

Pine Barrens Treefrog Survey Plan

NJARNG Facilities
2019



Image Provided By: <http://www.amphibianfact.com/pine-barrens-tree-frog.asp>

Prepared By:
Nick Cordivari and Laurel Klein
Stockton University Environmental Internship Program



Introduction

The goal of this project is to determine Pine Barrens Tree Frog (PBTF, *Hyla andersonii*) presence/absence and subsequently recommend action at 51 NJARNG facilities listed below. The species population has been declining gradually. It is listed as an endangered species in New Jersey due to loss of habitat, pollution of breeding ponds, and its restricted range. It is not federally listed. The Pine Barrens treefrog is an amphibious species that prefers herbaceous and shrubby acidic seepage bogs and draining sandy uplands such as Atlantic white cedar swamps and pitch pine lowlands. The species range consists of New Jersey counties within the Pine Barrens in Burlington, Ocean and Atlantic Counties. They also may occur outside the Pine Barrens Range in the counties of Camden, Cape May, Cumberland, Gloucester, Mercer or Monmouth. Outside of New Jersey, the Pine Barrens treefrog may also occur in North and South Carolina, Florida, Georgia and Alabama.

Fieldwork will begin in the spring of 2019, coinciding with their breeding period that takes place from late April to August. Male Pine Barrens Tree Frogs are easiest to identify during warm (≥ 70 °F) humid or rainy nights in May and June. Passive survey techniques using acoustic recording devices will be used to identify Pine Barrens treefrog presence by call. When possible, active survey methods, such as actively listening for calls, or actively searching for egg masses will also be implemented. In addition, pH levels of the potential habitat and water depth will also be included. Knowing water depth and pH is important for better understanding the PBTF's habitat preferences. After passive survey techniques gather data with acoustic recording devices, they will be analyzed using songscope software. Software will be developed by building a call library and recognizer settings for this species.

This survey plan identifies NJARNG facilities that are within the range of Pine Barrens treefrog. High priority sites are sites that are located within the Pine Barrens treefrog range and contain a wetland within the property boundary. Medium priority sites are sites that are located within the Pine Barrens treefrog range but do not contain a wetland onsite, wetlands are located within 100 meters of the property boundary. Low priority sites are sites within range of the Pine Barrens treefrog but do not provide suitable habitat on or within 100 meters of the site. Out of range sites are sites that are located out of the Pine Barrens treefrog range, and will not be included in our survey effort. Potential action plans are described below to implement based on data collected. It also contains range data for the Pine Barrens Tree Frog.

Pine Barrens Treefrog Priority List

High Priority Facilities (13)

The sites below are located “Within the Range of the Pine Barrens Treefrog with Wetlands present onsite or 100 meters of the property boundary” and have suitable habitat on site.

- B.G. Doyle Veteran’s Cemetery
- Bridgeton
- Bordentown
- Cape May
- Fort Dix
- Hammonton
- Lawrenceville
- Princeton
- Sea Girt
- Toms River
- Trenton Mercer Aviation
- Vineland
- Woodstown

Medium Priority Facilities (3)

The sites below are located “Within the Range of the Pine Barrens Treefrog” but do not contain potential breeding habitat for Pine Barrens treefrogs directly onsite. However, wetlands exist within 100 meters of the property boundary.

- Lakehurst CLTF
- Lakehurst AASF
- Tuckerton

Low Priority Facilities (12)

The Sites Below are located “Within the Range of the Pine Barrens Treefrog” but do not contain wetlands which provide suitable habitat for Pine Barrens treefrog or provide suitable habitat within 100 meters of the site.

- Atlantic City
- Burlington
- Cherry Hill
- Freehold
- Korean War memorial
- Lakehurst 129 & 608
- Mt. Holly
- New Egypt
- Veteran’s Haven (South)
- Vietnam War Memorial
- Vineland Veteran’s Home
- Woodbury

Lowest Priority Facilities (20)

The sites below are “Outside of the Range of the Pine Barrens treefrog”.

- Dover
- Franklin
- Flemington
- Hackettstown
- Jersey City
- Lodi
- Menlo park Veteran’s Home
- Morristown
- Newark
- Newton
- Paramus Veteran’s Home
- Picatinny
- Riverdale
- Somerset
- Teaneck
- Veteran’s Haven North
- Washington
- West Orange
- Westfield
- Woodbridge

Sampling Order

High priority facilities should be surveyed first. Once completed, medium priority will be surveyed. Low and lowest priority sights will not be surveyed due to absence of potential habitat or being outside the species range.

