

# BRICKYARD POND CONSERVATION AREA

## NATURAL RESOURCES MANAGEMENT PLAN

DRAFT 1



Prepared for the  
Barrington Conservation Commission  
By  
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# 1. Introduction

This Natural Resource Management Plan is intended to inform the Town of Barrington in creating a comprehensive management plan for the Brickyard Pond Conservation Area (BPCA or Conservation Area) in Barrington, RI. This Plan relies on ecological information, gathered from research and in the field, to guide the development of recommendations for actions and policies that address Barrington's objectives for BPCA management regarding natural resources.

This report includes rapid ecological assessment (REA) of the Brickyard Pond Management Area conducted in June to November, 2008. The structure and content of the REA generally follow the guidelines of an assessment protocol developed by Sayre, *et al.* (2000). The protocol is based on the identification, characterization, classification, and mapping of vegetation communities, followed by research, inventories, and field surveys of flora and fauna. The intent is to reveal associations between habitat types, flora, and fauna, to identify species and habitats of conservation concern, and to identify anthropogenic stressors and the threats they pose to ecological integrity. This information is applied to the recommendations for natural resource management.

The REA protocol focuses on the spatial distributions of ecological and anthropogenic features to facilitate management decision-making. Wherever appropriate, maps are used to display data in a geospatial format.

## **2. Study Area**

The Brickyard Pond Conservation Area is located in central Barrington, RI and is managed by the Barrington Conservation Commission under the ownership of the Town Of Barrington. The conservation area covers 230 acres comprising a 101-acre shallow, man-made lake and a fringe of surrounding upland and wetland properties. The property is bordered by residential development to the west, south, and east, and by a raised bike path (East Bay Bike Path—formerly the Providence and Bristol Railroad) directly to the north (Fig 1).

### **2.1 History**

Brickyard Pond (technically a lake) was created by a long and intensive commercial strip-mining operation that excavated clay from the soils for the production of bricks, which were manufactured on-site. The mines intersected the water table, creating a freshwater lake 0.6 by 0.4 miles across, averaging 11 feet deep. A canal, 1.1-mile long by 20 feet wide, was dug to connect the excavation area to the West Passage of Narragansett Bay; this was used to transport bricks from the excavation site to freight ships. By opportunity, the canal incorporated and channelized a natural estuarine creek, Mussachuck Creek, running inland more than half that distance. The brick manufacturing operations, collectively called the “Brickyard”, lasted from 1847 to 1943, but the lake and the ditch remain, nearly unchanged in dimensions from when the operations were abandoned. The canal and creek retain a direct and unimpeded connection to Narragansett Bay.

The Providence and Bristol Railroad track, bordering the lake to the north, predated the mining operation. Barrington was already heavily developed with residences during the brickyard’s operation, and land cover to the North and East and West of the conservation area has not changed considerably since. A residential development has been constructed to the South on formerly agricultural lands.

### **2.2 Current Use**

The Conservation Area is open to the public between sunrise and sunset, year-round. Access is gained through a gate that leads into Veterans Memorial Park (or Veterans Park) in the northeast corner of the property and from Legion Way on the West side of the Property. Veterans Park contains active and passive recreational facilities; among these are a ball field, camping / picnic sites, and a series of foot trails that run from the Park’s parking lot through the upland and wetland forested lands that border the eastern edge of the lake. Legion Way, which runs adjacent the canal and bisects the western properties, lends access to a legion hall and skating facility. The steep-sided East Bay Bike Path runs directly to the north.

The lake itself is a resource to passive recreation and fishing. Small boat access is available from the Park and the waters contain black bass, pickerel and pan fish. The canal supports a river herring run that, until recently, was open to net fishing in the spring. No hunting is allowed on Barrington properties, but birders can observe numerous waterfowl and songbirds.

### **3. Rapid Ecological Assessment**

The goal of this section is to characterize and locate the ecological functions and values of, and threats to, the Brickyard Pond Conservation Area in order to provide a baseline for natural resources management recommendations, which follow.

The objectives of the REA are to:

- Create a baseline inventory of habitat types and characteristic flora
- Collect and generate ecological information about flora and fauna
- Identify ecologically sensitive, valuable, and otherwise important natural resources and sites
- Produce maps, tables, and other products to inform management decision-making
- Identify species and areas of special conservation concern

#### **3.1 REA Methods**

##### **3.1.1 Mapping and Inventory of Vegetation Communities**

The vegetation surveys consisted of a geospatial inventory of habitat types characterized and classified by dominance of vegetation and a survey of invasive plant species. Plant species diversity data were not collected due to inherent resource constraints.

##### **Habitat Inventory**

Vegetation communities were characterized by habitat type according to the NERRS Classification Scheme (Kutcher, *et al.* 2007). The classification is hierarchical; it is based on broad ecological classes at the upper levels, and by the dominant vegetation type or man-made ground cover at the lower levels. This classification scheme was chosen because it integrates upland, wetland, and cultural land cover into a common format and it is compatible with the National Wetlands Inventory (NWI). The inventory involved a combination of remote sensing and field surveys.

Habitat types were heads-up (on screen) delineated in a geographic information system (GIS) using true color, leaf-off digital imagery based on aerial photography collected in 2003 and 2004 (RIGIS 2008). Polygons were created by photo-interpretation of the color and texture of the land cover at a digital scale of approximately 1:5000 and a targeted minimum mapping unit of 0.25 acres (0.1 ha). Where necessary, true color leaf-on digital imagery collected in 2003 (RIGIS 2008) was used to facilitate interpretation.

A preliminary field map (both paper and digital—on GPS), depicting the digital imagery, the polygons, and scale bars, was created and taken into the field for verification. A datasheet was allocated to each identified vegetation unit. As each unit was verified in the field, data were collected to identify characteristic and other important (rare or invasive) plant species within each stratum. Percent cover of each species was then estimated in the field. Boundary and classification interpretations were adjusted as well.

The data were entered into a GIS table for analysis, export, and to create maps and other products.

##### **Invasive Plants**

Invasive plant species were inventoried in two ways; first opportunistically during field work for habitat and fauna surveys, and second, during a survey targeting the locations and intensities of

exotic species incursions. During habitat surveys, percent cover of invasive species was estimated for each identified habitat unit. During all other surveys, invasive plant species occurrences were documented. The targeted survey involved canoeing the perimeter of the lake and all islands, and running transects through all accessible terrestrial properties. Incursion locations and intensities were marked on field maps and verified using GPS. These data were entered into a GIS.

### **3.1.2 Fauna Surveys**

Three surveys of fauna were conducted; a breeding songbird survey, an amphibian larva survey, and an incidental fauna survey. These surveys were chosen for the efficiency of collection and the information that can be derived from the specific taxa. Mammals and reptiles, though certainly important components of the ecology, are difficult to detect and field work involves specialized equipment; these groups were not surveyed.

#### **Breeding Songbird Survey**

Birds were surveyed using a 10-minute point-count method (e.g. Enser 1992), which quickly identifies and quantifies songbirds breeding in or otherwise utilizing a given area. Six sampling stations were selected in targeted habitat types throughout the conservation area. Each station was comprised of a point of survey and the surrounding 100-meter area in all directions (the theoretical distance that a bird song or call can be heard). All individual birds heard or seen during a 10-minute time period were recorded and tallied. The point counts were conducted on June 27, 2008 between 0600 and 0930.

#### **Amphibian Larva Survey**

Amphibian larvae were surveyed with a dip net. Survey stations were selected by using aerial photography and site reconnaissance to identify likely breeding areas. To survey the population, a dip net was swept a full arms length a total of 15 times per site. All amphibians captured were identified, counted, and documented (e.g. P. Paton personal communication).

#### **Incidental Fauna Survey**

During all aspects of field work, opportunistic fauna data sheets were on-hand to allow the documentation of incidental fauna. Any animal seen or heard during any field investigation was documented. Survey dates fell within June, September, and November, 2008.

### **3.1.3 Surrounding Landscape Assessment**

GIS was utilized to characterize the intensity of land use surrounding the Conservation Area. A 1-Km buffer donut polygon was produced from an outline of the Conservation Area. This was used to clip RIGIS data to represent the surrounding landscape only. The resulting clipped data were used to compute results. Two analyses were run. First, 2003-2004 land use / land cover data (RIGIS 2008) were used to quantify the intensity of development in the surrounding 1 km by percentage of various land use and land cover types. Second, the percent of impervious surface cover within 1 km of the Conservation area was calculated using GIS and 2003-04 Impervious Surface data (RIGIS 2008).

