruses of breeding frogs. A number of resources were used to confirm identification of herptiles and invertebrates (Behler 1979, Conant 1975, Kenney and Burne 2009, Kenney and Burne undated).

Field observations were then applied to a set of standardized criteria for making a determination as to whether each potential vernal pool was eligible for certification. In order to be certified, a pool must occur in a defined basin depression without a permanent flowing outlet. If the first criteria cannot be satisfied then the pool is not certifiable and the process ends. The second step is to find out whether any obligate or facultative vernal pool species are breeding in the pond. A list of the relevant species is provided on the second page of the data sheet in Appendix IV. If an obligate species is breeding on site that - in conjunction with satisfaction of the first requirement - is sufficient evidence for certification and no further monitoring is required. If no obligate species is found but two facultative vernal pool amphibians are breeding on the site, the pool may be certified if two additional requirements are met. The first is that the pool retains water for a sufficient time to allow for the development of larval amphibians (two consecutive months), and the second is that the pool dries up completely at some time during the year or can be proven to be free of fish.

Weather conditions during the survey period were compared with average conditions for the region based on data provided by the National Climactic Data Center (Appendix V). The Palmer Drought Severity Index for southern New Jersey (Appendix V-A) indicated that water levels were fairly typical during the spring months but wetter than average from June through August. Below average rainfall during the latter part of the summer (Appendix V-B) brought the September and October water levels closer to normal range, although they were still slightly wetter than is typical for that time of year.

3.0 RESULTS

Eight of the 30 potential vernal pools met the criteria for certification and 22 did not. Site by site results follow.

3.1 Potential Vernal Pool # 7765

Hamilton Township, Mercer County, NJ	Block 2739, Lot 87.11
Location: Ironbridge Road	Landowner: Township of Hamilton
GPS Coordinates: Latitude 40°09'30.0197"	Longitude -074°36'55.9963"
Topo Quad Allentown, NJ	Appendix I - Map 2

Dates of site visits: April 9, April 18, May 6, May 30, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

The pool occurred in a natural depression about one thousand square meters in size, and was one to two feet deep in the center during the spring months. It was located at the edge of a red maple-sweetgum forest, and had ironwood and buttonbush growing around the edges. No emergent or floating herbaceous plants were seen, but a heavy growth of algae was noted both in the water and on the surface. The partially submerged branches of several fallen trees offered suitable substrate for those amphibians which prefer to attach their egg masses to woody debris (photo 3.1-a). The adjacent field was agricultural, and appeared to be an evergreen tree farm. Although the pool was located within a forested wetland complex, it was isolated from other nearby ponds and had no permanent inlet or outlet, so it met the first criteria.

Vernal pool species

Amphibians present on the site included green frog and Fowler's toad, both facultative vernal pool species. Invertebrates observed in the pond included mosquito, water boatman, water strider, mayfly, chironomid midge, isopod, ostracod, daphnia, and an aquatic beetle.

A surprisingly low number of amphibians were documented at this potential vernal pool. Observations of green frogs were limited to a couple of individuals, and although they were present in the pond during the breeding season no chorus of frogs was heard during a nocturnal survey at the end of May. Although some northern gray treefrogs were heard calling at other locations in the same wetland complex, none were heard at the vicinity of the pond.

The presence of Fowler's toad was established by the capture of a single larval individual. Toads generally lay copious amounts of eggs, and their tadpoles are typically found in large numbers wherever they occur. Despite diligent searching, no additional specimens were found. Fowler's toads were heard calling at a nearby wetland in the same forest, but none were seen or heard around the target pool.

The presence of two facultative vernal pool breeding amphibians allows this location to meet the second criteria, but the unusually low numbers of individuals make this a marginal qualification. The proximity of agricultural activity and heavy algal growth in the pool suggest that runoff from nearby fields makes this a less desirable amphibian breeding site than other nearby ponds.

Hydroperiod

The pool held water continuously throughout the months of April and May, and was still up to two feet deep at the end of May, meeting the third criteria. By early September, the depression was completely dry, thereby meeting the fourth criteria for certification (photo 3.1-b).

Photos

Photo 3.1-a. Pool 7765 on April 9 2013.

Photo 3.1-b. Pool 7765 on September 10 2013.

3.2 Potential Vernal Pool # 7769

Hamilton Township, Mercer County, NJ — Block 2739, Lot 87.11

Location: Ironbridge Road — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°09'26.9768" — Longitude -074°36'55.9601"

Topo Quad Allentown NJ — Appendix I - Map 2

Dates of site visits: April 9, April 18, May 6, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

The 'pool' was actually a large pond, approximately 1.5 acres in size, surrounded by forested wetlands (photo 3.2-a). While it is quite possible that the feature originated as a natural depression, the high ridges running lengthwise along either side of the pond suggest that the depth may have been enhanced at some point in the past. Nevertheless, the mature trees growing atop the berms indicated that they have been in place for many decades. Characteristic woody species included beech, sweet gum, red maple, red oak, spicebush and sweet pepperbush. Fishing bobbers caught in the surrounding bushes implied the presence of fish, and the pond had an outflow at the western end which was partially blocked by a beaver dam (photo 3.2-b). It did not meet the first criteria for certification.

Vernal pool species

No obligate vernal pool species were documented on the site. Some frogs were noted around the edges of the pond, and although no anuran choruses were heard during a nighttime visit in mid-April it is likely that a few common species breed in the area. Reptiles observed using the site included the eastern painted turtle, which was abundant, and the common snapping turtle. Because this was readily understood to be a permanent pond, sampling for invertebrates was not carried out at this location.

Hydroperiod

The large pond held a considerable amount of water, and the levels did not fluctuate between the spring and fall seasons. Observation of beavers swimming around above the dam confirmed that it is presently functioning as a permanent pond.

Photos

Photo 3.2-a. Pool 7769 on April 9 2013.

Photo 3.2-b. Beaver dam blocking outflow at Pool 7769.

3.3 Potential Vernal Pool # 7943

Hamilton Township, Mercer County, NJ — Block 1824.03, Lot 1

Location: Estates Boulevard — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'38.3799" — Longitude -074°40'46.0276"

Topo Quad Trenton East NJ-PA — Appendix I - Map 3

Dates of site visits: April 9, April 17, May 3, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	X	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 7943 is a natural shallow depression occupying about 1500 square meters in a small patch of oak-sweetgum forest near the intersection of Estates Boulevard and Trenton Avenue (photo 3.3-a). Wetland tolerant species such as red maple, sweet pepperbush, buttonbush and highbush blueberry are also present. The pool has little buffer from the back yards of several Trenton Avenue residences, and a ditch that appears to originate next to a roadside storm drain on Estates Boulevard leads directly into the pond (photos 3.3-b and 3.3-c). The site map (Map 3) indicates that the pool may receive water as overflow from a branch of Pond Run when water levels are high, but there is no permanent inlet or outlet so the first criteria is satisfied.

Vernal pool species

Although no amphibian egg masses were located during spring searches of the site, the vast numbers of juvenile wood frogs encountered during a late summer visit made it evident that the obligate vernal pool species was breeding there. Hundreds of young frogs were present in the remaining water and around the edges of the pool (photo 3.3-d). Breeding choruses of two facultative amphibian species, the northern spring peeper and the green frog, were heard during the spring, and a neighbor reported that both northern gray treefrogs and bullfrogs have utilized the pool during prior years.

Invertebrates observed in the pond included mosquito, water scavenger beetle, dragonfly, water boatman, water scorpion, water strider, mayfly, water mite, isopod, daphnia and aquatic oligochaete worms.

Hydroperiod

The pool maintained consistent water levels throughout the spring months. By early September, the water level had dropped considerably although the basin was not completely dry (photo 3.3-e). No fish were found while dipnetting for aquatic life, and it is likely that the pool does dry up completely at some point during a year of average rainfall. Because the first two criteria were met, 7943 can automatically be certified as vernal and documentation of the pond in a completely dry state was not necessary.

Photos

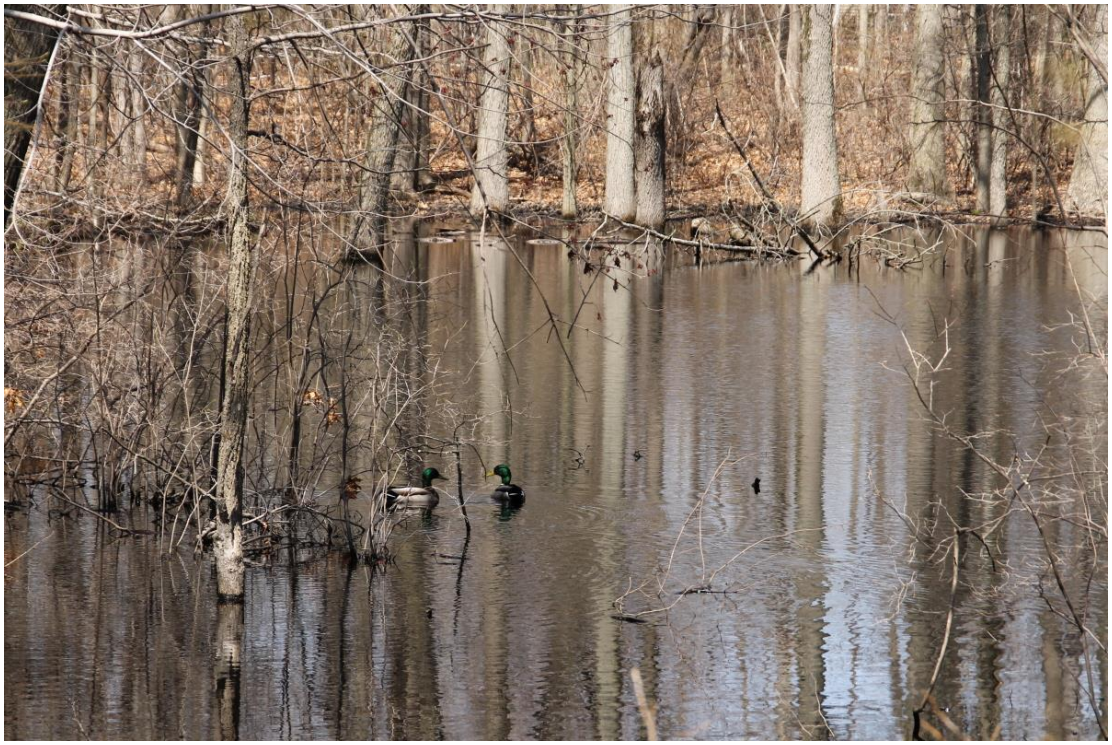
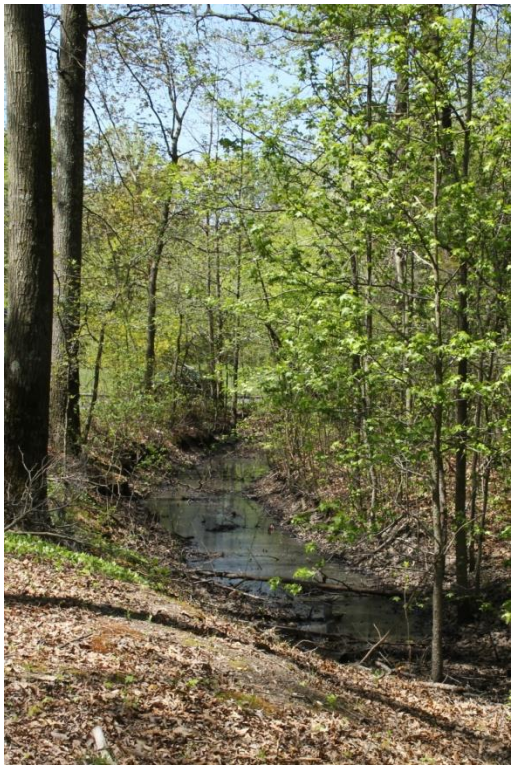


Photo 3.3-a. Pool 7943 on April 9 2013.



Photos 3.3-b and 3.3-c show roadside storm drain and ditch that enters the pool.

Photo 3.3-d. Two of the many young wood frogs seen in early September.

Photo 3.3-e. Lowered water level in Pool 7943 on September 10.

3.4 Potential Vernal Pool # 7947

Hamilton Township, Mercer County, NJ — Block 1824, Lot 59

Location: Trenton Avenue — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'39.1981" — Longitude -074°40'38.9793"

Topo Quad Trenton East NJ-PA — Appendix I - Map 3

Dates of site visits: April 10, April 14, May 3, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

The small depression identified as Pool 7947 was only about 500 square meters in size (photo 3.4-a), but during the spring months a series of ditches connected it to a much larger and deeper pond that fronted on Estates Boulevard. The surrounding forest had a mix of oaks, sweetgum and red maple as the dominant tree species with greenbriar, sweet pepperbush and spicebush as the prominent understory species. The wetland connected to storm drains on Trenton Avenue and Estates Boulevard, and also received runoff from a nearby development on Foy Drive. An odor suggestive of a nutrient-rich environment and a heavy growth of algae were noted on the initial visit. As the pond had neither a permanent flowing inlet or outlet, it met the first criteria.

Vernal pool species

No obligate vernal pool species were documented on the site. Breeding choruses of two facultative amphibian species, the northern spring peeper and green frog, were heard in mid-April, satisfying criteria 2b. Invertebrates observed in the pond included mosquito, dragonfly, water strider, ostracod, daphnia and aquatic oligochaete worms.

Hydroperiod

The pond retained water throughout the spring months, but was nearly dry by early September (photo 3.4-b). Only a few shallow puddles remained in the deepest part of the pond (photo 3-4-c). However, the puddles contained a number of small fish (photo 3.4-d), demonstrating that the pool is not fish-free when it is connected to the larger system, and therefore does not meet the fourth criteria.

Photos

Photo 3.4-a. Pool 7947 on April 10 2013.

Photo 3.4-b. Pool 7947 on September 10.

Photo 3.4-c. Small puddles remained in early September.

Photo 3.4-d. A number of small fish were found stranded in the puddles.

3.5 Potential Vernal Pool # 7954

Hamilton Township, Mercer County, NJ — Block 2169, Lot 2

Location: Veteran's Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'50.4361" — Longitude -074°40'08.0108"

Topo Quad Trenton East NJ-PA — Appendix I - Map 4

Dates of site visits: March 21, March 26, April 15, April 17, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	x	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	x	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	x	
3)	The area maintained ponded water for at least two continuous months between March and September.	x	
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

A variety of trees, shrubs and tussock sedges were scattered throughout the shallow depression that forms Pool 7954, which is approximately 750 square meters in size (photo 3.5-a). Although it was isolated from other pools in the Veteran's Park wetland complex, there was a pipe directing runoff from the park's adjacent entryway and parking area toward the pond (photo 3.5-b). However, it had no permanent flowing inlet or outlet and met the first criteria.

Vernal pool species

A number of wood frog egg masses were found in the pool on April 15. Most of the larvae had already wiggled their way out of the eggs, but a few tadpoles could still be seen in the gelatinous masses (photo 3.5-c). The presence of this obligate vernal pool breeder automatically fulfilled the second criteria, and healthy populations of facultative species including the northern spring peeper and green frog were present as well. Although mosquito larvae and water mites were noted in passing, no formal sampling of invertebrates was carried out at this location.

Hydroperiod

The pool held water throughout the spring. Although much of its surface area dried up over the course of the summer, a small area in the deepest part of the pond was still holding water and supporting a duckweed mat on September 10th (photo 3.5-d). Because the first two criteria were met, 7954 can automatically be certified as vernal and documentation of the pond in a completely dry state was not necessary.

Photos

Photo 3.5-a. Pool 7954 on April 15 2013.

Photo 3.5-b. Drainage pipe from driveway/parking area leading into pool.

Photo 3.5-c. Remains of wood frog egg mass on April 17 2013.

Photo 3.5-d. Pool 7954 on September 10 2013.