Survey Materials

Materials required for sampling include:

- Kestrel Weather Station
- Recorders - Wildlife Acoustic SM3 and SM3Bat
- Recorder Mounting Equipment
 - Lag bolts
 - Cable locks
 - Cable ties / zip ties
 - Custom built stands
- Camera
- Whiteboard
- GPS
- Clipboard
- Pens / Pencils / Dry Erase Markers
- Pre-work Safety Meeting Datasheet
- PBTF Recorder Deployment Sheet
- SD Cards - 32 GB

- pH Paper
- Thermometer
- Meter Stick

Survey Methods

Preliminary Research

Site Assessment

Sites were assessed based on their proximity to the Pine Barrens Treefrog range. If a site was within the Pine Barrens Treefrog range, based on data collected from HerpMapper, sites were further assessed to determine the onsite structures that could promote or inhibit Pine Barrens Treefrog habitat. Onsite forests with wetlands within 100 meters of a site in the Pine Barrens range was determined to most likely provide suitable habitat for the Pine Barrens Treefrog. The method used to prove Pine Barrens Treefrogs resided within site locations was to record acoustic calls during its breeding season. Before placing recorders, vernal pond surveys were conducted in high probability sites to locate the best possible habitat for Pine Barren Tree Frogs. Locations of vernal ponds were marked and recorded to have an approximate location for acoustic recorders once breeding season began.

Passive Survey Methods

Recorder Deployment Methods

During each deployment, a PBTF Recorder Deployment Sheet will be filled out. This datasheet includes facility information, facility conditions, GPS coordinates, and recorder deployment specifics. Location of the recorders will be based on if the site has potential habitat on site or within 100m of property boundary. Recorders will be as close to the center of the potential habitat as possible, or in a spot where breeding habitat is most dense. Exact location will be decided upon the arrival of the site. Each recorder will be secured to a tree at approximately head height and locked securely. Locking will include the use of lag bolts, cable locks, and cable and zip ties. After the deployment, pictures will be taken as well as the GPS coordinates of the exact location that it was taken. The following will also be documented at the time of deployment:

- Weather Conditions (Temperature, wind, humidity, number days since last precipitation)
- Wetland or Vernal Pond name
- Recorder name

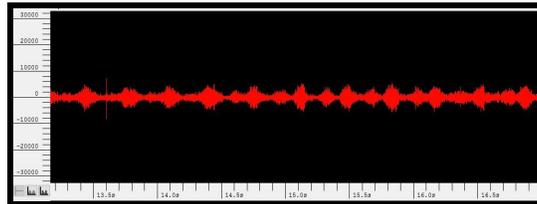
☐ Deployment time

Recorder Programming

Call Library and Recognizer Settings Development

Recorders were programmed to start 1 hour before sunset and stop at sunrise, recording for 5 minutes each hour, and pausing for 55 minutes. After installing recorders onsite, surveyors would return to the site frequently to visually inspect the recording site. Visual inspections included assessing lost, stolen or damaged recorders and the type of files compiled on the device. A laptop with Songscope software installed and a memory card reader will be brought to the field. This laptop will be used for surveyors to inspect the recordings on site. The visually observed data will also be used to determine if researcher have sufficient data, or if they need to leave recorders out for a longer period. MP3 call files supplied by HerpMapper were used to build our call library and recognizer settings.

The program Audacity will be used to convert the MP3 files into WAV files.



Pine Barrens Tree Frog audio graph

Active Survey Methods

Observational Data

When possible, active survey techniques such as actively listening for calls or searching for egg masses was implemented. The call of the Pine Barrens treefrog is easily distinguishable from the 15 other anuran species native to New Jersey. An active Survey Method data sheet was used to record if frogs or egg masses were located during survey periods. Characteristics of the potential habitat will be recorded such as pH level, water temperature, and water depth. If a vernal pond was located, they were meticulously looked through to determine if Tree frog activity was being supported.

American Toad (*Anaxyrus americanus*)

https://www.state.nj.us/dep/fgw/ensp/audio/american_toad.wav

Bullfrog (*Rana catesbeiana*)