## 3.2 REA Results and Discussion

### 3.2.1 Flora

#### Habitat Inventory

The Brickyard Pond Conservation Area covers 230 acres comprising a 100-acre shallow lake (Brickyard Pond), 120 acres of natural\* land, and eight acres of culturally-dominated land cover. The natural lands within the Area are dominated by forested uplands (64 acres) and forested wetlands (41 acres); forest covering 82% of terrestrial properties in total. The remaining is covered by shrub uplands (10%), cultural cover (6%), and herbaceous cover (2%).

Eleven habitat types were identified in the Conservation Area; these are described below. Refer to Table 1 and Fig. 2 for areas and spatial orientation.

#### Uplands

##### 1. Oak Forest

Oak forests are common in RI. BPCA uplands are dominated by Oak Forest and Oak-maple Forest habitat types in nearly equal proportions (30% and 28% of uplands respectively). Oak Forests generally fall on dryer, well-drained (e.g. Merrimac sandy loam—Mm) soils in the Veterans Memorial Park Area (Table 2, Fig. 3). The canopy of Oak Forests within the Conservation area is dominated by scarlet and black oaks (*Quercus coccinea* and *Quercus velutina*) with scattered pines (*Pinus* sp.). Characteristic shrub species include sassafras (*Sassafras albidum*) and red maple (*Acer rubrum*), and the understory is often thick with wild sarsaparilla (*Aralia nudicallis*) or blueberry (*Vaccinium* sp.). This habitat type has not been affected by invasive species in the BPCA.

##### 2. Oak-maple Forest

Oak-maple Forests of the BPCA grow primarily on mesic (e.g. Sudbury sandy loam—Ss) soils occurring east of the YMCA and along Broadview Drive to the south of the Conservation Area (Fig 1). The canopy is split between oaks, including white oaks (*Quercus alba*), and red maple in these areas. As with Oak Forest habitats, Oak-maple shrubs include sassafras, blueberry, and black raspberry (*Rubus occidentalis*), but also hydrophilic shrubs such as sweet pepperbush (*Clethra alnifolia*), while the ground cover commonly includes cinnamon fern (*Osmunda cinamomea*) as well as wild sarsaparilla. Invasive species associated with this habitat type include Oriental bittersweet (*Celastrus orbiculatus*; uncommon), multiflora rose (*Rosa multiflora*; uncommon), and scattered bush honeysuckle (*Lonicera morowwii*; scarce).

In the summer of 2008, some of these areas were suffering from insect damage; the leaf area of BLD tree and shrub species was diminished by as much as 50% in areas. This appears to be caused by the exotic invasive pest the winter moth (*Operophtera brumata*) according to RIDEM (L. Lopes-Duguay, personal communication).

##### 3. Mixed Broad-leaved Deciduous (BLD) Woodland

Mixed BLD Woodland habitats cover 23% of uplands in the BPCA. These are open to semi-closed-canopy forested habitats generally growing in areas recovering from fairly recent disturbance. The canopy is co-dominated by black locust (*Robinea pseudoacacia*) or oaks, and mixed maples,

including invasive Norway (*A. Platanoides*) and Sycamore (*A. pseudoplatanus*) maples, with scattered wild black cherry (*Prunus serotina*) and eastern red cedars (*Juniperus virginiana*). The shrub layer is dominated by invasive vine and shrub species such as Oriental bittersweet, honeysuckle, autumn olive (*Elaeagnus ubellata*), multiflora rose, and common privet (*legustrum vulgare*); native species include wild grape (*Vitis* sp.), sumacs (*Rhus* sp.), and greenbrier (*Smilax* sp.).

#### 4. Invasive Vineland

The term Invasive Vineland was coined to describe natural areas that have become overwhelmed with invasive and native vines (e.g. W. Niering, Harvard Forest). In the coastal Northeast, these generally occur in areas where the vegetation and soils have been highly disturbed and the invasive species Oriental bittersweet has overtaken the expected early-successional native shrubs. Thirteen acres of invasive vineland habitats located around the Legion Way area represent 17% of all uplands within the Conservation Area. Scattered tree and shrub species include chestnut oak (*Quercus prinus*), red maple, invasives autumn olive, multiflora rose, and bush honeysuckle, as well as native sumacs and eastern red cedar, but the leaf cover is mostly dominated by over-climbing oriental bittersweet and wild grape.

#### 5. White Pine Stand

A small (1.4-acre) White Pine Stand covers a knoll abutting Brickyard Pond near the Park entrance. The canopy is comprised mostly of white pine (*Pinus strobus*) with scattered black locust trees near the edges. Understory species include sassafras and maple saplings as well as poison ivy and invasive Oriental bittersweet taking advantage of light resources toward the edges.

### Wetlands

#### 6. Red Maple/shrub Swamp

Occurring throughout the BPCA, Red Maple/shrub Swamps comprise 79% of wetlands and 29% of all lands within the Conservation Area. This is the most common wetland habitat type in the State. These are areas that temporarily to seasonally flood during the growing season. The canopy of this habitat type is dominated by red maple with scattered pin oak (*Quercus palustris*) and birch (*Betula* sp.). Sweet pepperbush is abundant in the shrub layer, while winterberry (*Ilex* sp.), blueberry, and willow (*Salix* sp.) are also common. Cinnamon fern is common in the herbaceous layer. A large swamp in the southeast corner of the property contains a host of invasive species along access trails; these include bittersweet, multiflora rose, honeysuckle, and barberry (*Berberis thunbergii*).

#### 7-8. Red Maple Swamp Depressions -Vernal Pools

These habitat types fall within glacial depressions scattered throughout the eastern edge of the Conservation Area as well as along a utility corridor north of Legion Way. Both seasonally flooded, these types have a longer hydroperiod than the Red Maple/shrub Swamp habitats due to the depressions intersecting the water table for a longer period and their containment of poorly-drained muck soils. Vernal pools are differentiated here only by their smaller size and isolation from other wetlands. The vegetation composition is similar to Red Maple/shrub Swamp habitats, but due to the relative isolation, the closed canopy, and the wetness of depressions in the eastern area, invasive species are not as likely to become established. However, vernal pools abutting the utility corridor at Legion Way contain small incursions of invasive common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*) along the open corridor edges.

### Waters

### *9-10. Manmade Pond and Canal*

These features were constructed to connect the Brickyard to the Narragansett Bay for transport of bricks, which were towed on barges by teams of horses to a large dock and freight ships. Although these features are manmade, they are of significant ecological value in that they have become a tidal fresh system and a perennial connection for faunal access to the lake system from Narragansett Bay. These waterways are mostly unvegetated, but water celery (*Vallisneria americana*) was noted at the eastern edge of the pond. The canal and pond sides are steep and provide little grade for the establishment of wetland vegetation.

### *11. Shallow Manmade Lake*

Brickyard Pond is the most significant feature of the Conservation Area. The lake averages 11 feet deep and is thought to be 20 feet at its deepest point. The barren mineral substrate does not support much aquatic bed vegetation although pondweed (*Potamogeton* sp.) is sparsely distributed in certain shallow areas. Emergent vegetation is mostly represented by the invasive common reed, which will grow almost hydroponically in sand or on a mat of its own detritus in the presence of elevated nutrients in the water. In 2008, Brickyard Pond was de-listed from the State list of impaired waters for nutrients (dissolved oxygen and total phosphorus) following TMDL approval by EPA (App. 1.). Water quality can greatly affect lacustrine systems.

## **Plant Species of Conservation Concern**

The habitats of the BPCA have changed dramatically over the last century. The habitats that have supported rare species in the past are no longer represented and no rare species were noted during our vegetation community surveys. Although it is not likely that documented historic occurrences remain, RINHS recommends that Barrington work with available resources to investigate this further. Rare plant species surveys require time and resources not available in this project. Refer to section 4.2.9 for more information on rare species monitoring and to Appendix 2 for descriptions of historic element occurrences.

## **Invasive Plant Species**

Invasive plant species tend to become established in highly disturbed areas. This is overwhelmingly the case in the habitats within the BPCA. The Invasive Vineland communities occur at Legion Way, the site of high activity during the Brickyard era, the site of a former land fill (c. 1970s) and a current center for town activity. The infested Mixed BLD Woodlands are also occupying sites of former and current activity. 1972 aerial photos reveal the cleared land and activity predating the establishment of these invasive-dominated habitat types (Fig. 4). Invasive species are also present along trails in interior habitats within the Park. In most cases here, as elsewhere, invasion of exotic species is directly related to human impact. The lake has small incursions of common reed on open shallow edges and islands (Fig. 5), likely the result of nutrient enrichment and substrate disturbance. Refer to Table 2 for a list of invasive plant species inventoried during this work.