3.6 Potential Vernal Pool # 7958

Hamilton Township, Mercer County, NJ — Block 2169, Lot 2

Location: Veteran's Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'47.4446" — Longitude -074°40'12.9073"

Topo Quad Trenton East NJ-PA — Appendix I - Map 4

Dates of site visits: March 21, March 26, April 15, April 17, May 3, September 10, October 28

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 7958 was deep and large, occupying over 4000 square meters during the spring months. The pond was deepest at its southern end, where mature trees grew in the standing water around the edges and some scattered clumps of shrubs could be seen (photo 3.6-a). The northern portion of the pond was much shallower and was dominated by emergent herbaceous vegetation (photo 3.6-b). Much of the surrounding land was flooded during the early spring months, and some of the waters eventually drained into this pool via a temporary stream at the upper end. No permanent flowing inlets or outlets were present.

Vernal pool species

No obligate vernal pool breeders were documented on the site, although four facultative amphibian species were present. Strong breeding choruses of both the New Jersey chorus frog and the northern spring peeper were heard, but both species were confined to the grassy portion of the pond at the northern end. More widely spread throughout the habitat were the green frog and bullfrog. Numerous painted turtles also resided in the pond.

Hydroperiod

Notable drops in the water level occurred between the early spring and late summer months, but a substantial amount of water remained in the southern portion of the pond through the end of October (photo 3.6-c). By early September, however, a few small dry depressions were evident at the upper end where the chorus frogs and peepers had been noted during the spring (photo 3.6-d). It is possible that part of the area defined as Pool 7958 functions as vernal habitat, but as a unit it appears to be a permanent pond.

Photos

Photo 3.6-a. Southern end of Pool 7958 on March 21 2013.

Photo 3.6-b. Northern end of Pool 7958 on March 21 2013.

Photo 3.6-c. The southern end of 7958 still held plenty of water on October 28.

Photo 3.6-d. Small dry depressions were present in the northern end of 7958 by early September.

3.7 Potential Vernal Pool # 7966

Hamilton Township, Mercer County, NJ — Block 2168, Lot 1

Location: Cypress Lane — Landowner: Society Hill

GPS Coordinates: Latitude 40°12'54.2907" — Longitude -074°41'19.0642"

Topo Quad Trenton East NJ-PA — Appendix I - Map 5

Dates of site visits: March 22, April 10, April 17, May 6

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

This 900 square meter pool was located in a sweetgum-red maple forest with a shrub understory dominated by spicebush and greenbriar. The shallow pond was covered by a thin layer of ice on March 22 (photo 3.7-a). The pool was isolated in a natural depression and had no inlet or outlet, satisfying the first criteria.

Vernal pool species

A chorus of northern spring peepers was heard on the site on April 17, but this facultative vernal pool breeder was the only amphibian documented on the site. Invertebrate fauna was also limited in the pool, as sampling yielded only mosquito larvae and daphnia.

Hydroperiod

Although Pool 7966 appeared to have good vernal pool potential at the first site visit, most of the water had disappeared by early April (photo 3.7-b), and the depression was completely dry by early May (photo 3.7-c). The shallow water and brief hydroperiod made it an unsuitable breeding site for most amphibians.

Photos

Photo 3.7-a. Pool 7966 on March 22 2013.

Photo 3.7-b. Pool 7966 on April 10 2013.

Photo 3.7-c. Pool 7966 on May 6 2013.

3.8 Potential Vernal Pool # 7970

Hamilton Township, Mercer County, NJ — Block 1922, Lot 11

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'08.2682" — Longitude -074°41'22.3345"

Topo Quad Trenton East NJ-PA — Appendix I - Map 6

Dates of site visits: April 10, April 17, April 25, September 10, October 28

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 7970 was part of a cluster of small pools in an oak-maple forest at the corner of Route 533 and Cypress Lane, but it was hydrologically isolated from the others and had no permanent inlet or outlet. The pool was deep and steep-sided, suggesting that it may have originated from past excavation activity on the site (photo 3.8-a). Several old tires were present in the small pond.

Vernal pool species

No obligate vernal pool species were documented on the site. Green frogs were abundant around the pond (photo 3.8-b), and some larval bullfrogs were also present. Although spring peepers were calling from other ponds in the nearby woods they did not appear to be utilizing 7970. Invertebrates observed in the pond included water scavenger beetle, dragonfly, water boatman, isopod, and aquatic oligochaete worms.

Hydroperiod

The water level in the pool appeared to be fairly stable throughout the spring and summer months, and although it may have dropped a bit by early September it was still one to two feet deep. The pond continued to hold a substantial amount of water through the end of October (photo 3.8-c). The final criteria could not be satisfied, as this appeared to be a permanent pond.

Photos

Photo 3.8-a. Pool 7970 on April 10 2013.

Photo 3.8-b. Green frogs were abundant around the pond.

Photo 3.8-c. Pool 7970 on October 28 2013.

3.9 Potential Vernal Pool # 7974 (connected to #7978)

Hamilton Township, Mercer County, NJ — Block 1922, Lot 11

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'08.2238" — Longitude -074°41'20.8955"

Topo Quad Trenton East NJ-PA — Appendix I - Map 6

Dates of site visits: April 10, April 17, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 7974 and Pool 7978 were contiguous and remained connected to one another throughout the spring and summer and on into the dryer fall months. Together the pools occupied an area approximately 300 square meters in size. Two views of the wetland complex are presented in photos 3.9-a and 3.9-b. Although the pools were connected to each other, they were separate from other waterways and had no permanent inflow or outflow. It was noted, however, that a ditch receiving road runoff during periods of high flow emptied directly into the pool system (photo 3.9-c).

Vernal pool species

No obligate vernal pool species were documented on the site, although several facultative amphibians were breeding in the pools. A healthy chorus of northern spring peepers was heard during a night visit in mid-April, and green frogs and bullfrogs were present in both larval and adult form. Invertebrates observed in the pond included water scavenger beetles, water striders and isopods.

Hydroperiod

No change in the water level of the pools was noted between early spring and late summer visits. Furthermore, a small fish was found while sampling for aquatic life (photo 3.9-d), so the pool did not meet the fourth criteria.

Photos

Photo 3.9-a. A view of Pools 7974/7978 on April 10 2013.

Photo 3.9-b. Another view of Pools 7974/7978 on April 10 2013.

Photo 3.9-c. A roadside ditch emptied directly into the ponds.

Photo 3.9-d. A small fish was captured in the pools.

3.10 Potential Vernal Pool # 7978 (connected to #7974)

Hamilton Township, Mercer County, NJ — Block 1922, Lot 11

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'08.4877" — Longitude -074°41'19.5671"

Topo Quad Trenton East NJ-PA — Appendix I - Map 6

Dates of site visits: April 10, April 17, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool 7978 was connected to Pool 7974. See section 3.9 for discussion.

3.11 Potential Vernal Pool # 7996

Hamilton Township, Mercer County, NJ — Block 1841, Lot 61

Location: Bree Drive — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'59.6836" — Longitude -074°38'43.9737"

Topo Quad Trenton East NJ-PA — Appendix I - Map 7

Dates of site visits: April 9

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	X	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		
3)	The area maintained ponded water for at least two continuous months between March and September.		
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 7996 was a natural depression with no visible inflow or outflow at the edge of a forested area. On first view, the outline of the pond was clearly visible but the basin appeared to be dry (photo 3.11-a). Upon closer examination, however, a small pool about 12 square meters in size and one to two feet deep was found at the base of an uprooted tree.

Vernal pool species

Several masses of wood frog eggs were found attached to roots and branches in the little pool. As the wood frog is considered an obligate vernal pool breeder, its presence satisfied the criteria for certification.

Hydroperiod

The evidence suggests that Pool 7996 was once an average-sized vernal pool, but that the hole created by the absent root mass of a fallen tree changed the hydrology of the site and significantly reduced the volume of the pond. As the tree fall appeared to be relatively recent, it is possible that a few of the wood frogs returning to their former procreation site just made the best of the situation. Although 7996 was definitely functioning as vernal breeding habitat in 2013, it is uncertain whether it will continue to be utilized by the frogs. The pool may stabilize and return to its former dimensions as the soil settles, or it may dry up too quickly to allow sufficient time for the larvae to develop. A follow-up visit to this location during April of 2014 is recommended.

Photos

Photo 3.11-a. The original basin of Pool 7996.

Photo 3.11-b. Pool 7996 on April 9 2013.

Photos 3.11-c and 3.11-d. Some wood frog egg clusters in Pool 7996.

3.12 Potential Vernal Pool # 8000

Hamilton Township, Mercer County, NJ — Block 1722, Lot 105

Location: Sayen Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°14'08.2572" — Longitude -074°39'40.1599"

Topo Quad Trenton East NJ-PA — Appendix I - Map 8

Dates of site visits: March 21, April 15, April 17, April 25

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8000 was a 1500 square meter ponded area adjacent to the ball fields at Sayen Park. It may have started as a natural wetland, but some berms along the edges suggested that it may also have been enhanced by excavation at some point. Shrubs surrounded the borders and emergent vegetation was abundant throughout the shallow pond (photo 3.12-a). Trash was also abundant in the area, both in and around the pond (photos 3.12-b and 3.12-c). The pond was directly connected to a stream via an open ditch at its southeastern corner, so it did not meet the first criteria (photos 3.12d and 3.12e).

Vernal pool species

No obligate vernal pool species were observed on the site, and the single facultative species found in the pond was the northern spring peeper. Typical invertebrates seen in the pond included the water strider, isopod, ostracod, snail and aquatic oligochaete worm.

Hydroperiod

Surface water was present during late March, but by mid-late April most of the pond was made up of a thick layer of saturated mud with a few shallow ponded areas scattered throughout (photo 3.12-f). Monitoring of the water levels was discontinued once the connection to the stream was documented.

Photos

Photo 3.12-a. Pool 8000 on March 21 2013.

Photos 3.12-b and 3.12-c. Trash in and around the pond.

Photos 3.12-d and 3.12-e. Two views of the ditch connecting the pond and stream.

Photo 3.12-f. Pool 8000 on April 25 2013.

3.13 Potential Vernal Pool # 8008

Hamilton Township, Mercer County, NJ — Block 2169, Lot 2

Location: Veteran's Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'42.1695" — Longitude -074°40'15.5482"

Topo Quad Trenton East NJ-PA — Appendix I - Map 9

Dates of site visits: March 21, March 26, April 15, April 17, May 3

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8008 was a large, shallow depression occupying almost a quarter acre in an oak-maple-sweetgum forest. The pond was adjacent to Veteran's Lake, and a channel connecting the pool and the lake suggested intermittent flow between the two although there was no permanent inflow or outflow. Woody branches around the edge offered potential substrate for attachment of amphibian egg masses (photo 3.13-a).

Vernal pool species

Despite its promising appearance, not a single amphibian was observed using the pond and no frogs were calling at the site during a night visit in mid-April. Sampling for invertebrate species during the same time period yielded only mosquito larvae, daphnia and aquatic oligochaete worms.

Hydroperiod

The water level observed during the initial visits was noted as one to two feet deep at the center, but the pool did not seem to be fully occupying the available depression (photo 3.13-a). By early May the pond bed was completely dry (photo 3.13-b).

Photos

Photo 3.13-a. Pool 8008 on March 21 2013.

Photo 3.13-b. Pool 8008 on May 3 2013.

3.14 Potential Vernal Pool # 8012

Hamilton Township, Mercer County, NJ — Block 2169, Lot 2

Location: Veteran's Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'43.8813" — Longitude -074°40'11.1036"

Topo Quad Trenton East NJ-PA — Appendix I - Map 9

Dates of site visits: March 21, March 26, April 15, April 17, May 3

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

A large but mostly dry bowl-shaped depression was found at the site labeled as Pool 8012. A remnant pond, less than ten square meters in size, was found within the depression under the branches of a fallen black cherry tree (photo 3.14-a). The entire pit, including the pond, was isolated from other bodies of water.

Vernal pool species

A green frog was observed in the tiny pool during one visit, but there was no evidence that the species was breeding at this location. No frog calls were heard at the pool during a nocturnal survey in mid-April, and no invertebrates were documented in the water column.

Hydroperiod

Very little water was present in the basin during the early spring, and it was completely dry by the beginning of May (photo 3.14-b).

Photos

Photo 3.14-a. Pool 8012 was nearly dry on March 21 2013.

Photo 3.14-b. By May 3rd the water had completely dried up.

3.15 Potential Vernal Pool # 8016

Hamilton Township, Mercer County, NJ — Block 2169, Lot 2

Location: Veteran's Park — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'34.9224" — Longitude -074°40'40.7561"

Topo Quad Trenton East NJ-PA — Appendix I - Map 10

Dates of site visits: March 26, April 14, May 3

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8016 was both small and shallow. The tiny water-filled depression in a forested portion of Veteran's Park was less than six square meters in size and only held a few inches of water during early spring (photo 3.15-a). It was completely isolated and had no inflow or outflow.

Vernal pool species

No amphibians were found at the site. Although the pool was barely larger than a puddle it did have a few invertebrate species, including mosquito larvae, water boatmen and daphnia.

Hydroperiod

Unlike some of the other sites examined during this study, Pool 8016 was not a small remnant pond in a larger depression. In this case the entire depression was diminutive. Not surprisingly, the water had completely dried up by early May (photo 3.15-b).

Photos

Photo 3.15-a. Pool 8016 on March 26 2013.

Photo 3.15-b. Pool 8016 on May 3.

3.16 Potential Vernal Pool # 8024

Hamilton Township, Mercer County, NJ — Block 2168, Lot 60

Location: Whitehorse-Mercerville Road — Landowner: Hamilton YMCA

GPS Coordinates: Latitude 40°12'40.8193" — Longitude -074°41'28.0105"

Topo Quad Trenton East NJ-PA — Appendix I - Map 11

Dates of site visits: March 22, April 17, April 25, May 6, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	X	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 8024 was a good-sized pond located at the edge of the woods behind the YMCA building on Whitehorse-Mercerville Road (photo 3.16-a). The 1600 square meter pond was fairly uniform in depth at one to two feet, with a soft layer of mud on the bottom. It was surrounded by shrubs and dotted with emergent herbaceous vegetation, and by the end of the summer the surface was completely covered with duckweeds. Although a tributary of Pond Run passes through the adjacent forest, the depression containing 8024 was isolated and had no permanent inflow or outflow.

Vernal pool species

Amphibians utilizing the pond included the wood frog, the northern spring peeper and the green frog. A good chorus of spring peepers was heard during mid-April, and both spring peepers and wood frogs were present in larval form. Wood frog tadpoles were abundant in early May (photo 3.16-b), and an adult was also observed on the site. Pool 8024 had a rich invertebrate fauna that included mosquito, dragonfly, water boatman, water strider, mayfly, ostracod, daphnia, fingernail clam and aquatic oligochaete worm.

Hydroperiod

The water level had substantially decreased by early September, although the pond still held a fair amount of water (photo 3.16-c). Because the first two criteria were met, 8024 can automatically be certified as vernal and documentation of the pond in a completely dry state was not necessary.

Photos

Photo 3.16-a. Pool 8024 on March 22 2013.

Photo 3.16-b. Wood frog tadpoles were abundant in the pond on May 6.

Photo 3.16-c. The pool still held some water and had a solid cover of duckweeds on September 10.

3.17 Potential Vernal Pool # 8062

Hamilton Township, Mercer County, NJ — Block 2169, Lot 265

Location: Veteran's Park — Landowner: Twp of Hamilton, County of Mercer

GPS Coordinates: Latitude 40°12'15.8392" — Longitude -074°39'56.3337"

Topo Quad Trenton East NJ-PA — Appendix I - Map 12

Dates of site visits: March 21, April 15, April 17, May 3, May 30, June 14, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8062 was located on the edge of a woodland patch behind Dunmoor Court South. It was set in a natural depression approximately 2100 square meters in area and had no permanent inflow or outflow, although it was positioned to receive runoff from the adjacent residential lots (photo 3.17-a). Forest composition included a number of beech trees as well as the oak-maple-sweetgum mix typical throughout the Township, and the pond was edged by wetland–loving shrubs such as sweet pepperbush, highbush blueberry and fetterbush.