<https://www.state.nj.us/dep/fgw/ensp/audio/bullfrog.wav>

Carpenter Frog (*Rana virgatipes*)

https://www.state.nj.us/dep/fgw/ensp/audio/carpenter_frog.wav

Eastern Spadefoot (*Scaphiopus h. holbrooki*)

https://www.state.nj.us/dep/fgw/ensp/audio/spadefoot_toad.wav

Fowler's Toad (*Anaxyrus fowleri*)

https://www.state.nj.us/dep/fgw/ensp/audio/fowlers_toad.wav

Green Frog (*Rana clamitans melanota*)

https://www.state.nj.us/dep/fgw/ensp/audio/green_frog.wav

New Jersey Chorus Frog (*Pseudacris triseriata kalmi*)

https://www.state.nj.us/dep/fgw/ensp/audio/nj_chorus_frog.wav

Northern Cricket Frog (*Acris C. crepitans*)

https://www.state.nj.us/dep/fgw/ensp/audio/no_cricket_frog.wav

Northern Gray Treefrog (*Hyla versicolor*)

https://www.state.nj.us/dep/fgw/ensp/audio/no_gray_frog.wav

Northern Spring Peeper (*Pseudacris c. crucifer*)

https://www.state.nj.us/dep/fgw/ensp/audio/spring_peeper.wav

Pickerel Frog (*Rana palustris*)

https://www.state.nj.us/dep/fgw/ensp/audio/pickerel_frog.wav

Pine Barrens Treefrog (*Hyla andersonii*)

https://www.state.nj.us/dep/fgw/ensp/audio/pine_barrens_treefrog.wav

Southern Gray Treefrog (*Hyla chrysoscelis*)

https://www.state.nj.us/dep/fgw/ensp/audio/so_gray_treefrog.wav

Southern Leopard Frog (*Rana utricularia*)

https://www.state.nj.us/dep/fgw/ensp/audio/so_leopard_frog.wav

Upland Chorus Frog (*Pseudacris triseriata feriarum*)

https://www.state.nj.us/dep/fgw/ensp/audio/upland_chorus_frog.wav

Wood Frog (*Rana sylvatica*)

https://www.state.nj.us/dep/fgw/ensp/audio/wood_frog.wav

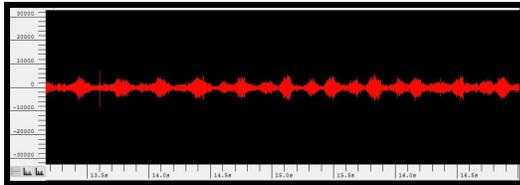
Data Analysis

Recorder Data Analysis Using Songscope Software

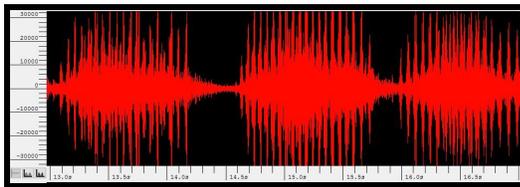
Recorder Data will be analyzed using Songscope Software. The unique call signature of the Pine Barrens Tree Frog will allow researchers to differentiate the PBTF call from other frog species. Once analyzed, the data will be compiled into a formal report with detailed survey results.

Call Identifications of Common New Jersey Frog Species:

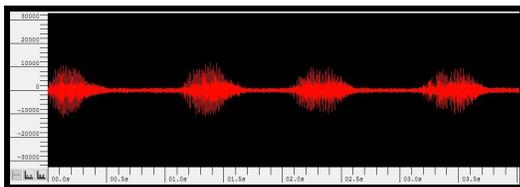
Pine Barrens Tree Frog (*Hyla andersonii*)



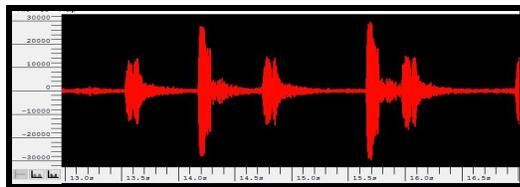
Eastern Gray Tree Frog (*Hyla versicolor*)



American Bullfrog (*Lithobates catesbeianus*)



Northern Spring Peeper (*Pseudacris crucifer*)



Action Plan

In each of the following scenarios, these actions should be taken.

1. No Pine Barrens treefrog are present on-site.
 - a. Take no action.

2. Pine Barrens treefrog are present on-site. The NJDEP would likely assign exceptional resource value to all potential breeding habitat on site, as these wetlands meet criteria 2 of 13:9B-7 of the Freshwater Wetlands Protection Act. This classification would place additional restrictions on the assigned areas, including a 150 ft buffer around all wetlands classified as potential breeding habitat. These restrictions require any person proposing to engage in regulated activities to obtain a freshwater wetland permit, in accordance with N.J.S.A 13:9B-9.
 - a. Continue to monitor the trees for evidence of Pine Barrens treefrog presence.
 - b. Submit observations to HerpMapper
 - c. Submit calls spatial data or observations to the NJ Division of Environmental Protection (NJDEP)