## **3.2.2 Fauna**

### **Birds**

Birds are effective indicators of environmental status because they are omnipresent, sensitive to environmental structure and change, and they can be monitored efficiently. Species assemblages can give managers information about how habitats are functioning, since certain species are habitat-specific. Rhode Island Natural History Survey (August *et al.* 2008) has compiled abundance and

breeding status of RI birds, RIDEM (2005) has compiled a list of species of greatest conservation need (GCN), and the Nature Conservancy (2008) has compiled a database of the conservation status of bird species in North America. This information for each species listed is presented below and in subsequent tables. A total of 45 bird species were observed during RINHS fieldwork, of which 15 were GCN species.

#### Bird Point Count Survey

Breeding songbird point count surveys were conducted to provide current information on bird species and habitat function. Twenty-nine species were identified during breeding bird survey at BPCA, including 9 GCN species. Refer to Table 3 and Fig. 6 for tallies and locations of species. The Black-crowned Night Heron is listed as S1B (state critically imperiled, breeding) in RI (NatureServe 2008). At least four were observed, along with more common wading birds, in the Legion Way area utilizing the canal/pond area; likely to feed on river herring juveniles.

#### Opportunistic Fauna Surveys

Opportunistic fauna surveys were also conducted during all field work. Thirty-three avian species were identified during these surveys, including 9 GCN species, 6 of which were not previously observed in the point count surveys. Refer to Tables 3, 4 and 5 for tallies and approximate locations of these species. The surveys revealed a strong use of the lake by water birds, including wading birds, waterfowl (ducks, geese and swans), and osprey. Ospreys are listed as S2B/S2N (state imperiled for breeding and non-breeding) in RI (NatureServe 2008).

#### Other Bird Data

In a study conducted from 1981 to 2000, Starring (2008) found that the community composition of bird species shifted in response to natural succession in the BPCA and adjoining areas (App. 3). This corroborates with numerous studies and theories on bird habitat selection. The current species inhabiting the BPCA are indeed dependant upon current habitat types: this is very important to consider during any activities that affect habitats in the Conservation Area., especially where GCN or rare species are concerned.

#### **Amphibians and Reptiles**

Amphibians are good indicators of the environmental health of seasonally flooded wetlands and surrounding uplands because they are extremely sensitive to environmental stressors and can be efficiently surveyed. RIDEM DFW identified species of greatest conservation need (GCN) and the RINHS has compiled a database of the conservation status of all amphibians known to occur in Rhode Island. This information for each species listed here is presented in subsequent tables.

#### Dip Net Surveys

Dip net surveys conducted in vernal pools detected no amphibians. This is highly unusual, but the lack of amphibians in this area has been seen in more intensive studies as well. Annie Curtis, a URI Masters student, sampled a Vernal Pool just east of the YMCA several times throughout the spring of 2008 and had the same results. RIDEM DFW concurs that the area is severely lacking in amphibians. Intensive mosquito spraying in the early 1970s may have caused a decline of amphibians in the area and the population has not yet recovered (C, Raithel, personal communication).

### Opportunistic Fauna Surveys

During all field work, only the call of a single green frog (*Rana clamitans*) was observed in the large Red Maple/shrub Swamp-Vernal Pool area in Veterans Park.

### Other Amphibian Data

RIDEM DFW has been conducting statewide surveys of amphibians and reptiles for decades. Table 7 shows species tallies from those data. The lack of expected species is not thought to be from deficient effort (C. Raithel, personal communication).

### **Mammals**

Although mammals are difficult to survey, incidental and anecdotal evidence is supplied here as best available information. The data were either collected from opportunistic fauna surveys or were first-hand accounts by RIDEM DFW (C. Brown, personal communication). Refer to Table 8. BPCA does not carry an overabundance of deer, as many areas in RI do. This may be the result of the high intensity of surrounding land use limiting immigration and survival. As a result, the understory of forested habitats remains more intact than is common in the State.

### **Fish**

RIDEM DFW monitors fish species in Brickyard pond. Besides supporting expected freshwater game and pan fish, the lake also supports a run of the anadromous river herring alewife (*Alosa sp.*) and the catadromous American eel (*Anguilla rostrata*), both identified as GCN species (RIDEM 2005). This is particularly important, because the presence of diadromous fishes (those running between fresh and saltwater as part of their life cycles) indicates that strong functional connection has developed between Brickyard Pond and Narragansett Bay. The diadromous species mentioned are both experiencing severe population declines in the State, Regionally, and Nationally. Abundant river herring are thought to contribute to faster-than-average growth rates among recreational game fishes in Brickyard Pond. Refer to Table 9 for a full list of finfish species observed during DEM electroshock surveys.

### **Macroinvertebrates**

Sampling for dragonflies and damselflies (Odonates) was conducted at Brickyard Pond between May 1998 and June 2004 as part of the Odonata Atlas of Rhode Island. A total of 25 voucher specimens of 12 species were collected during 25 sampling events, representing 24% of Barrington's total odonate diversity. Refer to Table 9.

Individuals of the estuarine shrimp species grass shrimp (*Palaemonetes pugio*) were observed at the interface between the canal and the lake during field surveys in November. As does the herring run, this indicates a strong functional connection between the lake and Narragansett Bay.

### **3.2.3 Surrounding Landscape**

The surrounding landscape can have a strong effect on the ecological functions of a conservation area. This is because the surrounding landscape can influence habitat connectivity, migration patterns, water quality, species dispersion, edge effects, metapopulations, direct disturbances, the introduction of invasive species, and a host of other factors. Two analyses were run to characterize the surrounding land use intensity. The first is an analysis of the land use and land cover (LU/LC) surrounding the Area and the second is an impervious surfaces analysis.

The LU/LC analyses revealed that 71% of the land surrounding the BPCA is developed, while 3% is agricultural and 26% is natural (Table 10, Fig. 7). The impervious surface analysis can be an indicator of a stressed environment. A watershed containing greater than 10% impervious cover is considered to be at risk or degraded. The land surrounding the BPCA contains 21.5 % impervious surface (Fig. 8).

### **3.3 Areas of Special Consideration**

Two areas of special concern are identified here. These areas require special management consideration because they are regionally unique, support species of concern, are critical to ecological integrity and function, and are particularly threatened by human interference.

#### **3.3.1 Brickyard Pond**

Brickyard Pond is the central feature to the BPCA. Although it is a manmade lake, many natural deepwater and wetland habitats have developed to provide cover, roosting, and foraging opportunities to a diverse suite of wildlife including several GCN fish and bird species. It also supports diverse recreational activities and aesthetics. Maintaining the water quality and habitat integrity of this feature is central to the ecological and recreational utility of the BPCA. Major threats to Brickyard Pond include inputs of sediments, toxins and nutrients, and the establishment of invasive vegetation and fauna.

#### **3.3.2 Mussachuck Creek Mouth / Legion Way Area**

Mussachuck Creek is a critically important ecological feature that connects the Brickyard Pond system to Narragansett Bay. This provides unique habitat that supports diadromous fish species including American eels and river herring, both declining GCN species in RI. Along with adjacent habitats, it also provides foraging opportunities to a variety of wading birds, some of which are locally threatened. Recent historic intensive land uses, including clearing and use as a landfill have facilitated the extensive establishment of invasive vegetation in the area. Although the composition structure of the vegetation is functionally inferior to native vegetation, it still provides cover and perching structure for wildlife. Major threats to the Mussachuck Creek area include high foot traffic activity, municipal activities, development, further domination by invasive species, and threats to hydrologic continuity with Narragansett Bay.

Active disturbance has been shown to be a major factor in foraging habitat selection among wading birds (R. McKinney, USEPA unpublished data). RINHS observed high-intensity municipal activity at the site during the summer months in 2008; several wading birds were observed perched and foraging along Mussachuck Creek during the activity. This was likely a tradeoff for the birds, since they prefer to forage and perch in sites away from activity. Daytime foot and pet traffic may pose an even greater disturbance threat to wading birds utilizing the area due to closer possible proximity, although determining specific use patterns requires more work. Foraging habitat is critical to wading birds throughout the summer and fall months; in summer, they are brooding and feeding young; in fall they are storing extra body fat for fall migration to Southern US and Central and South America. Regionally, historic foraging habitat has been significantly reduced and degraded by human activities.