Vernal pool species

The only two amphibian species observed on the site were the northern spring peeper and the red-backed salamander. A few spring peepers were heard singing in the vicinity during a night visit on April 17, but a second night visit late in May yielded no additional species of calling anurans. The red-backed salamander is a woodland species that does not utilize vernal ponds during its life cycle, so it could not be counted as a facultative breeder. Invertebrates observed in the pond included mosquito, water strider, ostracod, daphnia, and aquatic oligochaete worm. The absence of vernal pool breeders was surprising at this site, particularly in view of the fact that more field visits were made to this pond than to any other location in the study. One possible explanation is that contamination from backyard runoff has made the pool inhospitable to amphibians that might otherwise be expected to utilize it.

Hydroperiod

Although 8062 was rather shallow, it held water continuously from late March through mid-June. The pond bed was completely dry by early September (photo 3.17-b).

Photos

Photo 3.17-a. Pool 8062 on March 21 2013.

Photo 3.17-b. Pool 8062 on September 10.

3.18 Potential Vernal Pool # 8090

Hamilton Township, Mercer County, NJ — Block 2714, Lot 4

Location: Edgebrook Road — Landowner: Oliver, Robert E. Et ux.

GPS Coordinates: Latitude 40°11'21.4126" — Longitude -074°37'58.7118"

Topo Quad Trenton East NJ-PA — Appendix I - Map 13

Dates of site visits: March 22

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	X	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		
3)	The area maintained ponded water for at least two continuous months between March and September.		
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 8090 was one of a number of natural depressions scattered throughout the forested area between Edgewood Road and the Back Creek tributary. The pools in the woodland were isolated both from the creek and from one another. The target pool occupied about 900 square meters and contained sufficient shrubby growth and woody debris to attract the kinds of amphibians that require such substrate for attachment of egg masses (photo 3.18-a).

Vernal pool species

Wood frog egg masses were abundant in the pool, and were also present in some nearby tire-ruts that were filled with water (photo 3.18-b). Egg masses could also be seen in a nearby pool that was not on the numbered list of potential vernal pools in the Township. Because the wood frog is an obligate vernal pool breeder no additional efforts were made to document the pond's fauna, although some spring peepers were also noted on site.

Hydroperiod

Multiple visits were not made to Pool 8090 because the criteria for certification as a vernal pool were satisfied on the first trip.

Photos

Photo 3.18-a. Pool 8090 on March 22 2013.

Photo 3.18-b. Wood frog eggs were abundant on the site.

3.19 Potential Vernal Pool # 8104

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Whitehorse-Mercerville Road — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'02.5266" — Longitude -074°41'23.1996"

Topo Quad Trenton East NJ-PA — Appendix I - Map 5

Dates of site visits: April 10, April 14, April 25, June 14, September 10

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.	X	
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 8104 was approximately 240 square meters in size, and about a foot deep in the center. It was located in a maple-oak-sweetgum forest with a notable amount of greenbriar in the understory. The pond occurred in a shallow natural depression with no permanent inflow or outflow (photo 3.19-a).

Vernal pool species

No obligate vernal pool breeders were found on site, but two facultative species – the northern spring peeper and the green frog – were present. Mosquitoes, mayflies and water scavenger beetles were characteristic invertebrates of the pond.

Hydroperiod

The pond held water consistently from mid-April through mid-June. In fact, it was noted on a June 14 visit that water levels were higher than they had been earlier in the spring. By the end of the summer, the basin was completely dry (photo 3.19-b).

Photos

Photo 3.19-a. Pool 8104 on April 10 2013.

Photo 3.19-b. Pool 8104 on September 10.

3.20 Potential Vernal Pool # 8519

Hamilton Township, Mercer County, NJ — Block 2520, Lot 1

Location: Hobson Avenue — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°11'00.6433" — Longitude -074°42'46.6288"

Topo Quad Trenton East NJ-PA — Appendix I - Map 14

Dates of site visits: None.

3.21 Potential Vernal Pool # 8523

Hamilton Township, Mercer County, NJ — Block 2520, Lot 1

Location: Hobson Avenue — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°10'57.8025" — Longitude -074°42'47.3728"

Topo Quad Trenton East NJ-PA — Appendix I - Map 14

Dates of site visits: None.

Notes on #8519 and #8523

The Township identified these two pools as former sludge lagoons, and a quick drive up to the site confirmed that these large open bodies of water were not likely to offer high quality vernal habitat (photo 3.20-a). A second look at the end of the season showed that the pools were still full and would therefore be considered permanent ponds (photo 3.20-b). No formal survey was carried out for the lagoons.

Photos for #8519 and #8523

Photo 3.20-a. The two former sludge lagoons were not included in the survey.

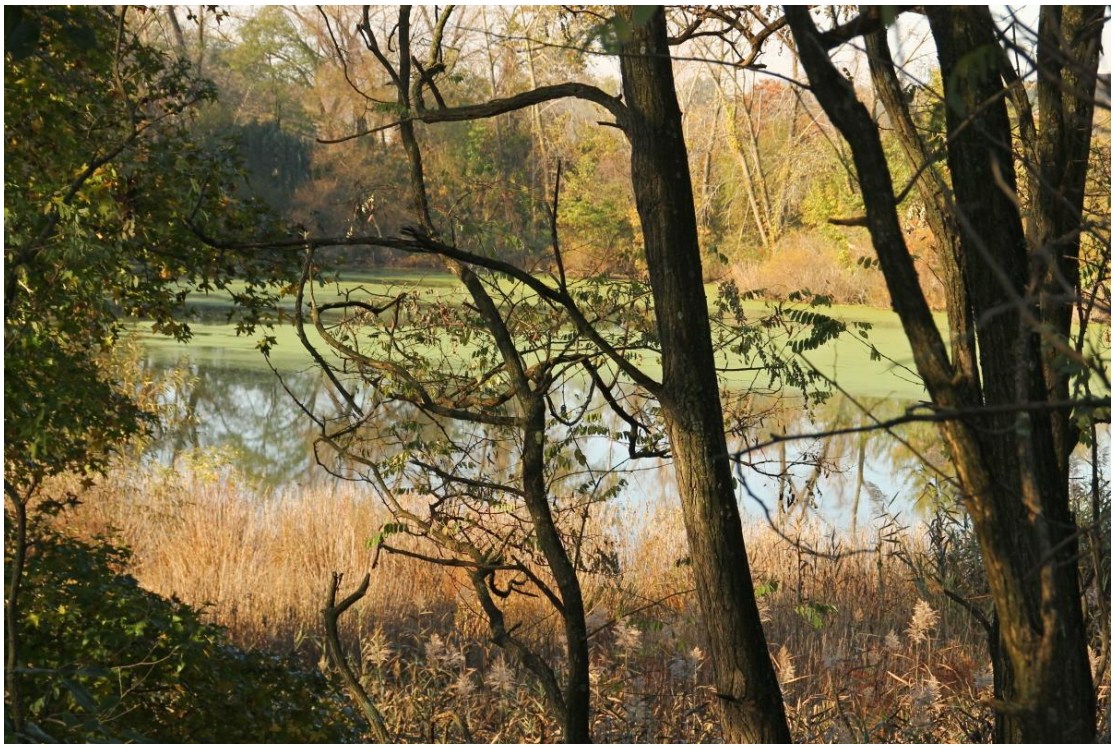


Photo 3.20-b. The lagoons were still full of water at the end of October.

3.22 Potential Vernal Pool # 8566

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'11.0749" — Longitude -074°41'34.9778"

Topo Quad Trenton East NJ-PA — Appendix I - Map 15

Dates of site visits: April 13

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8566 was a deep pond occupying about a quarter acre on the north side of Cypress Lane (photo 3.22-a). Although it was immediately adjacent to a shallow wetland and ditch that lead toward a nearby uncoded tributary, it had a distinct perimeter that separated it from the adjoining wetlands. It was not apparent whether this was a naturally occurring feature or one that had been enhanced at some time in the past. Red maple, river birch and willow were typical trees growing on the banks.

Vernal pool species

Northern spring peepers were observed on the site and dragonflies, water striders and snails were also present. As 8566 was quickly established to be a permanent pond, no additional efforts were made to identify resident species.

Hydroperiod

Aquatic vegetation typical of established ponds was noted upon arrival at the site, and as large fish were seen jumping during the initial visit no further evidence of the pond's permanence was required.

Photos

Photo 3.22a. Pool 8566 on April 13 2013.

3.23 Potential Vernal Pool # 8570

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'09.1854" — Longitude -074°41'35.8809

Topo Quad Trenton East NJ-PA — Appendix I - Map 15

Dates of site visits: April 13, April 17, May 3

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8570 occupied about 900 square meters of space at the edge of the woods on the south side of Cypress Lane (photo 3.23a). The shallow pool was immediately adjacent to the road, and a cut in the curb allowed road runoff to enter the pool directly. Trash was found in and around the pool.

Vernal pool species

Some northern spring peepers were heard singing near the pond during an evening visit in mid-April, but no other amphibians were observed at this location. A few invertebrates were found in the water column including mosquito larvae, daphnia and aquatic oligochaete worms.

Hydroperiod

The deepest portion of the pond was only eight inches deep in the middle of April, and by early May the pool was completely dry (photo 3.23b).

Photos

Photo 3.23a. Pool 8570 on April 13 2013.

Photo 3.23b. Pool 8570 on May 3.

3.24 Potential Vernal Pool # 8574

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Cypress Lane — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°13'05.8553" — Longitude -074°41'40.4857"

Topo Quad Trenton East NJ-PA — Appendix I - Map 15

Dates of site visits: April 13, May 3

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

The largest portion of Pool 8574 was about 900 square meters in size, but the pool continued to meander through the woods forming a large, irregular shape (photo 3.24-a). No distinct basin could be clearly defined. Red maple and sweetgum were the dominant forest trees, while greenbriar and spicebush prevailed in the understory.

Vernal pool species

No amphibians were seen in or around the pond, and no invertebrates were found in the shallow water.

Hydroperiod

The average depth of the water in mid-April was six inches, both in the central area of the pool and throughout the entire area occupied by the ponding. The site was completely dry by early May (photo 3.24-b).

Photos

Photo 3.24a. Pool 8574 on April 13 2013.

Photo 3.24b. The site was completely dry by May 3.

3.25 Potential Vernal Pool # 8578

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Whitehorse-Mercerville Road — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'56.0323" — Longitude -074°41'45.8520"

Topo Quad Trenton East NJ-PA — Appendix I - Map 16

Dates of site visits: April 13

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8578 was a series of interconnected deep pits surrounded by higher berms (photo 3.25a). They appeared to be the result of some former excavation. The pools had a distinctive appearance due to their light colored substrate and bright blue-green water (photo 3.25b). The total area occupied by the complex was nearly four-tenths of an acre. Although connected to one another, the pools were isolated from other aquatic systems and had no inflow or outflow.

Vernal pool species

Due to the highly visible presence of fish no effort was made to document the fauna at this site, although a painted turtle was observed basking at the edge of a pond.

Hydroperiod

The pools were deep and obviously permanent, and large fish could be seen swimming around in the clear water.

Photos

Photo 3.25-a. Pool 8578 was a series of deep pits separated by high berms.

Photo 3.25-b. The bright blue-green water was accented by the light substrate.

3.26 Potential Vernal Pool # 8582

Hamilton Township, Mercer County, NJ — Block 2163, Lot 3

Location: Whitehorse-Mercerville Road — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°12'56.1603" — Longitude -074°41'28.5600"

Topo Quad Trenton East NJ-PA — Appendix I - Map 5

Dates of site visits: April 13, April 17, April 25, May 6

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.		X
4)	The pool was free of fish or dried up completely at some time during the year.	X	

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8582 was a natural depression approximately 1000 square meters in size located in a forested area near the intersection of Route 533 and a powerline right-of-way. Although it was situated between a permanent pond and a flowing creek, it was clearly separate from both and had no permanent inflow or outflow (photo 3.26-a). It was noted during the initial site survey that its position downslope from Route 533 might make it susceptible to contamination from road runoff.

Vernal pool species

No amphibians were observed on the site during any of the field visits, and the only invertebrates found in the water were mosquito larvae and ostracods.

Hydroperiod

Despite the substantial size of the depression, the pool itself was very shallow. On April 13th it held only a foot of water at its deepest section. By the 25th of April most of the previously ponded area was dry except for two puddles containing one to two inches of water, and the site was completely dry by early May (photo 3.26-b).

Photos

Photo 3.26-a. Pool 8582 on April 13 2013.

Photo 3.26-b. Pool 8582 was completely dry by May 6 2013.

3.27 Potential Vernal Pool # 8604 (connected to 8612)

Hamilton Township, Mercer County, NJ — Block 1913, Lot 428

Location: Cypress Lane — Landowner: Wolverton, Richard

GPS Coordinates: Latitude 40°13'04.1483" — Longitude -074°42'15.1309"

Topo Quad Trenton East NJ-PA — Appendix I - Map 17

Dates of site visits: March 26, April 18

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Although Pools 8604 and 8612 appeared to be separated by some distance on the map, they actually proved to be part of the same large, meandering wetland that spread throughout a three-acre section of forest. During the initial site survey on March 26, Pool 8612 appeared to be separated from the rest of the wetland system (photo 3.27-a), although it was irregular in shape and turned a corner to extend into the adjacent woods (photo 3.27-b). On the same date, a wet swale was noted between 8612 and 8604 (photo 3.27-c), and 8604 presented as a forested swamp rather than an isolated depression (photo 3.27-d). There was just enough rainfall prior to the second field visit on April 18th to demonstrate that all of those features were connected to one another when the water level rose.

Vernal pool species

Little searching for amphibians was carried out in the complex because it was established early on that it did not have the hydrological characteristics of a vernal pool, although some northern spring peepers were heard calling in the vicinity during the April visit. Invertebrates observed in the pond included water striders, mayflies, water mites, isopods, ostracods and aquatic oligochaete worms.

Hydroperiod

While water levels varied throughout different parts of the swamp, some of the deeper locations held up to two feet of water. A number of fish fry were captured while sampling for aquatic fauna, demonstrating that at least a portion of the wetland functions as a permanent pond. Because all of the pools connect during periods of high water, the presence of fish indicated that the complex did not offer suitable habitat for species that breed in temporary ponds.

Photos

Photo 3.27-a. Pool 8612 begins at the edge of a residential neighborhood.

Photo 3.27-b. Pool 8612 extend into the woods and flows around a bend.

Photo 3.27-c. Part of the swale that connects 8604 to 8612, on March 26 2013.

Photo 3.27-d. 8604 was a spreading forested wetland.

3.28 Potential Vernal Pool # 8612 (connected to 8604)

Hamilton Township, Mercer County, NJ — Block 1913, Lot 428

Location: Cypress Lane — Landowner: Wolverton, Richard

GPS Coordinates: Latitude 40°13'04.6923" — Longitude -074°42'21.4517"

Topo Quad Trenton East NJ-PA — Appendix I - Map 17

Dates of site visits: March 26, April 18

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool 8612 was connected to Pool 8604. See section 3.27 for discussion.

3.29 Potential Vernal Pool # 8616

Hamilton Township, Mercer County, NJ — Block 1602, Lot 3

Location: State Street — Landowner: SMN Holdings, LLC

GPS Coordinates: Latitude 40°14'42.3139" — Longitude -074°42'14.1869"

Topo Quad Trenton East NJ-PA — Appendix I - Map 18

Dates of site visits: March 22, April 17, May 6, September 10, October 28

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.		X
2a)	At least one obligate vernal pool breeding amphibian was found on site.		X

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		X
3)	The area maintained ponded water for at least two continuous months between March and September.	X	
4)	The pool was free of fish or dried up completely at some time during the year.		X

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?		No

Observations From Site Visits

Pool Characteristics

Pool 8616 was a fairly deep pond that appeared to have been developed or enhanced to create a water feature for the adjacent office building (photo 3.29-a). Although it did not have a visible connection to the nearby stream, a concrete overflow box was present at the lower end (photo 3.29-b). Lures and bobbers tangled in the bushes around the pond suggested the presence of fish.

Vernal pool species

It is likely that some common frog species inhabit the pond, although none were observed during the survey and no frogs were calling during a nocturnal visit in mid-April. Because this was readily established as a permanent pond, no sampling for invertebrates was carried out at this location.