Site Specifics **Facilities with on-site habitat**

Bridgeton Armory

Wetlands

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory and the 2013 NJDMAVA Wetlands PLS Report, this wetland type is the only wetland type present at this site. This wetland series add up to approximately 3.2 acres of total land. These wetlands were dominated by white oak (*Quercus alba*, FACU), multiflora rose (*Rosa multiflora*, FACU), sweet pepperbush (*Clethra alnifolia*, FAC), Japanese honeysuckle (*Lonicera japonica*, FAC), poison ivy (*Toxicodendron radicans*, FAC), American red raspberry (*Rubus idaeus*, FACU), common greenbrier (*Smilax rotundifolia*, FAC), jewelweed (*Impatiens capensis*, FACW), American pokeweed (*Phytolacca americana*, FACU), water smartweed (*Persicaria amphibian*, OBL), and false nettle (*Boehmeria cylindrica*, FACW) (NJARNG, 2015).

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, vernal ponds do not exist onsite.

Built Infrastructure

Terrestrial System, Landscapes – Two buildings, parking lots, a pallet company's operating area, and mowed landscape areas occupy approximately 5.75 of built infrastructure.

Forest Assessment

Terrestrial System, Dry Oak-Pine forest, and open field

1. Canopy layer – white ash and scarlet oak. The white ash had a DBH of 19 inches and scarlet oak had two individuals with DBH of 52 and 32 inches.
2. Shrub Layer – lowbush blueberry
3. Herbaceous layer – moss species and grass species

Bordentown Warrior Center

Wetlands

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory and the 2013 NJDMAVA Wetlands PLS Report, this wetland type is the only wetland type present at this site. This wetland series add up to approximately 2.1 acres of total land.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, 4 vernal ponds were identified on this site.

Built Infrastructure

Terrestrial System, Landscapes- Three buildings and a parking lot occupies approximately 2.6 acres of build infrastructure.

B.G. Doyle's Cemetery

Wetlands

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory, this wetland type is present at this site. This type of wetland is located throughout the property and is approximately 16.51 acres in total.

Freshwater Emergent Wetland- According to USFWS National Wetlands Inventory, this wetland type is present at this site. This type of wetland is approximately 1.29 acres in total.

Vernal Ponds

B.G. Doyle's Cemetery was not assessed during the vernal pond survey conducted by NJDMAVA EMB in 2019.

Freshwater Pond- According to USFWS National Wetlands Inventory, a freshwater pond exists and includes 0.5 acres in total.

Built Infrastructure

Terrestrial System, Landscapes- Three buildings and a parking lot occupies approximately 2.6 acres of build infrastructure

Cape May Armory

Wetlands

Estuarine and Marine Wetland- According to USFWS National Wetlands Inventory and 2013 NJDMAVA Wetlands PLS Report, this wetland type is the only wetland type present at this site. This wetland series add up to approximately 10.4 acres of total land.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, 1 vernal pond was identified on this site.

Built Infrastructure

Terrestrial System, Landscapes – The limits of the mowed lawn and developed land have not changed since the Parson's 2005 survey. Three buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 11 acres.

Forest Assessment

Terrestrial System, coastal plain hardwood forest

1. Canopy layer – Red maple, sweetgum, and black willow trees.
2. Shrub layer– Dense understory of Atlantic white cedar (2), red cedar (3), southern arrow wood (4), and sweetgum (1).
3. Herb layer– Tartarian honeysuckle, poison ivy, raspberry, wild rose, virginia creeper, sweetgum, and blackjack oak.
4. Vine layer– Dense growth of Greenbrier, japanese honeysuckle and southern arrow wood.

Fort Dix HQ

Wetlands

Palustrine forested broad-leaved deciduous wetland (PFO1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type includes a total of 1.54 acres. This wetland type was dominated by red maple (*Acer rubrum*, FAC), scrub oak (*Quercus berberidifolia*, N/L), spicebush (*Lindera benzoin*, FACW), Virginia creeper (*Parthenocissus quinquefolia*, FACU), common greenbrier (*Smilax rotundifolia*, FAC), and Japanese stilt grass (*Microstegium vimineum*, FAC) (wetland sample point B4) and black willow (*Salix nigra*, OBL), American sycamore (*Platanus occidentalis*, FACW), red birch (*Betula occidentalis*, FACW), red maple (*Acer rubrum*, FAC), purple chokeberry (*Aronia prunifolia*, FACW), wool grass (*Antheophora pubescens*, OBL), and soft rush (*Juncus effusus*, OBL) (NJARNG 2013).