### **3.4 REA Conclusion**

The Brickyard Pond Conservation Area is a diverse and highly functioning natural “island” occurring within a highly developed landscape matrix. The main feature, a manmade 100-acre shallow lake, has a permanent connection to Narragansett Bay via a man-made canal and Mussachuck Creek. This acts as a tidal fresh system that allows the passage and breeding support of regionally declining diadromous fish species, the support of wading bird foraging habitat, the support of a recreational fishery, and the support of state imperiled species. The lake itself supports diverse water birds and finfish, while the surrounding habitats contain diverse avifauna and mammals. Amphibian populations have not recovered from extirpation thought to be the result of either heavy mosquito spraying or intensely developed surrounding land use, while common turtles persist.

The BPCA land surrounding the lake contains mostly forested uplands and wetlands common to the State, but scarce in Barrington. Invasive plant species dominate vegetation in habitats developing on recently disturbed properties, mostly around Legion Way and the entrance to Veterans Memorial Park. They also have taken hold along walking trails deeper into the forested habitats; this is common, since they generally thrive on habitat disturbance. This situation represents an ecological threat to habitats that is often difficult to mitigate, but possible to prevent. In turn, this threatens the function of species support. A threats-analysis will be included in the upcoming natural resources management recommendations for the properties.

In total, at least 15 bird species and 2 fish species of greatest conservation need (GCN) in RI utilize the lands and waters of the Brickyard Pond Conservation Area. These natural resources depend on continued maintenance of BPCA habitats, which can be achieved through careful management.

## **4. Management Objectives and Actions**

Management objectives for the BPCA have been identified by the Barrington Conservation Commission (BCC) and in the Draft Comprehensive Community Plan. The goal of this section is to inform management planning regarding these objectives in relation to natural resources.

### **4.1 Overarching Actions for Resource Management**

Five overarching recommendations for natural resource management are offered here. These actions have broad applications that address multiple objectives. Applicability of these and other actions regarding specific objectives is offered in Section 4.2.

#### **4.1.1 Control Pollution Inputs to Surface Waters**

The variety of high intensity land uses in the areas surrounding the BPCA contributes to the degradation of water quality within Brickyard Pond in numerous ways. Urban runoff contributes nutrients and hydrocarbons, entrained in sheet flow and through several direct runoff outfalls, directly into Brickyard Pond and surrounding wetlands in the properties. A TMDL has recently been completed to assess nutrient inputs and their impacts; recommendations are provided for compliance with water quality standards. These guidelines should be prioritized and implemented according to the TMDL and recommendations offered in this plan.

#### **4.1.2 Preserve or Strengthen the Property Designation as a Conserved Area**

Nearly every objective identified in Barrington's Draft Comprehensive Plan regarding the BPCA requires its continued and strong designation as conserved land. Conservation of the properties contributes to the maintenance of surface water quality in Brickyard Pond and Mussachuck Creek, protection of the Barrington Aquifer, the integrity of wildlife habitat, the aesthetics of scenic views, and the recreational enjoyment of the land. It appears that the status of BPCA as conservation land is based on town policy. This is not considered a particularly secure form of conservation by the Rhode Island Land Trust Council (R. Friday, personal communication). Contingency planning to protect the status of conservation land should the owner fall on hard times is also a best practice recommended by the Land Trust Alliance (Land Trust Alliance 2004). It is recommended that Barrington consider steps to reinforce BPCA's conservation status.

There are many ways to improve the security of a parcel's conservation status and they represent trade-offs between security and acceptability or feasibility. The use of various types of conservation easement to protect land in public ownership is anticipated in the Land Trust Alliance's Conservation Easement Handbook (Byers and Ponte 2005), and the Audubon Society of Rhode Island and a number of Rhode Island land trusts now regularly buttress conservation status of land by distributing ownership interests—separating development rights or other interests from fee ownership (L. Taft, personal communication). Barrington should consider whether a transfer to another party such as a land trust, statewide conservation group, or the state of Rhode Island of certain use rights to BPCA in the form of a conservation restriction is desirable and feasible. Other approaches to strengthening conservation status could include by-law or zoning modifications.

#### **4.1.3 Minimize Public Impacts to Areas of Special Concern**

Brickyard Pond and Mussachuck Creek provide a unique and critical ecological system that is important to people and wildlife. Public enjoyment of these resources encourages public

appreciation, raises awareness, and increases support for the conservation of public land. However, all uses impact the resource to some extent. Those uses commonly considered passive, such as hiking, bird watching, canoeing, and sightseeing, generally have a limited impact on the resource. Activities that require development or the extraction of resources generally have a higher impact on the resource. Management must strike a balance between enjoyment and sustainability of the resources identified in the BPCA.

#### **4.1.4 Manage Property Access and Use**

Providing liberal access and use of the BPCA enhances the public's feeling of ownership and investment in the Conservation Area. However, uncontrolled misuse of the properties will have negative impacts on the resources. For example, dumping of trash or organic materials can introduce toxins, nutrients and pathogens to the surface waters and wetlands; illegal extraction of river herring can impact breeding success of the species; trailblazing can directly impact habitats, cause fragmentation, and spread invasive species; and partying at the shoreline by teenagers causes litter, erosion, fire threats, and direct health hazards. An access and use management plan needs to be incorporated into the management plan to protect the resources.

#### **4.1.5 Manage Invasive Species**

The establishment and spread of invasive species are directly related to human use, but they can be minimized through proper management. Terrestrial invasive plant species are often dispersed by dumping yard waste and by lawn care equipment. Municipalities often infest their roadsides by carrying seeds and viable plant fragments from one mowing site to the next. Invasive plants can establish and thrive anywhere vegetation has been removed or substrate has been disturbed. Aquatic invasive plant and animal species are often carried from one water body to the next attached to the boots and boats of fishermen. Other aquatic species are introduced as discarded bait or intentionally as game fish. Likewise, invasive animal species can impact native fauna through competition for resources. For example, with its large body size and long neck, the mute swan out-competes dabbling ducks in foraging for submerged food resources. The introduction of invasive species to an ecosystem can have widespread and significant effects on the system.

Invasive species must, then, be considered in many management actions and activities, especially grounds maintenance, development, and other activities involving the clearing or cutting of vegetation. RINHS recommends the development of an overarching invasive species management plan, as well as the incorporation of targeted invasive species planning into all project and activity planning. The overarching plan should utilize all available resources including volunteers, community organizations, and State and Federal funding. It should include language that lays out monitoring methods, identification of responsible parties, and response protocols. It should also identify specific activities in the BPCA that facilitate invasive species introduction and spread. Finally, it should mandate that as part of planning, all management activities include a targeted invasive species management plan specific to the site and the activity.

Recommendations toward the management of invasive species, as it relates to management objectives, are offered throughout section 4.2. A summary of general guidelines for invasive species management are offered in Section 4.2.8:

## **4.2 Objectives and Actions for Resource Management**

The following is an outline of objectives identified by the BCC and in the Draft Barrington Comprehensive Community Plan, followed by recommendations for actions regarding each objective. Recommendations are given in approximate order of importance. Natural resource management is complex in that it relies on predicting intricate interactions of the physical and biological world that cannot be easily generalized. Management planning for any specific project will require an equally specific degree of natural resource planning that is well beyond the scope of this effort.

### **4.2.1 Protection and Restoration of Water Quality**

Loss and degradation of aquatic habitat has been identified as a major problem affecting GCN species in RI. Brickyard Pond and Mussachuck Creek have been identified as critical areas of the BPCA because they support varied, unique, and threatened wildlife. The water quality of these resources is central to the ecological integrity of the BPCA. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the protection and restoration of the water quality of Brickyard Pond and Mussachuck Creek.