Hydroperiod

Water levels in the pond were relatively stable from March through the end of October. Because this was assessed as a permanent pond during the spring, fall visits were limited to brief visual checks to determine that the water level had remained constant.

Photos

Photo 3.29-a. Pool 8616 was a permanent pond.

Photo 3.29-b. Concrete overflow box at Pool 8616.

3.30 Potential Vernal Pool # 18740

Hamilton Township, Mercer County, NJ — Block 1505, Lot 1

Location: Basin Road — Landowner: Township of Hamilton

GPS Coordinates: Latitude 40°16'02.5557" — Longitude -074°41'51.4858"

Topo Quad Princeton NJ — Appendix I - Map 19

Dates of site visits: March 26

Summary of Survey Results

		YES	NO
1)	The area occurs in a defined basin depression without a permanent flowing outlet.	X	
2a)	At least one obligate vernal pool breeding amphibian was found on site.	X	

If both (1) and (2a) are yes, the pool can be certified and the survey is complete.

2b)	At least two facultative vernal pool breeding amphibians were found on the site.		
3)	The area maintained ponded water for at least two continuous months between March and September.		
4)	The pool was free of fish or dried up completely at some time during the year.		

If (1), (2b), (3) and (4) are yes the requirements for certification of the pool have been met.

CERTIFIABLE VERNAL POOL?	Yes	

Observations From Site Visits

Pool Characteristics

Pool 18740 did not occur in a natural swale, but instead appeared to have been formed by a combination of landscape features and human activity. The lower part was a long, narrow channel approximately 50 meters long and five meters wide (photo 3.30-a), while the upper part was shrub/cattail marsh occupying about 3750 square meters on the border of an open field (photo 3.30-b). Nearby, a smaller depression about six square meters in size was apparently formed by tire tracks. However, the entire system was distinct from the both the surrounding forested wetlands and a nearby tributary of the Assunpink Creek.

Vernal pool species

Wood frog eggs were abundant throughout the site, and were present in the tire-track depression as well as in the ditch and the marsh (photo 3.30-c). The presence of this obligate breeding species negated the need for further evaluation of the fauna, although two facultative vernal pool amphibians – the northern spring peeper and the southern leopard frog - were heard calling on the site. A spotted turtle was also observed on the bank of the ditched portion of the pool (photo 3.30-d).

Hydroperiod

Additional visits were not made to Pool 18740 because the criteria for certification as a vernal pool were satisfied on the first trip.

Photos

Photo 3.30-a. A view of the long, narrow portion of Pool 18740.

Photo 3.30-b. The upper end of 18740 was a marshy area on the edge of a field.

Photo 3.30-c. Wood frog eggs were abundant on the site.

Photo 3.30-d. A spotted turtle was seen along the edge of ditched section.

4.0 SUMMARY

Table 1 summarizes the results of this survey. Eight of the surveyed sites met the vernal pool certification criteria: #7765, #7943, #7954, #7996, #8024, #8090, #8104, and #18740. Wood frogs were documented at all but two of these pools (#7765 and #8104), both of which met the criteria due to the presence of two facultative breeding amphibians. The complete absence of mole salamanders throughout the township was surprising, as they would have been expected to share the habitats utilized by wood frogs. However, no spotted salamander egg masses were found during the study period and no salamander larvae were found in any of the pools. Although #7765 met the criteria, the number of amphibians present was exceptionally low and it is possible that the quality of the habitat at that site has been compromised in some way. Pool #7996 appeared to have undergone recent changes in hydrology, and some follow-up visits to that site are recommended.

Seventeen of the surveyed sites were clearly eliminated because they did not meet the hydrological criteria for vernal pools. Pool #8000 was directly connected to a nearby stream. Nine pools were determined to be permanent ponds based on a lack of fluctuation in the water level and/or the presence of fish (#7769, #7947, #7974/7978, #8566, #8578, #8604/8612, and #8616). Seven others were too shallow and did not hold water long enough to allow larval amphibians to develop (#7966, #8008, #8012, #8016, #8570, #8574, and #8582). Two additional sites (#8519 and #8523) were not surveyed because it was established that they were permanent ponds that had been developed as sludge lagoons.

The final three sites did not meet the criteria for certification as a result of the survey, but with some open questions. Pools #7958 and #7970 both supported a number of facultative breeding frog species and showed considerable fluctuation in water level but never completely dried out. Because the groundwater levels during the fall of 2013 were somewhat higher than average (Appendix V-A), it is possible that these sites do completely dry out during a more typical year and might have qualified if the survey had been conducted at another time. Furthermore, the upper part of #7958 which did dry out appeared to be used by a different cohort of frog species than the main body of the pond. Pool #8062 had the appearance and all of the hydrological characteristics of a vernal pool but lacked the requisite number of amphibians. The reason for this absence was not evident but, as with #7765, it is possible that the water quality in the pool has been compromised.

Table 1: Summary of Sites Surveyed

ID #	BLOCK	LOT	OWNER	LOCATION	VERNAL?	MAP #
7765	2739	87.11	Township of Hamilton	198 Ironbridge Road	yes	2
7769	2739	87.11	Township of Hamilton	198 Ironbridge Road	no	2
7943	1824.03	1	Township of Hamilton	797 Estates Blvd, Trenton	yes	3
7947	1824	59	Township of Hamilton	342 Trenton Ave, Trenton	no	3
7954	2169	2	Township of Hamilton	2787 Klockner Road (Veteran's Park)	yes	4
7958	2169	2	Township of Hamilton	2787 Klockner Road (Veteran's Park)	no	4
7966	2168	1	Society Hill	Cypress Lane	no	5
7970	1922	11	Township of Hamilton	580 Cypress Lane	no	6
7974	1922	11	Township of Hamilton	580 Cypress Lane	no	6
7978	1922	11	Township of Hamilton	580 Cypress Lane	no	6
7996	1841	61	Township of Hamilton	25 Bree Drive	yes	7
8000	1722	105	Township of Hamilton	124 Maple Shade Ave (Sayen Park)	no	8
8008	2169	2	Township of Hamilton	2787 Klockner Road (Veteran's Park)	no	9
8012	2169	2	Township of Hamilton	2787 Klockner Road (Veteran's Park)	no	9
8016	2169	2	Township of Hamilton	2262 Kuser Road (Veteran's Park)	no	10
8024	2168	60	Hamilton YMCA	1315 Whitehorse-Mercerville Road	yes	11
8062	2169	265	Twp of Hamilton/ County of Mercer	2417 Kuser Road (Veteran's Park)	no	12
8090	2714	4	Oliver, Robert E. Et ux.	115 Edgebrook Road	yes	13
8104	2163	3	Township of Hamilton	1590 Whtehorse Mercerville Rd.	yes	5
8519	2520	1	Township of Hamilton	350 Hobson Ave	no	14
8523	2520	1	Township of Hamilton	350 Hobson Ave	no	14
8566	2163	3	Township of Hamilton	545 Cypress Lane	no	15
8570	2163	3	Township of Hamilton	545 Cypress Lane	no	15
8574	2163	3	Township of Hamilton	545 Cypress Lane	no	15
8578	2163	3	Township of Hamilton	1400 Whtehorse Mercerville Rd.	no	16
8582	2163	3	Township of Hamilton	1400 Whtehorse Mercerville Rd.	no	5
8604	1913	428	Wolverton, Richard	461 Cypress Lane	no	17
8612	1913	428	Wolverton, Richard	461 Cypress Lane	no	17
8616	1602	3	SMN Holdings, LLC	2960 E. State Street	no	18
18740	1505	1	Township of Hamilton	354 Basin Road	yes	19

5.0 REFERENCES CITED

Behler, John L. and F. Wayne King. 1979. Field Guide to Reptiles and Amphibians. Alfred A. Knopf, New York.

Conant, Roger. 1975. A Field Guide to Reptiles and Amphibians of Eastern/Central North America. Houghton Mifflin Company, Boston.

Kenney, Leo P. and Matthew R. Burne. 2009. A Field Guide to the Animals of Vernal Pools. Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program & Vernal Pool Association.

Kenney, Leo P., Matthew R. Burne, with adaptations and modifications for New Jersey by Jason Tesauro, Kris Schantz and Melissa Craddock. No date. Salamanders, Frogs and Turtles of New Jersey's Vernal Pools: A Field Guide. NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program. 54 pages.

National Climactic Data Center, NOAA Satellite and Information Service, online data accessed November 20 2013
at http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

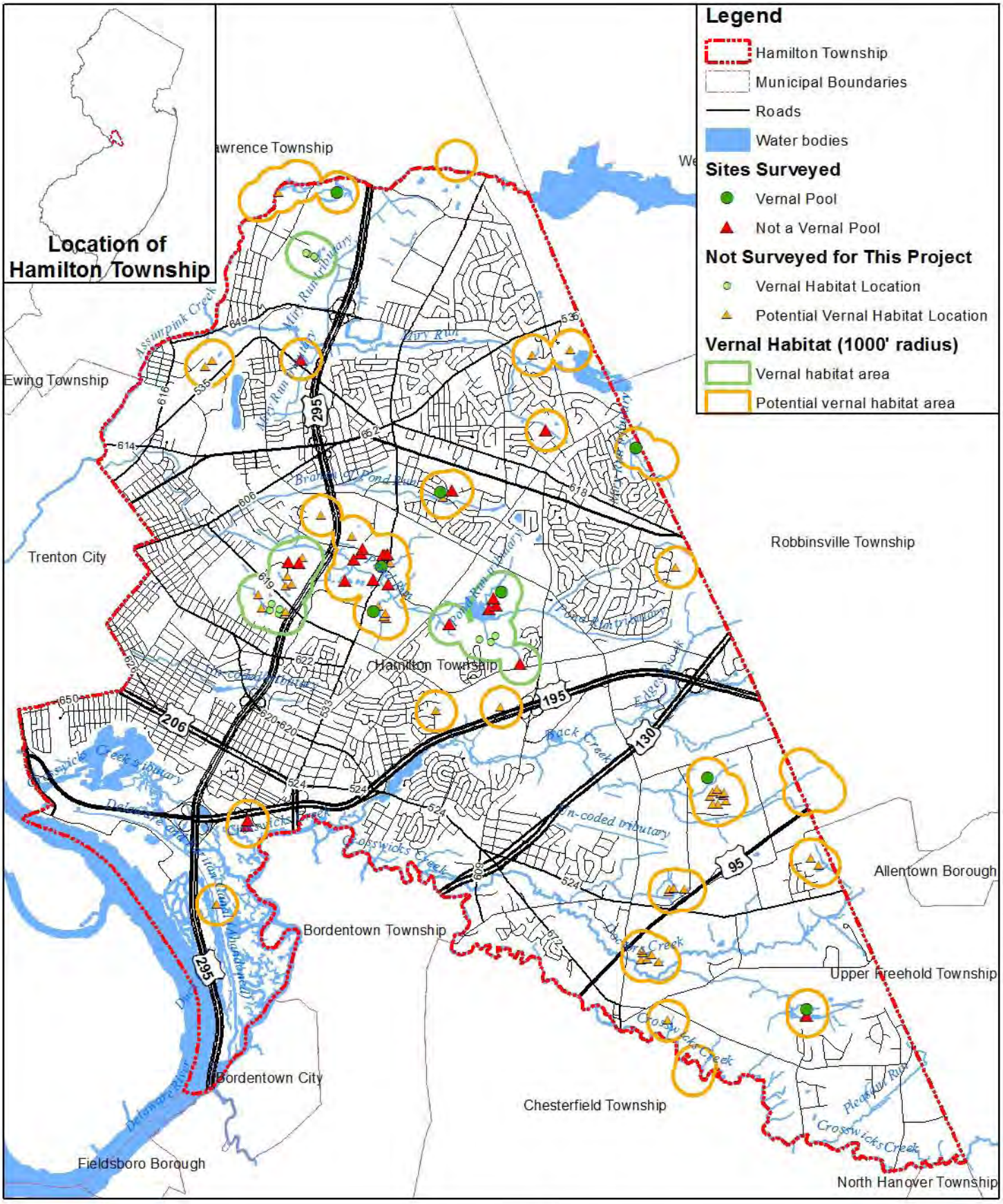
NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program (ENSP). February 21, 2012. NJDEP Species Based Habitat, Vernal Habitat (Version 3.1, 20120221). Metadata:
http://www.nj.gov/dep/gis/digidownload/metadata/landscape/vernal_habitat.htm
GIS data: http://www.nj.gov/dep/gis/landscape.html

NJDEP Division of Land Use Management. 2002. Freshwater Wetlands Vernal Habitat Protocol (updated May 17, 2002). 5 pages.
www.nj.gov/dep/landuse/download/fw_014.doc

NJDEP Division of Land Use Management. 2009. Freshwater Wetlands Protection Act Rules N.J.A.C 7:7A (last amended December 7, 2009). 239 pages.
http://www.nj.gov/dep/rules/rules/njac7_7a.pdf.

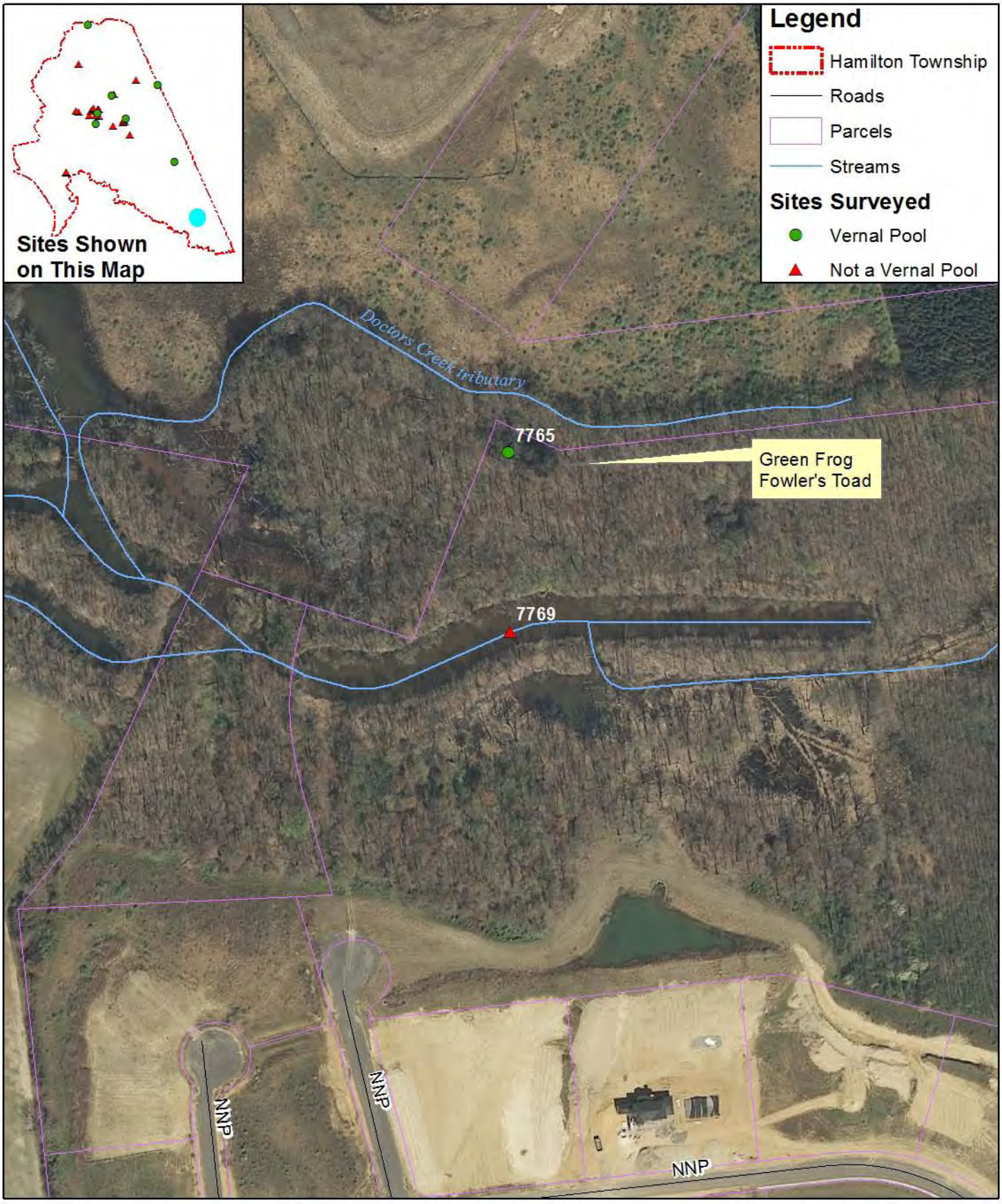
Tesauro, Jason. No date. New Jersey's Vernal Pools. NJDEP Division of Fish and Wildlife. http://www.state.nj.us/dep/fgw/vpoolart.htm.