Palustrine emergent persistent wetland (PEM1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is includes 0.92 acres total. These wetlands were dominated by black willow (*Salix nigra*, OBL), common cattail (*Typha latifolia*, OBL), soft rush (*Juncus effusus*, OBL), phragmites (*Phragmites australis*, FACW), wool grass (*Antheophora pubescens*, OBL) and goldenrod sp. and dominated by black walnut (*Juglans nigra*, UPL), tussock sedge (*Carex stricta*, OBL), American red raspberry (*Rubus idaeus*, FACU), Japanese stilt grass (*Microstegium vimineum*, FAC), and jewelweed (*Impatiens capensis*, FACW).

Riverine- According to USFWS National Wetlands Inventory, a riverine systems flows across the southern property boundary with an area of approximately 0.19 acres.

Vernal Ponds

Fort Dix HQ was not assessed during the vernal pond survey conducted by NJDMAVA EMB in 2019.

Freshwater Pond- According to USFWS National Wetlands Inventory, a freshwater pond is present on site. This pond is approximately 0.39 acres in area.

Built Infrastructure

Terrestrial System, Landscapes – No additional structures have been built on the property since the Parsons's 2007 survey. Four buildings, surrounding parking lots, a baseball field, and mowed landscaped areas occupy approximately 48.2 acres (Parsons 2007).

Forest Assessment

Terrestrial System, perennial herbaceous woody plant community / old field

1. Canopy Layer - Red maples (*Acer rubrum*), and sassafras (*Sassafras*) were found in this layer.
2. Shrub Layer – Sassafras (*sassafras*), white snakeroot (*Ageratina altissima*), and blackjack oak (*Quercus marilandica*), are present in the shrub layer.
3. Vegetative Layer – Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), greenbrier (*Smilax*), Virginia creeper (*Parthenocissus quinquefolia*), American red raspberry (*Rubus strigosus*), and fescue (*Festuca*), are in the vegetative layer.

Hammonton Armory

Wetlands

Palustrine forested broad-leaved deciduous wetland (PFO1) – According to the 2013 NJDMAVA Wetlands PLS Report, this ~4.47 acre wetland type is the dominant community on this site. This wetland was dominated by eastern red cedar (*Juniperus virginiana*, FACU), tulip poplar (*Liriodendron tulipifera*, FACU), red maple (*Acer rubrum*, FAC), American white birch (*Betula papyrifera*, N/L), pitch pine (*Pinus rigida*, FACU), Atlantic white cedar (*Chamaecyparis thyoides*, OBL), sassafras (*Sassafras albidum*, FACU), coastal sweet pepperbush (*Clethra alnifolia*, FACW), horsebrier (*Smilax rotundifolia*, FAC), poison ivy (*Toxicodendron radicans*, FAC), Japanese honeysuckle (*Lonicera japonica*, FAC), Virginia creeper (*Parthenocissus quinquefolia*, FACU), ostrich fern (*Matteuccia struthiopteris*, FACW), purple pitcher plant (*Sarracenia purpurea*, OBL), sensitive fern (*Onoclea sensibilis*, FACW), blueberry sp., and goldenrod sp, as well as a monoculture of Atlantic white cedar (*Chamaecyparis thyoides*, OBL).

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory, this wetland is present on site, ~3.15 acres. A Riverine also runs through this wetland type with an area of 0.35 acres.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, no vernal ponds were found on this site.

Built Infrastructure

Terrestrial System, Landscapes - Two buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 4 acres.

Forest Assessment

Terrestrial System, Northern Hardwood Forest

1. Canopy Layer – Blackjack (*Quercus marilandica*) and white oak (*Quercus alba*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*) and pitch pine (*Pinus rigida*) trees.
2. Shrub Layer – Blackjack (*Quercus marilandica*) and white oak (*Quercus alba*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), American holly (*Ilex opaca*) and sassafras are present in the shrub layer.
3. Vine Layer – Virginia creeper (*Parthenocissus quinquefolia*), greenbrier (*S. rotundi*) and Japanese honeysuckle (*Lonicera japonica*) are present in the vine layer.

Lakehurst CLTF

Wetlands

According to USFWS National Wetlands Inventory and 2013 NJDMAVA Wetlands PLS Report, there are no wetlands on site.

According to USFWS National Wetlands Inventory, ~230 meters northeast of the property boundary exists Freshwater Forested/Shrub Wetland with an area of 3.29 acres. Approximately 85 meters west of the property boundary, there is a Riverine present.

Vernal Ponds

The Lakehurst CLTF was not assessed during the vernal pond survey conducted by NJDMAVA EMB in 2019.

Built Infrastructure

Terrestrial System, Landscapes - Nine buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 87 acres (64% of property).

Lakehurst AASF

Wetlands

According to USFWS National Wetlands Inventory and 2013 NJDMAVA Wetlands PLS Report, there are no wetlands on site.