- Continue current efforts to investigate and prioritize recommendations outlined in the recent TMDL report (RIDEM 2007). Implement the recommendations to the extent possible. Prioritize actions that alleviate ongoing stresses to the system. Prevention of further degradation, such as minimizing nutrient and sediment inputs, should be the focus of the effort, since it represents a sustainable solution to water quality problems. Curative measures, such as alum treatments, should be carefully applied only to complement long-term solutions.
- Incorporate BMPs according to RIDEM Pollutant Discharge Elimination System (RIPDES) into planning and implementation of stormwater mitigation for Brickyard Pond and BPCA wetlands.
- In prioritization and implementation of the TMDL actions, make every effort to avoid impacts to native and recreational fish populations. Most importantly, no actions should be implemented without assessing and minimizing impacts to river herring and American eels; both GCN species depend upon Brickyard Pond and Mussachuck Creek to complete their lifecycles (Section 3). As an example, treatment with flocculants, such as alum, can cause gill damage to fish; the extent of impacts might be seasonally dependent.
- In prioritization and implementation of the TMDL actions, make every effort to minimize hardening of the shoreline. In addition to compromising the aesthetic quality of the resource, hardening of the shoreline can displace native vegetation and habitats that wildlife depends on. Filling the shoreline can be a vector and facilitator of invasive plant species, such as common reed (*Phragmites australis*). Replanting of native vegetation in formerly cleared erosional areas will slow erosion and provide habitat for wildlife. A lake, by definition, is a high-energy habitat that naturally incorporates erosion. Minimizing ongoing, human-induced facilitating factors, such as the clearing of natural buffer and shoreline vegetation, should be the main focus of erosion mitigation.
- Create a management plan specifically to address the erosion of the steep bank of the East Bay Bike path on the north shore of Brickyard Pond. Careful supplementation or replacement of existing vegetation with native, compact, binding, woody vegetation could help stabilize the banks and minimize erosion. Open fencing or vegetation designed to thwart activity on the bank would be beneficial in reducing runoff gullies that result from

trailblazing. The URI Cooperative Extension lends expertise and management planning assistance to such projects.

- Further investigate inputs to Brickyard Pond from Mussachuck Creek. RINHS observed eastward flow (toward the lake) at the head of the creek, as well as the presence of estuarine fauna (see Section 3). Inflow was also observed coming from a pipe angled toward the pumping station at Legion Way. A volunteer group should be appointed to monitor flow direction and nutrient levels at the head of the creek and at the crossing of Middle Highway during high tides throughout the summer, since this is when pond levels are likely lowest. The volunteer-based group *Watershed Watch* at URI may be able to assist in monitoring and program design.
- Maintain and enforce a ban on the use of motor-powered vessels on Brickyard Pond. Outboard motors contribute to shoreline erosion, noise pollution, active disturbance, and hydrocarbon pollution that can impact property values, water quality, wildlife, plant life, and human enjoyment.
- Maintain or increase measures to thwart illegal dumping within the BPCA to minimize erosion, the spread of invasive species, and the introduction of nutrients and other pollutants to the surface waters.
- Impose and enforce a pet waste policy that requires owners to remove any pet waste introduced to the property to ensure that nutrients and pathogens will not be carried into surface waters and to increase the quality of passive recreation.
- In any planning to expand parking facilities, consider using permeable surfaces such as gravel or semi-pervious pavers to minimize the runoff of automotive fluids.

#### **4.2.2 Protection of Barrington Aquifer Recharge Zone**

The entire area of the BPCA falls within the recharge zone the Barrington Aquifer. The only major aquifer in the East Bay, Barrington Aquifer provides drinking water used by Bristol County and Barrington. Every effort should be made to preserve its integrity. The URI Cooperative Extension and RI HEALTH have developed a source water assessment for the Bristol County water sources (Hickey and Juobert 2003). The report details threats to the Barrington Aquifer. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the protection of the Barrington Aquifer recharge Zone:

- Preserve or strengthen the property designation as a Conservation Area. The Brickyard Pond Properties comprise 26% of the Barrington Aquifer recharge zone, and thus its designation for harmless uses significantly protects the aquifer. Forest cover and wetlands have been shown to positively correlate with aquifer health (Hickey and Joubert 2003). The BPCA currently contains 105 acres of forested uplands and wetlands comprising 85% of its terrestrial properties. Retaining these natural lands will protect the aquifer.
- Investigate and mitigate the threats to groundwater contamination at the former dump site at Legion Way. Landfills pose a serious threat to the aquifers.
- Investigate and regularly inspect or remove any underground fuel storage tanks on the properties. RIGIS (2009) data indicate that a leaking underground tank was located in the vicinity of the pumping station at Legion Way. Faulty sewer lines and pumping stations can also contaminate aquifers.
- Minimize the use of herbicides, pesticides, and fertilizers in the BPCA. Best management practices (BMPs) should be applied in the maintenance of the ball field at Veterans Park, particularly in the application of fertilizers. Also, encourage adjacent property owners,

including the Rhode Island Country Club and homeowners, to implement BMPs. Contact the Cooperative Extension Education Center, URI for information on BMPs.

- Use of the skating rink at Legion Way as a parking and activity area for town trucks and heavy equipment should be restricted to the parking (only) of clean and properly maintained vehicles. Leaking oil and other fluids associated with high-intensity vehicle use and maintenance poses a threat to groundwater.
- Protect the surface water quality of Brickyard pond as recommended in this report. Brickyard Pond and the underlying Barrington Aquifer are hydrologically connected. Impacts to Brickyard Pond may also affect the aquifer.
- Ensure that all zoning and planning within the Barrington Aquifer recharge zone considers potential impacts to the aquifer.

#### **4.2.3 Preservation or Enhancement of River Herring Run**

River herring are protected from harvest in RI and elsewhere on the East Coast in response to a recent sharp decline in Atlantic populations. All three species of river herring in RI have been identified as GCN species (RIDEM 2007b). Stresses to their populations include over-fishing and impediments to breeding. River herring are anadromous and depend on an unobstructed connection from the sea to calm fresh waters. In RI, only 18 of 45 rivers still support spawning historic herring runs. Brickyard Pond and Mussachuck Creek currently provide an important breeding system for herring. The herring run supports the recreational fishery in Brickyard Pond by providing forage to game fishes in the form of juvenile herring. They also provide forage for abundant herons that utilize the BPCA, especially at the Mouth of the creek at Legion Way as discussed in Section 3. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the protection of the river herring run:

- Strictly enforce state laws prohibiting the possession of river herring by monitoring historic netting sites by day and night. Fencing off the sites is not recommended because it may impair access of water birds that depend on the areas for foraging. River herring are superior bait for striped bass; fishermen may be willing to take a risk if odds of being caught are low.
- Work with adjacent land owners to maintain and enhance the continuity and habitat quality of Mussachuck Creek. For example initiate or continue cooperative efforts with Rhode Island Country Club to ensure and preserve an unimpeded and unpolluted passageway through the creek and into Brickyard Pond.
- Follow TMDL recommendations and water quality recommendations given in this report to mitigate nutrient and sediment pollution in Brickyard Pond. Investigate and consider impacts to river herring before implementing any mitigation action, particularly those resulting from the application of alum or other flocculants.

#### **4.2.4 Protection, Preservation, or Improvement of Habitat Integrity for Wildlife**

As detailed in Section 3, the BPCA is an important haven for wildlife within a heavily developed landscape matrix. Numerous fish and bird species of greatest conservation need utilize the habitats within the properties. Protection, preservation, and enhancement of the integrity of these habitats are critical to the preservation of the wildlife species that depend on them. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the protection of habitat integrity for wildlife:

- Protect and Restore surface water quality as recommended in this report. Many of the species identified as conservation priorities depend on the cleanliness of Brickyard Pond and Mussachuck Creek for various functions.
- Preserve or strengthen the property designation as a Conservation Area. Minimize development of the properties and fragmentation by roads, and trails. Even non-raised trails can introduce and facilitate invasive plant species. Fragmentation changes species interaction dynamics and can impact or preclude important species.
- Follow recommendations to protect and restore the river herring run. Above average growth rates of various fish species have been attributed to the presence of river herring juveniles in the lake. Water birds, such as herons, also likely depend on the herring for forage.
- Minimize activities that may impact areas of special concern. Specifically, minimize impacts to wildlife at the head of the Mussachuck Creek, especially during the summer and fall months when wading birds are using the creek for foraging. Noise pollution from heavy equipment and foot/pet traffic may pose disturbances to feeding birds, while illegal harvesting may pose a threat to breeding success. Determining specific use patterns of this area requires further work.
- Control the spread of invasive plant species by following recommendations given in this document. Develop and post signage at access points warning boaters and wading fishermen of the spread of invasive species via boats and boots. Invasive species can diminish habitat integrity by changing the structure and composition of vegetation.
- Minimize the use of pesticides in the area. Many bird and bat species depend on flying insects for forage. It has been suggested that former mosquito spraying practices may be in part responsible for the local extirpation of most expected amphibian species (Section 3). Removal of any trophic level (insects being toward the base of the food chain) may have unforeseen consequences on the environment.
- Work with adjacent landowners, DEM, and other stakeholders in the East Bay to develop an integrated, regional winter moth control strategy. The non-native winter moth was observed on the properties in 2008 (Section 3) and their presence may pose a threat to broad-leaved deciduous vegetation because they browse on foliage and are difficult to control. Among some trees in the Brickyard Wetlands, leaf cover was diminished by nearly 50% during the 2008 growing season. RIDEM has suggested that the introduction of a biological control agent may be effective at reducing their effects.
- Work with adjacent landowners to maintain and maximize connectivity of existing habitat corridors that connect the BPCA, Echo Lake, and Prince Pond. This can be accomplished by maintaining the status of conservation lands and minimizing further fragmentation of the corridors.
- Maintain and enforce a ban on the use of motor-powered vessels on Brickyard Pond. Outboard motors contribute to shoreline erosion, noise pollution, active disturbance, and hydrocarbon pollution that can impact wildlife, plant life, and human uses.
- Maintain and enforce the *no hunting* policies in the BPCA. Hunting can directly impact regionally scarce resources. In addition, spent lead shot, now banned in the US for waterfowl hunting but difficult to enforce, has been shown to impact waterfowl and raptors through lead poisoning, particularly in freshwater systems.
- Develop and maintain targeted monitoring methods to assess habitat integrity in Brickyard Pond. For example, a voluntary program to monitor fish harvest and release information for tracking fish populations over time could be applied to understanding trophic interactions that can affect the ecology, recreational uses, and even nutrient levels in the lake. Such a program could also rapidly detect the introduction of non-native fish species.

#### **4.2.5 Protection of Scenic Views**

Brickyard Pond offers scenic natural vistas from all accessible vantage points including from the East Bay Bike Path, the boat ramp and access roads in Veterans Park, access areas around the Legion Hall, and several waterfront homes. Regarding the protection of scenic views in the BPCA, RINHS recommends that the following policies be incorporated into Barrington's Management Plan concerning natural resources:

- Preserve or strengthen the property designation as a Conservation Area. BPCA scenery is distinct in that it is a haven for wildlife and recovering natural areas; the public's interest in the area as a scenic view hinges on this. To preserve the naturalness of the area is to preserve the integrity of the scenic views.
- In efforts to preserve vistas, clearing and cutting of vegetation should be avoided or minimized. Clearing and cutting of vegetation directly impacts habitats and can facilitate the establishment of invasive plant species. Removal of vegetation also contributes to erosion, sedimentation, and eutrophication through debilitating the binding function of root systems in the soil and facilitating sheet runoff. Where cutting is considered absolutely necessary, it should be limited to selective cutting of vegetation directly impairing views; all other strata should be left intact. For example, if tall shrubs are cut, then the canopy, low shrub, and herbaceous layers should be left intact. It is especially important to avoid disturbing the substrate or exposing it to light, as this will increase the likelihood of invasive species establishment.
- Work with experts to develop a plan to stabilize the bank of the East Bay Bike Path that utilizes existing or new native, low vegetation that will further bind soils and require minimal maintenance (e.g. pruning, mowing, or fertilization) to preserve vistas (see Section 4.2.1).

#### **4.2.6 Management of Recreational Uses**

The BPCA contains three developed activity areas and numerous foot trails. The first activity area includes a skating facility and Legion hall at Legion Way, the second, a softball field located near the entrance to Veterans Park, and the third is a boat ramp, gravel parking lot, and picnic area located east of Brickyard pond in Veterans Park. From the parking lot, unmarked foot trails lend access to upland and wetland habitats in the Park and to the lakeshore. Brickyard Pond itself supports an active recreational fishery. Plans to add another ball field have been suggested. While they enhance public enjoyment and their appreciation and support for open space conservation, public uses can also directly and indirectly compromise the natural integrity of the conservation area. Thus, they must be balanced against objectives that incorporate conservation. Best management practices can help minimize compromising effects. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding recreational uses as they relate to natural resources:

- Preserve or strengthen the property designation as a Conservation Area. Avoid the development of new activity areas and rather focus on the maintenance and stewardship of low-impact uses. Minimize trailblazing by designating and clearly marking hiking trails; post signage discouraging trailblazing. Even non-raised trails can introduce and facilitate invasive plant species and increase erosion and surface runoff into surface waters and wetlands. Furthermore, fragmentation of continuous habitats changes species interaction dynamics and can impact or preclude important species.
- Minimize activities that may impact areas of special concern. Specifically, minimize impacts to wildlife at the head of the Mussachuck Creek, especially during the summer and

fall months when wading birds are using the creek for foraging. Foot and pet traffic may pose disturbances to feeding birds, while illegal harvesting may pose a threat to breeding success of herring. Determining specific use patterns of this area requires further work.

- Strictly enforce state laws prohibiting the possession of river herring by monitoring historic netting sites by day and night. River herring are thought to be responsible for above-average growth rates of recreational game fishes.
- Repair or remove and campfire rings that pose a fire hazard, especially in the oak forest areas surrounding the picnic sites in Veterans Park (Fig. 2). Oak forest habitats are particularly susceptible to forest fire, especially in the summer and fall seasons. Consult with RIDEM Division of Forest Environment for regulations and risk assessment.
- Minimize the use of fertilizers used on the ball field and elsewhere in the BPCA. Best management practices (BMPs) should be applied in the maintenance of the ball field at Veterans Park, particularly in the application of fertilizers and schedule of watering. Contact the Cooperative Extension Education Center, URI for information on BMPs.
- Maintain and enforce a ban on the use of motor-powered vessels on Brickyard Pond. Outboard motors contribute to shoreline erosion, noise pollution, active disturbance, and hydrocarbon pollution that can impact wildlife, plant life, and human uses.
- Control the spread of invasive plant species by following recommendations given in this document. Develop an invasive species management plan that identifies specific regulations regarding activities conducted on the properties. The plan should include, for example, such requirements as: develop and post signage at access points warning boaters and wading fishermen of the spread of invasive species via boats and boots; a ban on cutting, removing, or introducing live or dead vegetation in the area; regulating mowing and brush-cutting protocols to include the cleaning of equipment between sites; discouraging trailblazing; etc.
- Assess and mitigate hazards associated with snags and falling limbs. This should be done by a trained expert. While incidence of tree and branch deaths is generally considered low, falling woody debris does pose a real risk to people. Quickly remove snags that appear to pose a danger to humans using the BPCA, especially large debris that is leaning or hung on other trees. Standing dead snags are valuable wildlife habitat for avian and mammalian cavity nesters and should be preserved when they pose no threats to humans.

#### **4.2.7 Development of New Activity Areas**

Plans to add another ball field within the BPCA have been suggested. While they enhance public enjoyment and use of the properties, active uses can potentially directly and indirectly compromise the natural integrity of the conservation area and thus they must be balanced against objectives that incorporate conservation. The development of recreational facilities within the properties is contradictory to conservation and to many objectives listed here that require conservation. Thus, development should be avoided within the BPCA. If it cannot be avoided, every effort should be made to minimize impacts to wildlife, critical habitats, surface waters, the Barrington Aquifer, and wetlands. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the development of new active use areas as it relates to natural resources:

- Preserve or strengthen the property designation as a Conservation Area. Preserve all existing habitats in their entirety. Relocate large-scale recreational development to another municipal property. There are no sections within the BPCA that are not ecologically sensitive or important.

- Any facility that cannot be avoided should be located as far as possible and, if possible, not upstream of Brickyard Pond, Mussachuck Creek, the Barrington Aquifer, or any wetlands. All development should be located within or adjacent to an existing center of activity and away from areas of special concern. These areas are already protected by state law; according to RIDEM and RICRMC, development should specifically not be located:
  - Within 200 feet of Mussachuck Creek
  - Within 200 feet of Brickyard Pond
  - Within 50 feet of any wetland
 Town laws may require additional setbacks from these features. These laws were put in place to reduce additional impacts to surface waters and wetlands; deviation from these setbacks will require special permitting and lead to degradation of the resources.
- Develop an invasive species control plan as a formal component of any development planning. Invasive species are facilitated by several activities associated with development, including removal of vegetation, introduction of soils and fill, disturbance of substrate, fertilization, mowing and brush-cutting, and foot traffic.
- In any planning to expand parking facilities, consider using permeable surfaces such as gravel or semi-pervious pavers to minimize the runoff of automotive fluids.