APPENDIX I. Potential Vernal Pool Location Maps



Map 1: Overview of Sites

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 2: Sites 7765 and 7769

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

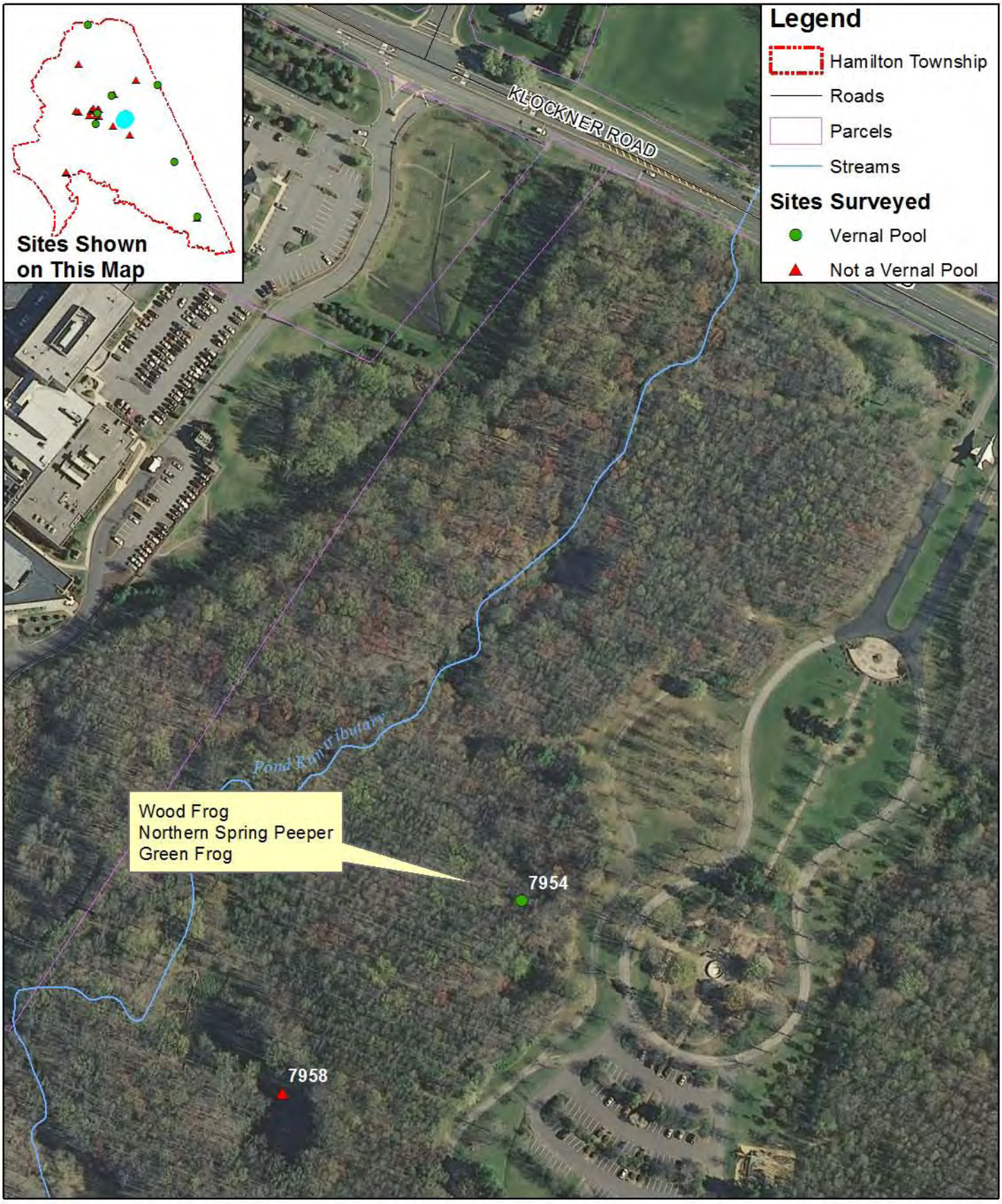
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 3: Sites 7943 and 7947

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



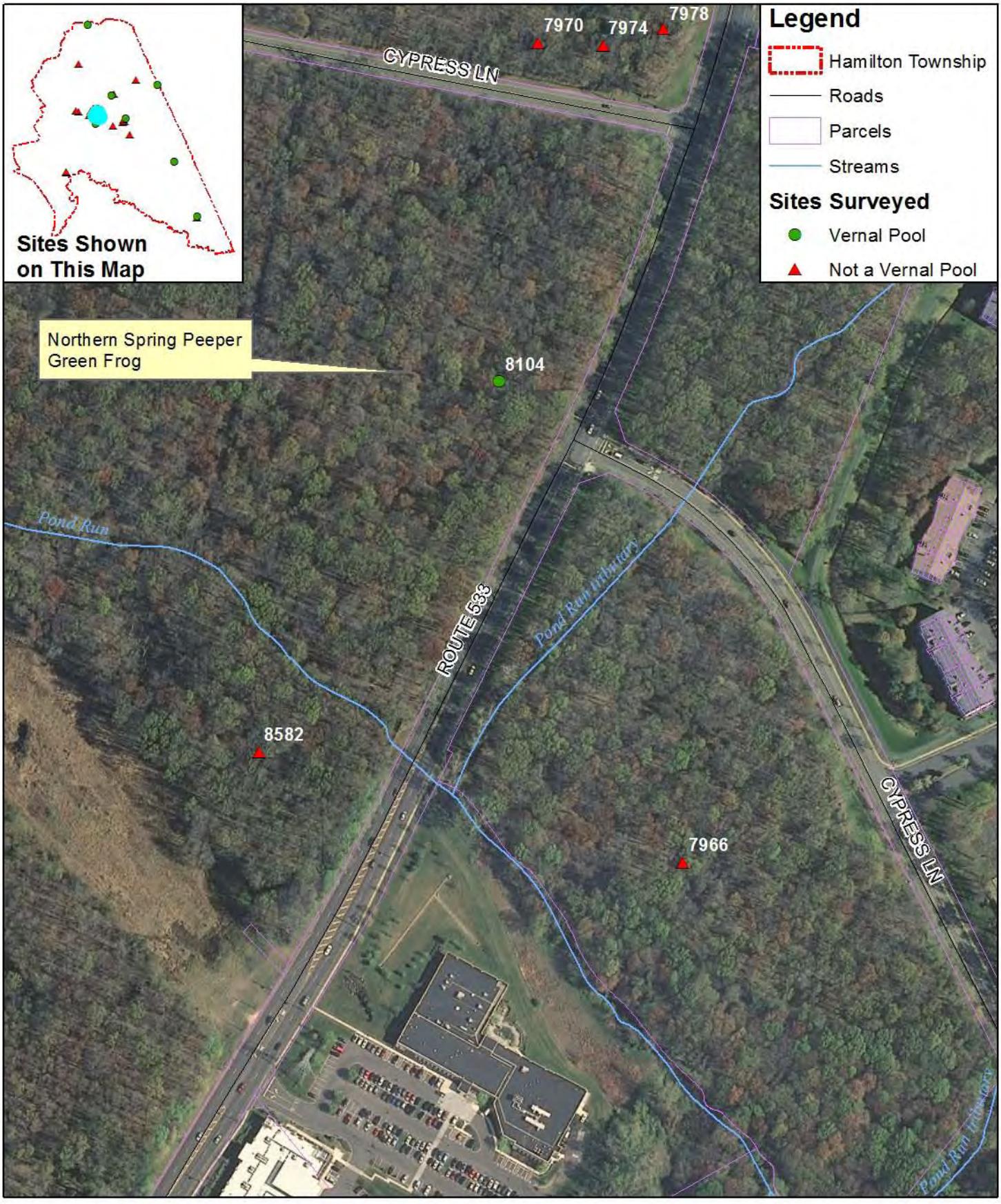
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 4: Sites 7954 and 7958

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 5: Sites 7966, 8104 and 8582

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

0 0.0125 0.025 0.05 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 6: Sites 7970, 7974 and 7978

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 7: Site 7996

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

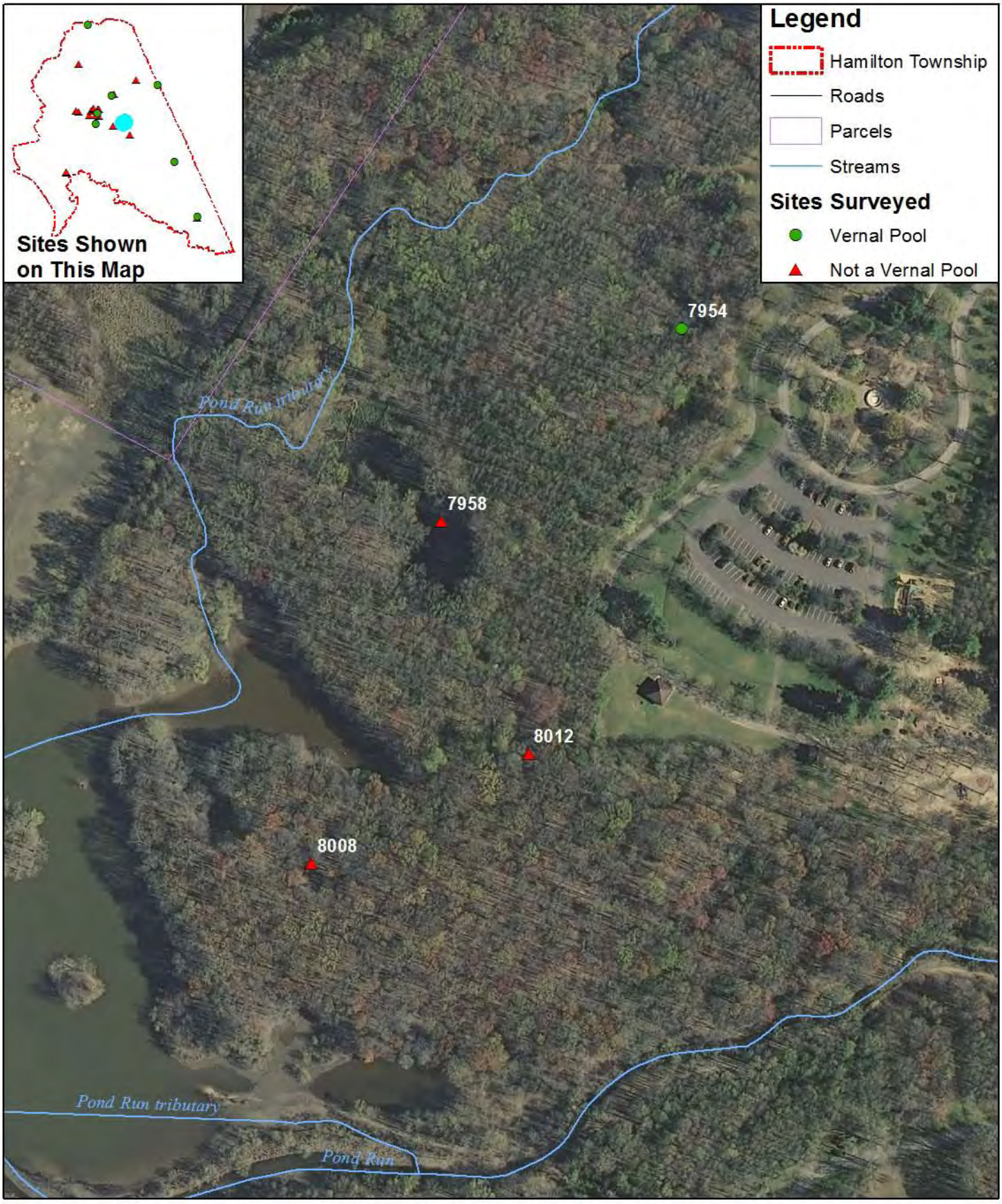
0 0.0125 0.025 0.05 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 8: Site 8000

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



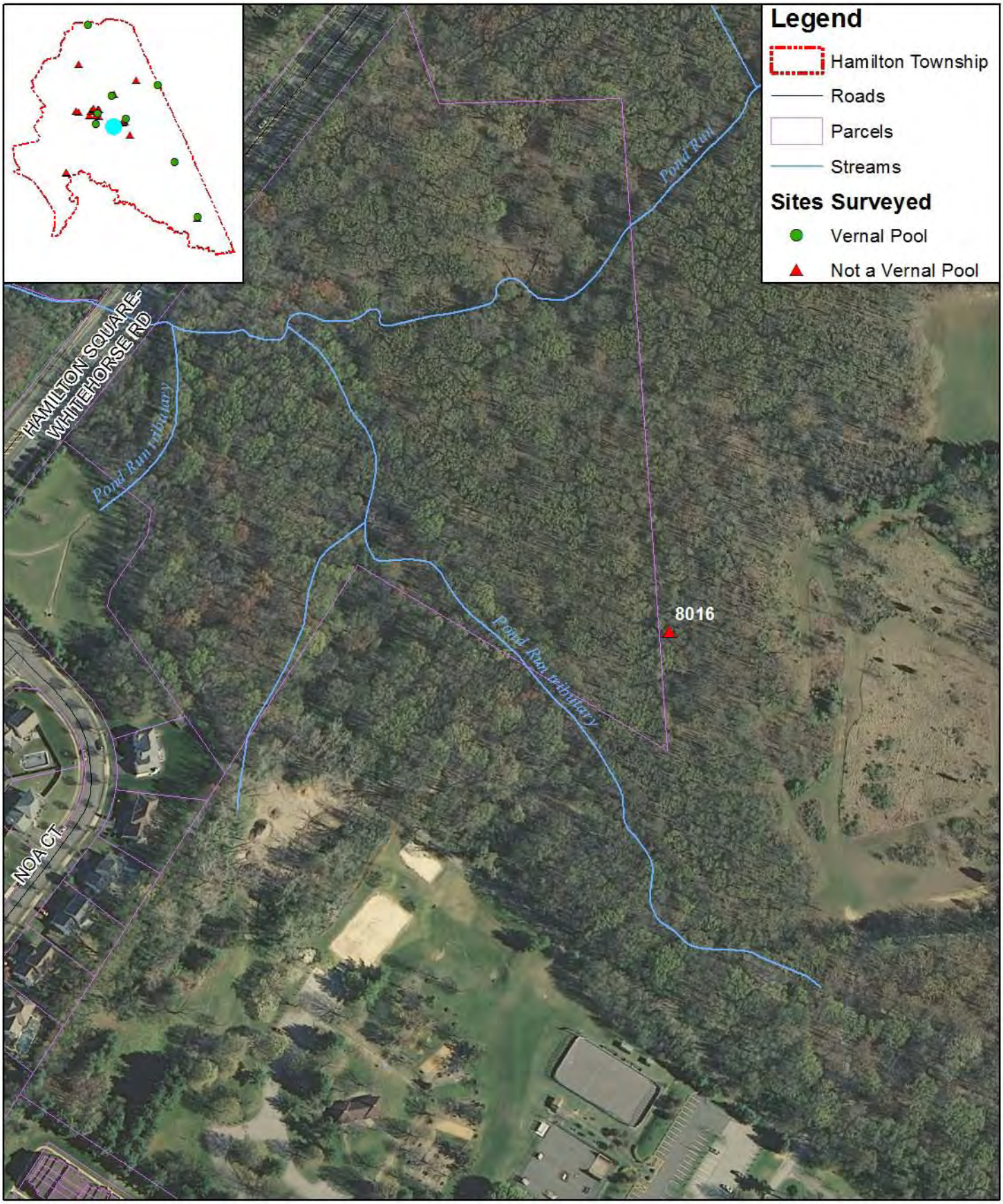
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 9: Sites 8008 and 8012