According to USFWS National Wetlands Inventory, ~75 meters west of the property boundary exists a Riverine.

Vernal Ponds

The Lakehurst AASF was not assessed during the vernal pond survey conducted by NJDMAVA EMB in 2019.

Built Infrastructure

Terrestrial System, Landscapes - Three buildings, surrounding parking lots, helicopter landing area, and mowed landscaped areas occupy approximately 45 acres.

Lawrenceville Armory

Wetlands

Palustrine forested broad-leaved deciduous wetland (PFO1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site. In total, this wetland community type is 1.95 acres, however only 0.7 acres of this wetland community type are within the site boundary. Identified plant species identified within Wetland Series A include red maple (*Acer rubrum*, FAC), black cherry (*Prunus serotina*, FACU), red osier dogwood (*Cornus sericea*, FACW), multiflora rose (*Rosa multiflora*, FACU), northern spicebush (*Lindera benzoin*, FACW), poison ivy (*Toxicodendron radicans*, FAC), common red raspberry (*Rubus idaeus*, FAC), and wild onion (*Allium*, NA) dominated. In addition, sweet gum (*Liquidambar styraciflua*, FAC), American beech (*Fagus grandifolia*, FACU), red osier dogwood (*Cornus sericea*, FACW), skunk cabbage (*Symplocarpus foetidus*, OBL), tussock sedge (*Carex stricta*, OBL), water smartweed (*Persicaria amphibia*, OBL), and clearweed (*Pilea pumila*, FACW). (NJARNG 2013)

Palustrine scrub-shrub broad-leaved deciduous (PSS1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located within Wetland Series D, and is 0.22 acres in size. This wetland is dominated by sweet gum (*Liquidambar styraciflua*, FAC), southern arrowwood (*Viburnum dentatum*, FAC), red maple (*Acer rubrum*, FAC), Russian olive (*Elaeagnus angustifolia*, FACU), red osier dogwood (*Cornus sericea*, FACW), northern arrowheart (*Sagittaria cuneata*, OBL), soft rush (*Juncus effusus*, OBL), tussock sedge (*Carex stricta*, OBL), arrow-leaved tearthumb (*Traucalon sagittatum*, OBL), wool grass (*Scirpus cyperinus*, OBL), sensitive fern (*Onoclea sensibilis*, FACW), and jewelweed (*Impatiens capensis*, FACW). Milkweed and goldenrod species were also present. (NJARNG 2013)

Palustrine emergent persistent wetland (PEM1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site and is 0.35 acres in size. Skunk cabbage (*Symplocarpus foetidus*, OBL) and water smartweed (*Persicaria amphibia*, OBL) were the most common vegetative species in this wetland community.

Freshwater forested/Shrub Wetland- According to USFWS National Wetlands Inventory, this type of wetland covers ~11.9 acres along the southern part of the property.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, 28 vernal ponds were found on this site.

Built Infrastructure

Terrestrial System, Landscapes – The buildings, surrounding parking lots, and maintained grass landscaped areas occupy approximately 50.1 acres (70%) of the property.

Forest Assessment

Terrestrial System, northern swamp forest

1. Canopy Layer – Black oak (*quercus velutina*) and sweetgum (*liquidambar styraciflua*) were found in this layer.
2. Shrub Layer – American beech (*fagus grandifolia*), black cherry (*prunus serotina*), and shellbark hickory (*carya laciniosa*) trees are found in this layer.
3. Vegetative Layer – cinnamon fern (*osmundastrum cinnamomeum*), mayapple (*podophyllum*), and jack-in-the-pulpits (*arisaema triphyllum*) are in the vegetative layer.

Princeton Armory

Wetlands

Palustrine forested broad-leaved deciduous wetland – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is the dominant community on this site and is approximately 3.33 acres in size. This wetland community was dominated by green ash (*Fraxinus pennsylvanica*, FACW), red maple (*Acer rubrum*, FAC), pin oak (*Quercus palustris*, FACW), multiflora rose (*Rosa multiflora*, FACU), tartarian honeysuckle (*Lonicera tatarica*, FACU), Japanese honeysuckle (*Lonicera japonica*, FAC), poison ivy (*Toxicodendron radicans*, FAC), Virginia creeper (*Parthenocissus quinquefolia*, FACU), sensitive fern (*Onoclea sensibilis*, FACW), soft rush (*Juncus effusus*, FACW), and polygonum sp.

Palustrine emergent persistent wetland – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site with an estimated area size of 0.08 acres. The

wetland at this site captures the typical plants and soil types in the wetland community, detailed within the palustrine forested broad-leaved deciduous wetland section above.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, no vernal ponds were found on this site.