#### **4.2.8 Management of Invasive Species**

The effects of invasive species have been discussed in Sections 3, 4.1.5, and throughout 4.2. Removal of invasive vegetation is not recommended without further work in determining its utility. Removal of invasive vegetation is often not a high priority in forested areas due to excessive costs, unintentional impacts to habitats and wildlife, and low effectiveness. The following is a summary of policies that RINHS recommends be incorporated into Barrington's management plan regarding management of invasive species in the BPCA:

- Develop an overarching invasive species management plan for the BPCA (Section 4.1.5).
- Develop a project-specific invasive species control plan as a formal component of any development or activity planning. Invasive species are facilitated by several activities associated with development, including removal of vegetation, introduction of soils and fill, disturbance of substrate, fertilization, mowing and brush-cutting, and heavy foot traffic.
- Continue current efforts to investigate and prioritize recommendations outlined in the recent TMDL report (RIDEM 2007). Invasive wetland and aquatic species thrive on increased nutrients.
- Do not plant non-native vegetation within the BPCA.
- Develop and post signage at access points warning boaters and wading fishermen of the spread of invasive species via boats and boots.
- Regulate mowing and brush-cutting protocols to include the cleaning of equipment between sites.
- Discourage trailblazing.
- Ban the cutting, removal or introduction of live or dead vegetation to the conservation area.
- Avoid filling along the shoreline; this can be a vector and facilitator of invasive plant species, such as common reed.
- Minimize development of the properties and fragmentation by roads, and trails. Even non-raised trails can introduce and facilitate invasive plant species.
- Maintain and enforce a ban on the use of motor-powered vessels on Brickyard Pond. In addition to contributing to shoreline erosion, noise pollution, active disturbance, and

hydrocarbon pollution, outboard motors and boat trailers are vectors for invasive species dispersal.

- Maintain or increase measures to thwart illegal dumping within the BPCA to minimize the spread of invasive species.
- Develop and maintain targeted monitoring methods to assess habitat integrity in Brickyard Pond. Incorporate methods that will rapidly detect the introduction of non-native fish species.
- In efforts to preserve vistas, clearing and cutting of vegetation should be avoided or minimized. Clearing and cutting of vegetation can facilitate the establishment of invasive plant species.
- Maintain cooperation with RIDEM Division of Fish and Wildlife in efforts to control mute swan populations.

#### **4.2.9 Preservation of Native Vegetation**

Native vegetation provides necessary cover, structure, and forage to wildlife and maintains biological diversity. Because Brickyard pond and the surrounding properties within the BPCA have been heavily modified by historic activities, the habitats have been changing over time by natural succession. With succession comes a change in vegetation composition. Restoring conditions to support historic rare species that relied on historic habitats may not be practicable due to the threats of invasive species establishment, erosion, and other consequences of land clearing. RINHS recommends that the following policies be incorporated into Barrington's Management Plan: regarding the preservation of native vegetation as it relates to natural resources:

- Control the spread of invasive plant species by following recommendations given in this document. Invasive species pose a serious threat to native flora.
- Ban the cutting or removal of vegetation in the conservation area.
- Work with the New England Wildflower Society's Plant Conservation Volunteer (PCV) program to update the status of historic rare species and develop management plans regarding current element occurrences of rare plants.

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## Tables and Figures

### Tables

Table 1 Areas of habitat types and habitat systems occurring within the BPCA in 2008.

| Habitat Type                                 | Area (acres) | Cultural Cover              | Area (acres) |
|----------------------------------------------|--------------|-----------------------------|--------------|
| <b><i>Uplands</i></b>                        |              | Park Facilities             | 3.5          |
| Oak Forest                                   | 22.4         | Baseball Field              | 2.8          |
| Oak-Maple Forest                             | 21.6         | Skating Rink                | 0.9          |
| Mixed BLD Woodland                           | 17.4         | Paved Parking Lot           | 0.6          |
| Invasive Vineland                            | 12.7         | Gravel Parking Lot          | 0.3          |
| White Pine Stand                             | 1.4          | Mowed Lawn                  | 0.2          |
| <b>Total Uplands</b>                         | <b>75.5</b>  | Utility Corridor (Forbs)    | 1.2          |
|                                              |              | <b>Total Cultural Cover</b> | <b>9.6</b>   |
| <b><i>Palustrine Wetlands</i></b>            |              |                             |              |
| Red Maple/Shrub Swamp                        | 34.1         |                             |              |
| Vernal Pool                                  | 5.0          |                             |              |
| Red Maple Depression Swamp                   | 3.4          |                             |              |
| Man-made Pond                                | 0.5          |                             |              |
| Pond                                         | 0.3          |                             |              |
| <b>Total Palustrine</b>                      | <b>43.4</b>  |                             |              |
| <b><i>Lacustrine Waters and Wetlands</i></b> |              |                             |              |
| Shallow Lake                                 | 101.4        |                             |              |
| <b><i>Estuarine Waters</i></b>               |              |                             |              |
| Canal                                        | 0.4          |                             |              |
| <b>Total Waters</b>                          | <b>101.8</b> |                             |              |

**Table 2 List of invasive plant species of the BPCA and associated habitats.**

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|                                                     |                                                                                                            |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <i>Acer platanoides</i> (Norway Maple)              | Mixed BLD woodland                                                                                         |
| <i>Acer pseudoplatanus</i> (Sycamore Maple)         | Mixed BLD woodland<br>White pine stand                                                                     |
| <i>Ampelopsis brevipedunculata</i> (Porcelainberry) | Invasive vineland                                                                                          |
| <i>Berberis thunbergii</i> (Japanese Barberry)      | Red maple / shrub swamp                                                                                    |
| <i>Celastrus orbiculatus</i> (Oriental Bittersweet) | Invasive vineland<br>Mixed BLD woodland<br>Oak-maple forest<br>Red maple / shrub swamp<br>White pine stand |
| <i>Eleaagnus umbellata</i> (Autumn Olive)           | Invasive vineland<br>Mixed BLD woodland (inventory)<br>Red maple / shrub swamp                             |
| <i>Euonymus alatus</i> (Burning Bush)               | Oak forest                                                                                                 |
| <i>Ligustrum vulgare</i> (European Privet)          | Mixed BLD woodland                                                                                         |
| <i>Lonicera japonica</i> (Japanese Honeysuckle)     | Red maple / shrub swamp                                                                                    |
| <i>Lonicera morrowii</i> (Morrow's Honeysuckle)     | Invasive vineland<br>Oak-maple forest<br>Red maple / shrub swamp<br>White pine stand                       |
| <i>Phragmites australis</i> (Common Reed)           | Eutrophic lake<br>Mixed BLD woodland<br>Oak forest<br>Red maple / shrub swamp                              |
| <i>Polygonum cuspidatum</i> (Japanese Knotweed)     | Invasive vineland<br>Red maple depression swamp                                                            |
| <i>Rosa multiflora</i> (Multiflora Rose)            | Invasive vineland<br>Mixed BLD woodland<br>Oak-maple forest<br>Red maple / shrub swamp                     |
| <i>Solanum dulcamara</i> (Climbing Nightshade)      | Invasive vineland                                                                                          |

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**Table 3 Bird species tallies from a breeding bird point count conducted in the BPCA in June, 2008.**