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



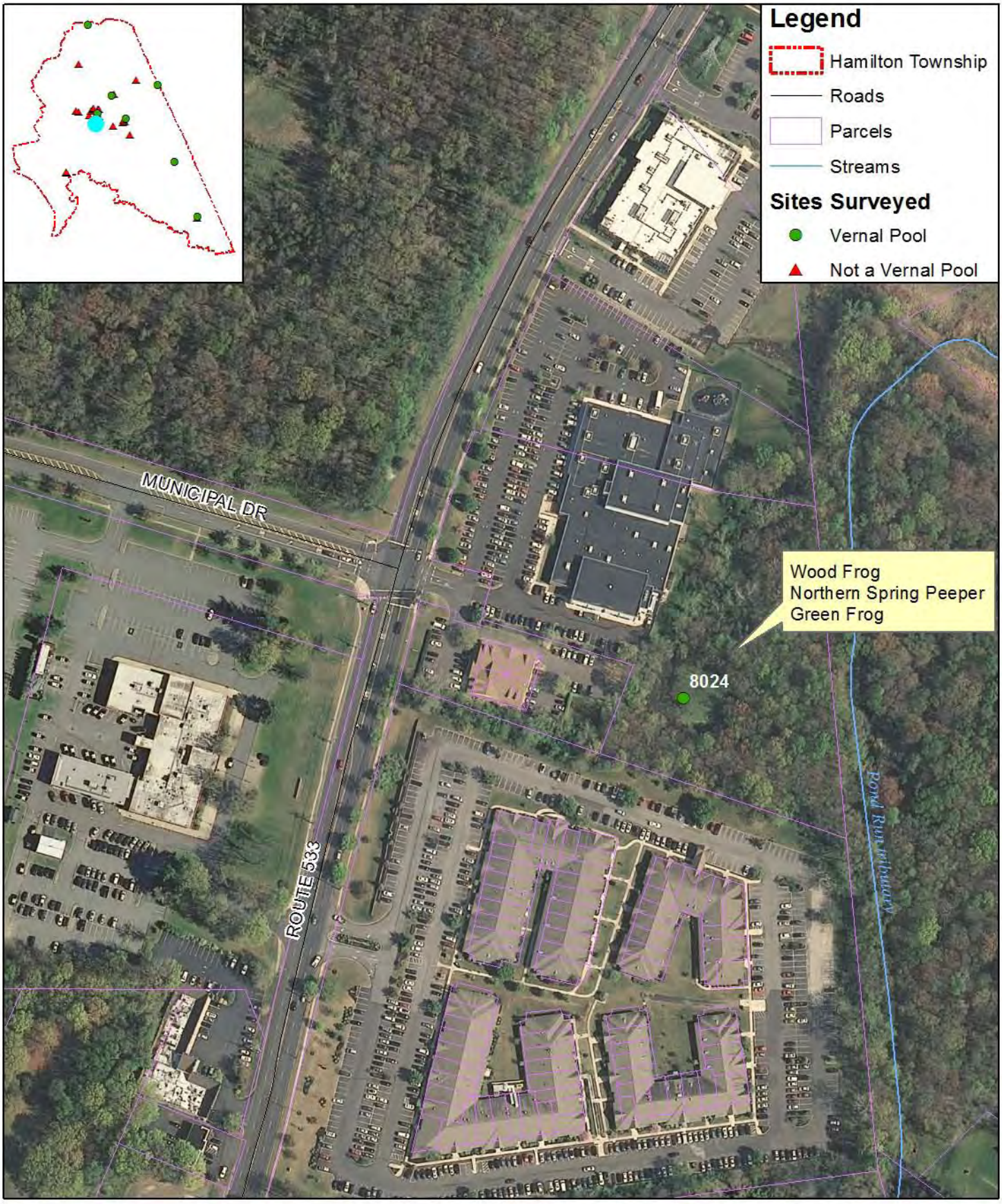
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 10: Site 8016

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



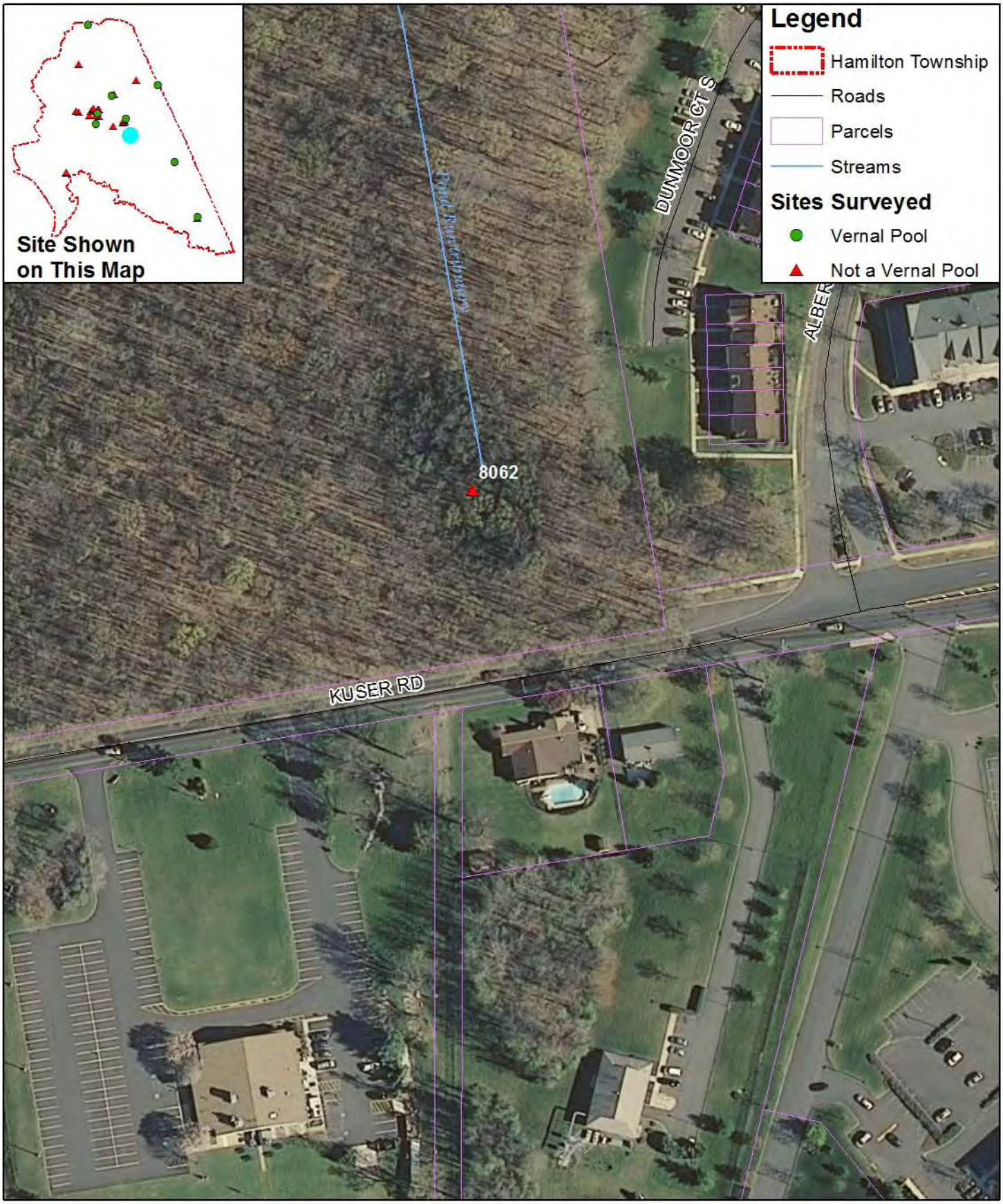
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 11: Site 8024

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



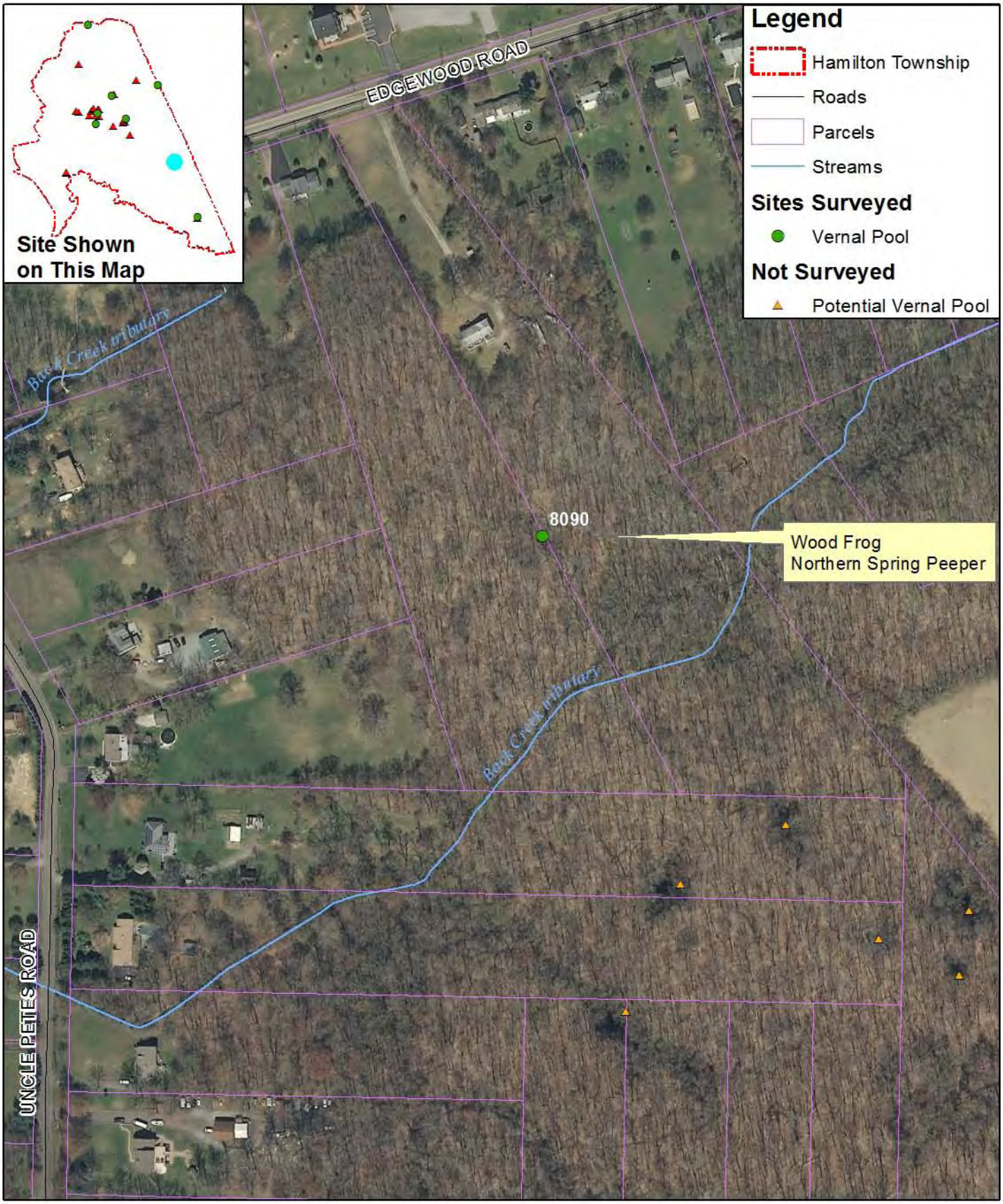
0 0.0125 0.025 0.05 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 12: Site 8062

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



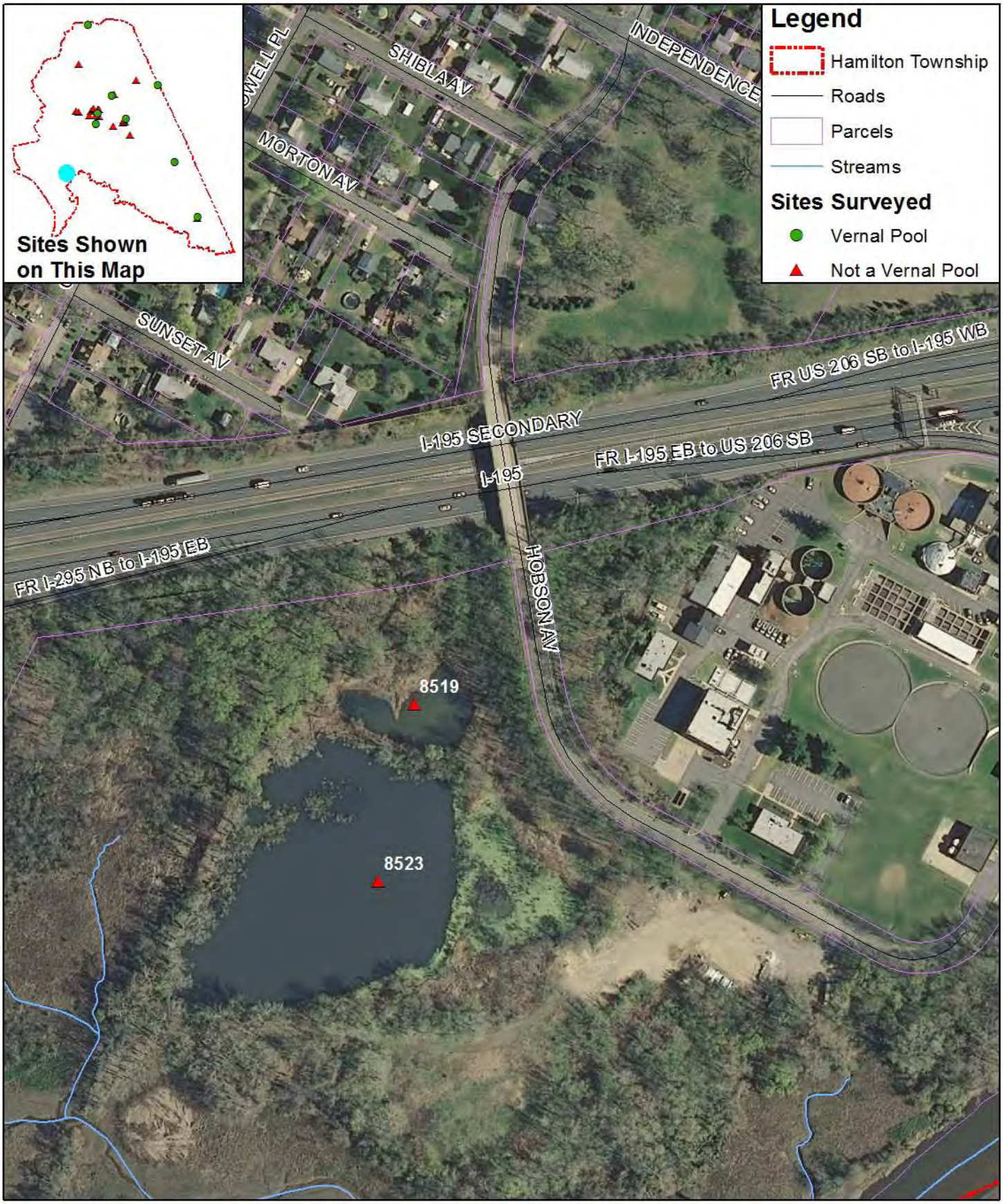
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 13: Site 8090