Built Infrastructure

Terrestrial System, Landscapes - No additional structures have been built on the property since the Parson's 1999 survey. One building, surrounding parking lots and an impound gravel lot is surrounded by a dry oak-pine forest. Forested acreage encompasses 6.2 acres of the approximate 8 acres of land onsite.

Forest Assessment

Terrestrial System, Dry Oak-Pine Forest

1. Canopy Layer- Green ash (*Fraxinus pennsylvanica*), Sassafras (*Lauraceae*), Red maple (*Acer rubrum*)
2. Shrub Layer- Tartarian Honeysuckle (*Lonicera tatarcia*), Common Raspberry (*Rubus idaeus*), Blueberry (*Cyanococcus*), Multiflora rose (*Rosa multiflora*)
3. Vegetative Layer- Spurry knotweed (*Polygonum spergulariiforme*), Japanese stiltgrass (*Microstegium vimineum*), Japanese Honeysuckle (*Lonicera japonica*), Poison ivy (*Toxicodendron radicans*), Virginia Creeper (*Parthenocissus quinquefolia*)

Sea Girt Armory

Wetlands

Freshwater Emergent Wetland- According to USFWS National Wetlands Inventory and 2013 NJDMAVA Wetlands PLS Report, this wetland type is present at this site. This wetland series add up to approximately 1.6 acres of total land.

Estuarine and Marine Wetland- According to USFWS National Wetlands Inventory, this wetland exists on site approximately 0.39 acres in area.

Vernal Ponds

The Sea Girt Armory was not assessed during the vernal pond survey conducted by NJDMAVA EMB in 2019.

Built Infrastructure

Toms River Armory

Wetlands

Palustrine forested broad-leaved deciduous wetland – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site and includes 9.7 total acres. This wetland type includes several land vegetation areas, including coastal plain atlantic white cedar swamp, red maple swamp, scrub shrub land, and dry oak-pine forest, and was dominated by red maple (*Acer rubrum*, FAC), coastal sweet pepperbush (*Clethra alnifolia*, FACW), bog fern (*Parathelypteris simulata*, OBL), tussock sedge (*Carex stricta*, OBL), highbush blueberry (*Vaccinium corymbosum*, FACW), pitch pine (*Pinus rigida*, FACU), sweetgum (*Liquidambar styraciflua*, FAC), and mountain laurel (*Kalmia latifolia*, FACU).

Palustrine emergent persistent wetland – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site and includes 0.55 total acres. The land vegetation area for this wetland is not documented.

Riverine lower perennial emergent wetland – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site with 1.23 total acres, and includes a dry oak-pine forest.

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory, this wetland exists on site and includes 9.9 total acres.

Freshwater Emergent Wetland- According to USFWS National Wetlands Inventory, this wetland exists on site and includes 0.9 total acres.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, 1 vernal pond was found on this site.

Built Infrastructure

Terrestrial System, Landscapes – No additional structures have been built on the property since the Parsons's 1999 survey. Three buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 4 acres.

Forest Assessment

Terrestrial System, Northern Pine-Oak Forest

1. Canopy Layer - Red oak (*Quercus rubra*), pitch pine (*Pinus rigida*) and white oak (*Quercus alba*) trees.
2. Shrub Layer – Highbush blueberry (*Vaccinium corymbosum*) and white oak are present in the shrub layer, and
3. Vegetative Layer –Highbush blueberry is in the vegetative layer.

Trenton Mercer Aviation

Wetlands

Palustrine forested broad-leaved deciduous wetland (PFO1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located within on site and includes XXX total acres. This wetland community was dominated by red maple (*Acer rubrum*, FAC), great lobelia (*Lobelia siphilitica*, FACW), water smartweed (*Persicaria amphibia*, OBL), and white snakeroot (*Ageratina altissima*, FACU). In addition, the wetland was dominated by silver maple (*Acer saccharinum*, FACW), red maple (*Acer rubrum*, FAC), black willow (*Salix nigra*, FACW), American elm (*Ulmus americana*, FACW), southern arrowwood (*Viburnum dentatum*, FAC), Japanese honeysuckle (*Lonicera japonica*, FAC-), Virginia creeper (*Parthenocissus quinquefolia*, FACU), Asiatic bittersweet (*Celastrus orbiculatus*, FACU), jewelweed (*Impatiens capensis*, FACW), and common cattails (*Typha latifolia*, OBL).

Lacustrine littoral unconsolidated bottom mud wetland (L2UB3) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site and includes ~0.5 total acres.

Riverine- According to USFWS National Wetlands Inventory, a riverine flows through the property approximately 0.47 total acres.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, no vernal ponds were found on this site.

Built Infrastructure

Terrestrial System, Landscapes – No additional structures have been built on the property since the Parsons's 1999 survey. Three buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 4 acres.

Vineland Armory

Wetlands

Palustrine emergent persistent wetland (PEM1) – According to the 2013 NJDMAVA Wetlands PLS Report, the wetland areas on this site were observed to be palustrine emergent persistent wetlands. This wetland was dominated by multiflora rose (*Rosa multiflora*, FACU), Allegheny blackberry (*Rubus allegheniensis*, UPL), highbush blueberry (*Vaccinium corymbosum*, FACW), water smartweed (*Persicaria amphibian*, OBL), false nettle (*Boehmeria cylindrica*, FACW), common threesquare (*Schoenoplectus pungens*, OBL), pokeweed (*Phytolacca americana*,

FACU), Japanese stiltgrass (*Microstegium vimineum*, FAC), and spotted water hemlock (*Cicuta maculata*, OBL).

Freshwater Forested/Shrub Wetland- According to USFWS National Wetlands Inventory, this wetland exists in site along the northern property boundary and includes 2.7 acres in total.

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, no vernal ponds were found on this site.

Built Infrastructure

Terrestrial System, Landscapes – Approximately 17.7 acres are developed, containing two main buildings, parking lot and driveway, mowed grass and bare ground.

Forest Assessment

Terrestrial System, Northern Pine Oak Forest –

1. Canopy Layer – Scrub pine (*Pinus virginiana*) and white oak (*Quercus alba*).
2. Shrub Layer – Pitch pine (*Pinus rigida*), scrub pine (*Pinus virginiana*), eastern red cedar (*Juniperus virginiana*), and red oak (*Quercus rubra*) are present in the shrub layer.
3. Vegetative Layer – Trumpet vine (*Campsis radicans*), white oak (*Quercus alba*), and sassafras (*Sassafras*) are in the vegetative layer.

Terrestrial System, Oak Hickory Forest

1. Canopy Layer – Pitch pine (*Pinus rigida*), white oak (*Quercus alba*), sassafras (*Sassafras*) and pignut hickory (*Carya glabra*).
2. Understory – Sassafras (*Sassafras*), white oak (*Quercus alba*), pignut hickory (*Carya glabra*), blackjack oak (*Quercus marilandica*), blueberry and dogwood are present in the understory layer.
3. Vegetative Layer – Sassafras (*Sassafras*), white oak (*Quercus alba*), blackjack oak (*Quercus marilandica*), and greenbrier (*Smilax glauca*) are in the vegetative layer.

Woodstown

Wetlands

Palustrine forested broad-leaved deciduous wetland (PFO1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland type is located on site ~0.06 acres. This wetland was dominated by silver maple (*Acer saccharinum*, FACW), eastern red cedar (*Juniperus virginiana*,

FACU), sweetgum (*Liquidambar styraciflua*, FAC), ashleaf maple (*Acer negundo*, FAC), Atlantic white cedar (*Chamaecyparis thyoides*, OBL), winged sumac (*Rhus copallina*, FACU), steeplebush (*Spiraea tomentosa*, FACW), poison ivy (*Toxicodendron radicans*, FAC), American bittersweet (*Celastrus scandens*, FACU), Virginia creeper (*Parthenocissus quinquefolia*, FACU), multiflora rose (*Rosa multiflora*, FACU), southern arrowwood (*Viburnum dentatum*, FAC), phragmites (*Phragmites australis*, FACW), and common three square (*Schoenoplectus pungens*, OBL). (NJARNG 2015).

Palustrine emergent persistent wetland (PEM1) – According to the 2013 NJDMAVA Wetlands PLS Report, this wetland was dominated by poison ivy (*Toxicodendron radicans*, FAC), Virginia creeper (*Parthenocissus quinquefolia*, FACU), ground ivy (*Glechoma hederacea*, FACU), sensitive fern (*Onoclea sensibilis*, OBL), soft rush (*Juncus effusus*, OBL), and phragmites (*Phragmites australis*, FACW).

Vernal Ponds

According to a vernal pond survey conducted by NJDMAVA EMB in 2019, one vernal pond was identified on this site.

Built Infrastructure

Terrestrial System, Landscapes – Two buildings, surrounding parking lots, and mowed landscaped areas occupy approximately 7.6 acres (Parsons 1999).

Wetland Information

USFWS (October 17, 2018) National Wetlands Inventory. Retrieved March 5, 2019
From <https://www.fws.gov/wetlands/data/mapper.html>