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



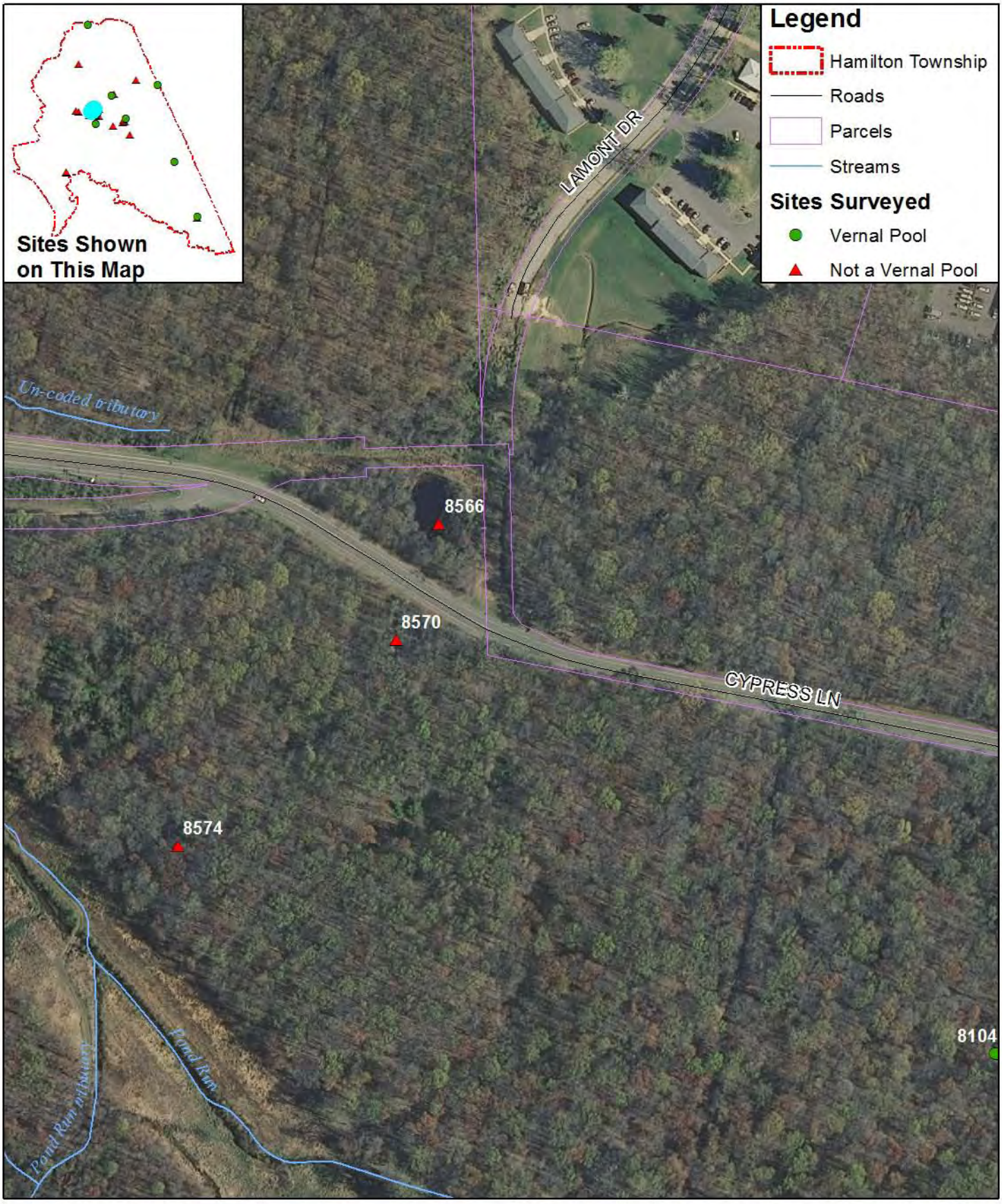
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 14: Sites 8519 and 8523

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



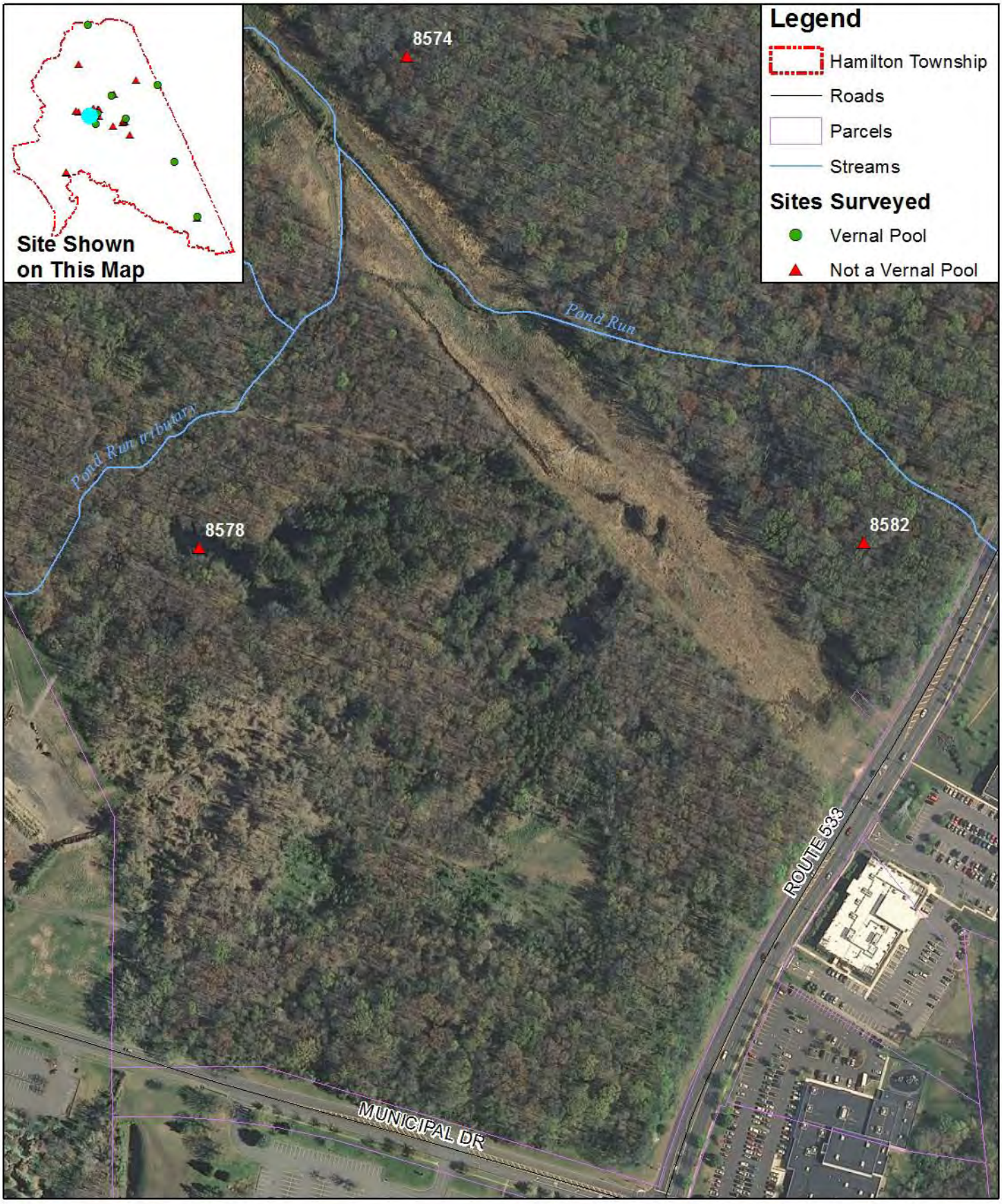
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 15: Sites 8566, 8570 and 8574

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 16: Site 8578

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 17: Sites 8604 and 8612

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

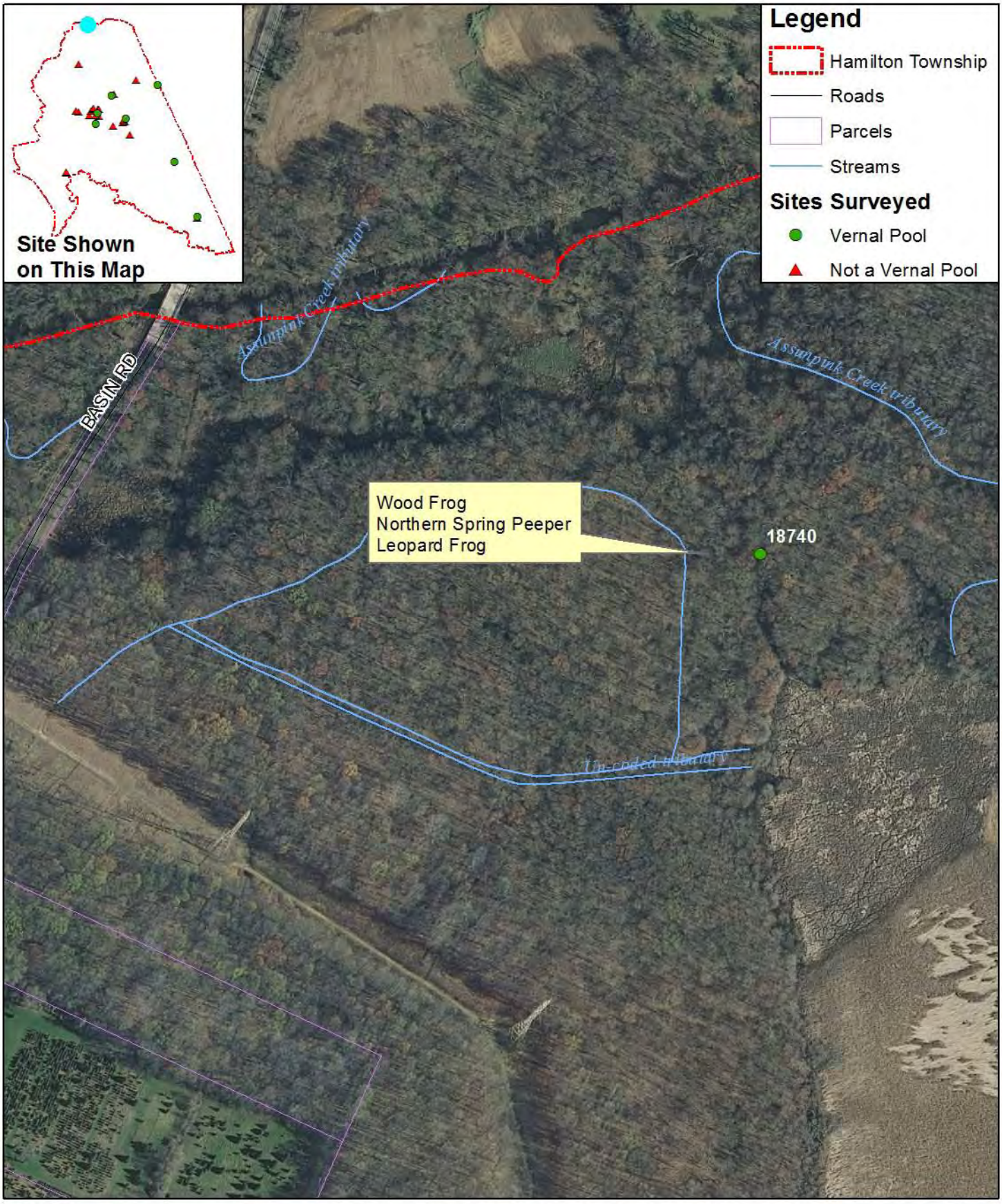
0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 18: Site 8616

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY



0 0.025 0.05 0.1 Miles

N

Data Source: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Map 19: Site 18740

A 2013 SURVEY OF POTENTIAL VERNAL POOLS
IN HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

APPENDIX II. Metadata for GIS Maps

Source of Data*	Data Title	Date	Scale	Online Linkage
NJDEP BGIS[1]	Municipalities of New Jersey (Clipped to Coast), Version 20090116	1/16/2009	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/muncoast.zip
NJDEP BGIS[1]	National Hydrography Dataset (NHD) Streams 2002	11/1/2010	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nhdstreams2002shp.zip
NJOIT OGIS[2]	New Jersey 2012 - 2013 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles	3/1/2013	1:2,400	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
NJDOT	New Jersey Roadway Network	5/31/2005	1:2,400	http://www.state.nj.us/transportation/gis/data.shtm
NJDEP BGIS[1]	NJDEP 2002 Waters of New Jersey (Lakes and Ponds), Version 20080501	5/1/2008	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/njwaterbody.zip
NJDEP DFW ENSP[1]	NJDEP Species Based Habitat, Vernal Habitat (Version 3.1, 20120221)	2/21/2012	1:12,000	http://www.njfishandwildlife.com/ensp/landscape/
NJDEP DFW ENSP[1]	NJDEP vernal habitat locations Edition: Version 1.0	07/2007	1:12,000	n/a
NJDEP BGIS[1]	NJDEP State Boundary of New Jersey	11/1/1998	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/state.zip
NJDEP BGIS[1]	State of New Jersey Composite of Parcels Data, New Jersey State Plane NAD83 and MOD-IV Tax List Search Database	7/29/2011	n/a	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp?DLayer=Parcels by County/Muni

***Source of Data:**

NJDEP BGIS = New Jersey Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS)

NJDEP ENSP = New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife (DFW), Endangered Nongame Species Program (ENSP)

NJDOT = New Jersey Department of Transportation

NJOIT OGIS = NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS)

(continued on next page)

[1]Terms of Agreement for use of NJDEP GIS data

1. Digital data received from the NJDEP are to be used solely for internal purposes in the conduct of daily affairs.

2. The data are provided, as is, without warranty of any kind and the user is responsible for understanding the accuracy limitations of all digital data layers provided herein, as documented in the accompanying Data Dictionary and Readme files. Any reproduction or manipulation of the above data must ensure that the coordinate reference system remains intact.

3. Digital data received from the NJDEP may not be reproduced or redistributed for use by anyone without first obtaining written permission from the NJDEP. This clause is not intended to restrict distribution of printed mapped information produced from the digital data.

4. Any maps, publications, reports, or other documents produced as a result of this project that utilize NJDEP digital data will credit the NJDEP Geographic Information System (GIS) as the source of the data with the following credit/disclaimer:

> This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

5. Users shall require any independent contractor, hired to undertake work that will utilize digital data obtained from the NJDEP, to agree not to use, reproduce, or redistribute NJDEP GIS data for any purpose other than the specified contractual work. All copies of NJDEP GIS data utilized by an independent contractor will be required to be returned to the original user at the close of such contractual work. Users hereby agree to abide by the use and reproduction conditions specified above and agree to hold any independent contractor to the same terms. By using data provided herein, the user acknowledges that terms and conditions have been read and that the user is bound by these criteria.

[2] Use Constraints (for NJOIT OGIS data)

The data sets that make up the statewide composite of parcels data are not survey documents and should not be used as such. The spatial data (polygons) do not represent legal boundaries. For all data contained herein, New Jersey Office of Information Technology, Office of Geographic Information Systems makes no representations of any kind, including, but not limited to, the warranties of merchantability or fitness of the data sets that make up the statewide composite of parcels data for a particular use, nor are any such warranties to be implied with respect to the digital data sets furnished hereunder. New Jersey Office of Information Technology, Office of Geographic Information Systems assumes no responsibility to maintain them in any manner or form.

APPENDIX III. Vernal Pool Protocol.

Land Use Regulation Program
Freshwater Wetlands Vernal Habitat Protocol
(updated: 05/17/02)

Purpose:
This protocol will be used by the Land Use Regulation Program to determine whether an area meets the definition of a "vernal habitat" in N.J.A.C. 7:7A-1.4. If the application of this protocol results in a Department determination that an area meets the definition of a vernal habitat, the area will be placed on the list of certified vernal habitats, maintained by the Department. The Department will also develop digital mapping to show the locations of certified vernal habitats.

The definition of a vernal habitat includes four criteria that must be satisfied. Item 1 requires that the area occur in a confined basin depression without a permanently flowing outlet. Item 2 requires the documentation of obligate or facultative vernal habitat species (these species are identified in N.J.A.C. 7:7A, Appendix 1). Item 3 requires that the area maintain ponded water for at least two continuous months between March and September of a normal rainfall year. Item 4 requires that the area is free of fish populations throughout the year, or dries up at some time during a normal rainfall year. The elements required to satisfy each item are discussed below.

Item 1: "Occurs in a confined basin depression without a permanent flowing outlet"
The area must be a depression in the surrounding ground, confined by areas of higher upland or wetland ground. It must not have a permanently flowing outlet but may have a periodic outlet through which water flows during periods of heavy rain events, flooding or seasonally high water tables.

Item 2: "Features evidence of breeding by one or more species of fauna adapted to reproduce in ephemeral aquatic conditions"
The area must feature evidence of breeding by vernal habitat species. These species are listed in N.J.A.C. 7:7A, Appendix 1, and are divided into obligate and facultative species. An obligate vernal habitat species is one for which vernal habitats are the only type of habitat used for breeding. A facultative species will use vernal habitat for various activities, for example breeding or foraging, but can also use other types of habitats.

Obligate species: For the purposes of item 2 of the definition of vernal habitat, the following will constitute evidence of breeding by a species listed as an obligate species at N.J.A.C. 7:7A, Appendix 1:

a. The following types of evidence of breeding adults:
i. Frog breeding chorus;
ii. Mated pairs of frogs;
iii. Salamander courting individuals; and/or
iv. Salamander spermatophores;
b. Two or more egg masses of any obligate species;
c. Frog tadpoles;
d. Mole salamander larvae; and/or
e. The following types of evidence of transforming juveniles:
i. Wood frogs with tail stubs evident; and/or
ii. Salamanders with gill remnants evident.

Facultative species: For the purposes of item 2 of the definition of vernal habitat, evidence of the presence of one or more members of the species within the area of the habitat listed as facultative species at N.J.A.C. 7:7A, Appendix 1 shall constitute evidence of breeding or foraging by that species.

Item 3: "Maintains ponded water for at least two continuous months between March and September of a normal rainfall year"

If an area satisfies item 2 by showing evidence of breeding by obligate species, the criteria in items 3 and 4 are presumed to be satisfied. (See flow chart below for an illustration of this.) This presumption does not apply if an area satisfies item 2 solely by showing evidence of breeding by facultative species. This application of the presumption reflects the fact that the species listed as obligate depend almost exclusively on vernal habitat for breeding, and cannot breed in other types of habitat. They must breed in an area that maintains water for certain time periods, and in which there are no fish to eat their eggs. Obligate species also tend to be site tenacious, meaning that succeeding generations of the species frequently return to their natal pond for breeding purposes. Therefore, if an area shows evidence of breeding by an obligate species, the area must meet the criteria in items 3 and 4.

However, the species listed as facultative do not depend exclusively on vernal habitat, although they do regularly use vernal habitats. These species also use other similar types of habitat that would not meet the definition of a vernal habitat. Therefore, the presumption that an area is ponded for at least two months and is free of fish populations (i.e., that the criteria in items 3 and 4 are met) does not apply where only facultative species have been found. In those cases, the ponding of water (Item 3) and the drying up or lack of fish populations (Item 4) must be independently demonstrated in accordance with this protocol.

To satisfy Item 3, an area that is not subject to the presumption discussed above (i.e., an area with evidence of facultative species only) must maintain ponded water continuously for at least two contiguous months (60 days) between March 1st and September 30th of a normal rainfall year.

Item 4: "Is free of fish throughout the year, or dries up at some time during the year"
As discussed above under Item 3, if an area satisfies item 2 by showing evidence of breeding by obligate species, the criteria in items 3 and 4 are presumed to be satisfied. (See flow chart below for an illustration of this.)

To satisfy Item 4, an area that is not subject to the presumption discussed above (i.e., an area with evidence of facultative species only) must be free of fish populations throughout the year, or dry up at some time during the year. Meeting either one of these criteria is sufficient to satisfy Item 4.

Required Field Observations for Certifying a Vernal Habitat

Item 1: Clear photographs are required to document that an area is a confined basin depression without a permanent flowing outlet. The photographs must be taken from several angles, and must be sufficient to clearly display the area's complete or intermittent hydric isolation.

Item 2: At least one of the following types of evidence is required to document each observation of a vernal habitat species:

1. Photograph(s). This is the preferred method. Prints, slides, or digital photographs are acceptable. The location, date of observation, and observer's name must be provided;
2. Videotape recording. The location, date, and recorder's name must be provided;
3. Taped audio recording of a frog breeding chorus. The location, date, and recorder's name must be provided; and/or
4. Detailed written description(s) of species observed, including a discussion of the criteria that were used to identify the species involved. Field notes, and/or a drawing of the animal, may be submitted as part of the description. It is preferred that the description and field notes be prepared by a biologist competent in animal identification.

Item 3: The following evidence is required to support observations that an area maintains ponded water for at least two contiguous months between March and September:

1. A logbook containing a record of observations, made approximately weekly, of the presence or absence of standing water in the area. For each observation date, the logbook shall state the approximate depth and dimensions of the area covered by standing water; and/or
2. A list of one or more amphibian and reptile species that were observed using the area for breeding purposes (including dates).

Item 4: At least one of the following types of evidence is required to demonstrate that an area is free of fish populations throughout the year, or dries up at some time during the year:

1. Clear photograph(s) and/or statement of direct observation, including date of observation, showing the area to be dried up; or
2. Scientific evidence sufficient to conclude that the area is free of fish populations.

Documenting The Location Of A Vernal Habitat

The following documentation is required to identify the location of a vernal habitat:

1. One or more of the items at i through iii below:
    i. Metes and bounds description. Compass bearings and measured distances (the distances should be 1000 feet or less) of the habitat from at least two permanent landmarks, and the locations of landmarks. The compass bearings must account for the appropriate declination. The locations of the landmarks and the vernal habitat must be shown on the municipal tax map required in 2 below;
    ii. Aerial photographs. The vernal habitat must be clearly visible on the aerial photograph; or
    iii. Professional survey or GPS coordinates; and
2. A photocopy of an 8.5" by 11" section of the appropriate United States Geological Survey quadrangle map with the approximate site of the vernal habitat clearly marked should also be included (USGS quad maps are available from the Department's Office of Maps and Publications at (609) 777-1038); and
3. It is recommended that a sketch map and/or detailed description of features in the immediate vicinity (within 1000 feet) of the vernal habitat also be provided.

Use Of This Protocol In The Freshwater Wetlands Permit Program:

1. The Department will develop a list of certified vernal habitats. After the list is developed, the Department will develop digital GIS maps showing the locations of certified vernal habitats.

2. When an application for a freshwater wetlands permit is submitted, the Department will review the list of certified vernal habitats to determine if the site may contain a vernal habitat.

3. If the site contains a certified vernal habitat, the Department will inform the applicant of this fact.

4. For each permit application, LUR accepts public comment during the period of application review, in accordance with N.J.A.C. 7:7A-12.3. If the Department receives information indicating that an area may be a vernal habitat during the public comment period (whether the information is submitted by the public, discovered by staff during a site investigation, or obtained in some other way), the Department will evaluate this information. If the information is sufficient to certify the area as a vernal habitat in accordance with this protocol, the Department will do so. Alternatively, the Department may delay a final decision on the application in order to obtain further information. The Department's action in these cases will vary on a case by case basis depending upon the quality of information available to the Department and/or the credentials of the person providing the information.

5. If the Department does not receive or discover any information indicating that an area is a vernal habitat prior to the Department's final decision on the application, the area shall not be considered a vernal habitat for purposes of the final decision on that application.

6. An applicant may contest the certification of an area as a vernal habitat. In order to contest a certification, an applicant must demonstrate that the area no longer meets the criteria in items 1, 2, 3, or 4 of the definition of vernal habitat. If such a demonstration includes a survey for vernal habitat species, the survey must be conducted over a minimum of two normal rainfall years, and must show no evidence of the presence of any vernal habitat species during the survey period.

APPENDIX IV. Sample Vernal Pool Data Sheet.

VERNAL POOL DATA SHEET

GENERAL INFO

SITE NAME/NUMBER: _____ OBSERVER:_____

ORGANIZATION: _____ DATE:_____ COUNTY:_____

_

MUNICIPALITY: _____ TOPO QUAD/BLOCK:_____

GPS COORDINATES: _____

LANDOWNER: _____

DIRECTIONS TO SITE: _____

_____

POOL CHARACTERISTICS

POOL TYPE (check): __natural swale/depression __excavated pit/ditch __impoundment

WATER LEVEL (check): __full __>50%full __<50%full __dry

POOL DIMENSIONS (at max capacity): _____m x _____m

WATER QUALITY (check): __clear __tea-colored __algae-green

STRUCTURE OF VEGETATION WITHIN/OVERHANGING POOL (ESTIMATE % COVER):

____trees ___scrub/shrub ___floating vegetation ___emergent vegetation

DOMINANT PLANT SPECIES WITHIN/OVERHANGING POOL (optional): _____

_____

SURROUNDING HABITAT (check all that apply): __upland forest __forested wetlands

__emergent/scrub-shrub wetland __agricultural field/grassland __suburban

GENERAL NOTES/COMMENTS:

_____

_____

_____

_____

_____

	STATUS	ADULT	JUVENILE/LARVA	VOCALIZATION	EGG MASS
OBLIGATE VERNAL POOL HERPETOFAUNA					
1) spotted salamander (Ambystoma maculatum)	decreasing	_____	_____	_____	_____
2) eastern tiger salamander (Ambystoma t. tigrinum)	endangered	_____	_____	_____	_____
3) marbled salamander (Ambystoma opacum)	special concern	_____	_____	_____	_____
4) Jefferson salamander (Ambystoma jeffersonianum)	special concern	_____	_____	_____	_____
5) blue-spotted salamander (Ambystoma laterale)	endangered	_____	_____	_____	_____
6) Jefferson x blue-spotted salamander (Ambystoma jeffersonianum x laterale)	no status	_____	_____	_____	_____
7) wood frog (Rana sylvatica)	stable	_____	_____	_____	_____
8) eastern spadefoot toad (Scaphiopus holbrookii)	decreasing	_____	_____	_____	_____
FACULTATIVE VERNAL POOL HERPETOFAUNA					
1) long-tailed salamander (Eurycea l. longicauda)	threatened	_____	_____	_____	_____
2) red-spotted newt (Notophalmus v. viridescens)	stable	_____	_____	_____	_____
3) four-toed salamander (Hemidactylium scutatum)	decreasing	_____	_____	_____	_____
4) northern spring peeper (Pseudacris crucifer)	stable	_____	_____	_____	_____
5) New Jersey chorus frog (Pseudacris triseriata kalmii)	stable	_____	_____	_____	_____
6) upland chorus frog (Pseudacris triseriata ferarium)	unknown	_____	_____	_____	_____
7) northern cricket frog (Acris c. crepitans)	unknown	_____	_____	_____	_____
8) northern gray treefrog (Hyla versicolor)	stable	_____	_____	_____	_____
9) southern gray treefrog (Hyla chrysoscelis)	endangered	_____	_____	_____	_____
10) pine barrens treefrog (Hyla andersonii)	threatened	_____	_____	_____	_____
11) american toad (Bufo americanus)	stable	_____	_____	_____	_____
12) fowlers toad (Bufo woodhousii fowleri)	special concern	_____	_____	_____	_____
13) green frog (Rana clamitans melanota)	stable	_____	_____	_____	_____
14) bullfrog (Rana catesbeiana)	stable	_____	_____	_____	_____
15) carpenter frog (Rana virgatipes)	special concern	_____	_____	_____	_____
16) pickerel frog (Rana palustris)	stable	_____	_____	_____	_____
17) southern leopard frog (Rana utricularia)	stable	_____	_____	_____	_____
18) spotted turtle (Clemmys guttata)	special concern	_____	_____	_____	_____
19) wood turtle (Clemmys insculpta)	threatened	_____	_____	_____	_____
20) eastern painted turtle (Chrysemys p. picta)	stable	_____	_____	_____	_____
21) eastern mud turtle (Kinosternon subrubrum)	undetermined	_____	_____	_____	_____
22) common snapping turtle (Chelydra serpentina)	stable	_____	_____	_____	_____

VERNAL POOL INVERTEBRATES (Please check appropriate line)
mosquito __ fairy shrimp __ caddisfly __ predaceous diving beetle __ crawling water beetle __ water scavenger beetle __
whirligig beetle __ damselfly __ dragonfly __ backswimmer __ water boatman __ water scorpion __ giant water bug __ water strider __
fishfly __ mayfly __ chironomid midge __ phantom midge __ springtail __ water mites __ amphipod __ isopod __
clam shrimp __ ostracod __ daphnia __ copepod __ snail __ fingernail clam __ horsehair worm __ planaria __ leech __
aquatic oligochaete worms __

SPECIES NOTES: _____

_____

_____

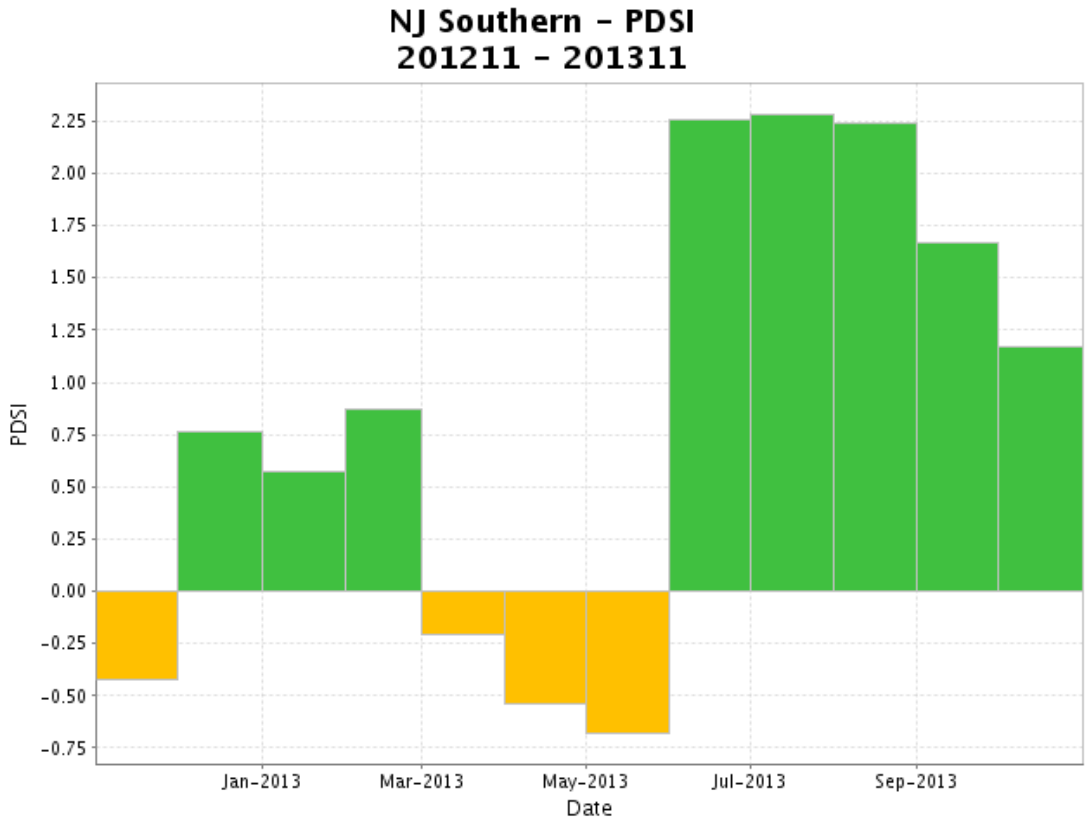
_____

_____

_____

APPENDIX V. Weather data during study period.

V-A. Monthly graph of the Palmer Drought Severity Index for southern New Jersey from November 1 2012 through October 30 2013.



Key to Palmer Drought Severity Index

4.0 or more	**extremely wet**
3.0 to 3.99	**very wet**
2.0 to 2.99	**moderately wet**
1.0 to 1.99	**slightly wet**
0.5 to 0.99	**incipient wet spell**
0.49 to -0.49	**near normal**
-0.5 to -0.99	**incipient dry spell**
-1.0 to -1.99	**mild drought**
-2.0 to -2.99	**moderate drought**
-3.0 to -3.99	**severe drought**
-4.0 or less	**extreme drought**

V-B. Monthly rainfall data for southern New Jersey from November 1 2012 through October 30 2013.