| Bird Code    | Location |     |     |     |     |     | Common (Scientific) Name                                     |
|--------------|----------|-----|-----|-----|-----|-----|--------------------------------------------------------------|
|              | BY1      | BY2 | BY4 | BY5 | BY6 | BY7 | Total                                                        |
| AMGO         |          | 1   | 1   | 2   |     |     | 4 American Goldfinch ( <i>Carduelis tristis</i> )            |
| AMRE         |          |     | 1   |     | 1   |     | 2 American Redstart ( <i>Setophaga ruticilla</i> )           |
| AMRO         | 3        | 2   | 9   |     | 1   |     | 15 American Robin ( <i>Turdus migratorius</i> )              |
| BCC          |          |     | 1   |     |     | 1   | 2 Black-capped Chickadee ( <i>Poecile atricapillus</i> )     |
| BCNH*        | 3        | 1   |     |     |     |     | 4 Black-crowned Night Heron ( <i>Nycticorax nycticorax</i> ) |
| BLJA         |          | 1   |     |     |     | 1   | 2 Blue Jay ( <i>Cyanocitta cristata</i> )                    |
| CAWR         | 1        |     |     |     | 1   |     | 2 Carolina Wren ( <i>Thryothorus ludovicianus</i> )          |
| COYE*        |          |     | 1   |     |     |     | 1 Common Yellowthroat ( <i>Geothlypis trichas</i> )          |
| DOWO         |          |     | 2   |     |     | 1   | 3 Downy Woodpecker ( <i>Picoides pubescens</i> )             |
| EWPE         |          |     | 1   | 2   | 1   |     | 4 Eastern Wood Pewee ( <i>Contopus virens</i> )              |
| GBHE*        | 2        |     |     |     |     |     | 2 Great Blue Heron ( <i>Ardea herodias</i> )                 |
| GCFL*        |          |     |     |     | 1   |     | 1 Great Crested Flycatcher ( <i>Myiarchus crinitus</i> )     |
| GRCA         |          | 3   | 5   | 1   | 4   | 1   | 14 Gray Catbird ( <i>Dumetella carolinensis</i> )            |
| GREG*        | 2        |     |     |     |     |     | 2 Great Egret ( <i>Ardea alba</i> )                          |
| HAWO*        | 1        |     |     |     |     |     | 1 Hairy Woodpecker ( <i>Picoides villosus</i> )              |
| HOFI         | 1        | 1   | 3   |     |     |     | 5 House Finch ( <i>Carpodacus mexicanus</i> )                |
| HOWR         |          |     |     |     | 2   |     | 2 House Wren ( <i>Troglodytes aedon</i> )                    |
| MODO         |          |     | 1   |     |     |     | 1 Mourning Dove ( <i>Zenaida macroura</i> )                  |
| NOCA         |          | 1   | 2   | 1   |     |     | 4 Northern Cardinal ( <i>Cardinalis cardinalis</i> )         |
| NOFL*        |          |     | 1   |     |     | 1   | 2 Northern Flicker ( <i>Colaptes auratus</i> )               |
| EAPH         |          |     |     |     |     | 1   | 1 Eastern Pheobe ( <i>Sayornis phoebe</i> )                  |
| PIWA         |          |     | 1   |     |     |     | 1 Pine Warbler ( <i>Dendroica pinus</i> )                    |
| REVE         |          |     |     | 1   | 2   |     | 3 Red-eyed Vireo ( <i>Vireo olivaceus</i> )                  |
| SOSP         |          | 1   | 1   |     |     |     | 2 Song Sparrow ( <i>Melospiza melodia</i> )                  |
| TUTI         |          |     |     |     |     | 2   | 2 Tufted Titmouse ( <i>Baeolophus bicolor</i> )              |
| VEER         |          |     |     |     | 1   |     | 1 Veery ( <i>Catharus fuscescens</i> )                       |
| NOWA*        |          |     |     |     | 1   |     | 1 Northern Waterthrush ( <i>Seiurus noveboracensis</i> )     |
| WBNU         |          |     |     |     |     | 1   | 1 White-breasted Nuthatch ( <i>Sitta carolinensis</i> )      |
| YEWA*        |          | 1   | 1   | 1   | 1   | 1   | 5 Yellow Warbler ( <i>Dendroica petechia</i> )               |
| Sp. Richness | 7        | 9   | 15  | 6   | 11  | 9   | 29                                                           |
| Tally        | 13       | 12  | 31  | 8   | 16  | 10  | 90                                                           |

\*Identified as species of greatest conservation need (GCN) by RIDEM (2005).

**Table 4 Bird tallies from opportunistic surveys conducted at the BPCA in June 2008.**

| Closest Sampling Location | Common Name                | Species                      | State Abundance | Status                      | Evidence | Number Observed |
|---------------------------|----------------------------|------------------------------|-----------------|-----------------------------|----------|-----------------|
| Oak Forest                | Eastern Wood Pewee         | <i>Contopus virens</i>       | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Oak Forest (BY5)          | Northern Flicker*          | <i>Colaptes auratus</i>      | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Oak Forest (BY5)          | Red-bellied Woodpecker     | <i>Melanerpes carolinus</i>  | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Oak Forest (BY5)          | Yellow Warbler*            | <i>Dendroica petechia</i>    | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Oak Forest (BY5)          | Northern Cardinal          | <i>Cardinalis cardinalis</i> | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Oak Forest (BY5)          | American Goldfinch         | <i>Carduelis tristis</i>     | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Red Maple Swamp (BY6)     | Downy Woodpecker           | <i>Picoides pubescens</i>    | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Red Maple Swamp (BY6)     | Tufted Titmouse            | <i>Parus bicolor</i>         | Common          | Breeding; Migrant / visitor | Sound    | 1               |
| Red Maple Swamp (BY6)     | House Wren                 | <i>Troglodytes aedon</i>     | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Red Maple Swamp (BY6)     | White-breasted Nuthatch    | <i>Sitta carolinensis</i>    | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Red Maple Swamp (BY6)     | Great Blue Heron*          | <i>Ardea herodias</i>        | Present         | Breeding; Migrant / visitor | Sight    | 3               |
| Lake edge                 | Song Sparrow               | <i>Melospiza melodia</i>     | Common          | Breeding; Migrant / visitor | Sight    | 1               |
| Lake                      | Common Loon                | <i>Gavia immer</i>           | Common          | Migrant / visitor           | Sight    | 1               |
| Lake                      | Mute Swan                  | <i>Cygnus olor</i>           | Common          | Resident-introduced (1923)  | Sight    | 1               |
| Lake edge                 | Hairy Woodpecker           | <i>Picoides villosus</i>     | Present         | Breeding; Migrant / visitor | Sound    | 1               |
| Legion Way (BY2)          | Great Egret*               | <i>Ardea alba</i>            | Present         | Breeding; Migrant / visitor | Sight    | 1               |
| Legion Way (BY2)          | Black-crowned Night Heron* | <i>Nycticorax nycticorax</i> | Present         | Breeding; Migrant / visitor | Sight    | 2               |
| Legion Way (BY2)          | Green Heron                | <i>Butorides virescens</i>   | Present         | Breeding; Migrant / visitor | Sight    | 2               |
| Legion Way (BY2)          | Canada Goose               | <i>Branta canadensis</i>     | Common          | Breeding; Migrant / visitor | Sight    | 1               |
| Legion Way (BY2)          | Osprey*                    | <i>Pandion haliaetus</i>     | Present         | Breeding; Migrant / visitor | Sight    | 1               |
| Bike Path                 | American Redstart          | <i>Setophaga ruticilla</i>   | Present         | Breeding; Migrant / visitor | Sight    | 1               |

\*Identified as species of greatest conservation need (GCN) by RIDEM (2005).

**Table 5 Bird tallies from opportunistic surveys conducted at the BPCA in September 2008.**

| Closest Sampling Location | Common Name                | Scientific Name              | State Abundance  | Status                      | Evidence | Number Observed |
|---------------------------|----------------------------|------------------------------|------------------|-----------------------------|----------|-----------------|
| Bike path                 | Great Blue Heron*          | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 5               |
| Pond-west                 | American Black Duck        | <i>Anas rubripes</i>         | Present / common | Breeding; Migrant / visitor | Sight    | 3               |
| Pond-west                 | Black-crowned Night Heron* | <i>Nycticorax nycticorax</i> | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-west                 | Mute Swan                  | <i>Cygnus olor</i>           | Common           | Resident-introduced (1923)  | Sight    | 15              |
| Pond-south                | Belted Kingfisher*         | <i>Megasceryle alcyon</i>    | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-south                | Double-crested Cormorant*  | <i>Phalacrocorax auritus</i> | Present / common | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-south                | Great Blue Heron*          | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-south                | Laughing Gull              | <i>Larus atricilla</i>       | Present          | Migrant / visitor           | Sight    | 1               |
| Pond-north                | American Black Duck*       | <i>Anas rubripes</i>         | Present / common | Breeding; Migrant / visitor | Sight    | 3               |
| Pond-north                | Belted Kingfisher*         | <i>Megasceryle alcyon</i>    | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-north                | Green-winged Teal*         | <i>Anas crecca</i>           | Rare / present   | Breeding; Migrant / visitor | Sight    | 2               |
| Pond-north                | Double-crested Cormorant*  | <i>Phalacrocorax auritus</i> | Present / common | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-north                | Great Blue Heron*          | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-north                | Mallard                    | <i>Anas platyrhynchos</i>    | Common           | Breeding; Migrant / visitor | Sight    | 5               |
| Legion Way                | Belted Kingfisher*         | <i>Megasceryle alcyon</i>    | Present          | Breeding; Migrant / visitor | Sight    | 1               |

\*Identified as species of greatest conservation need (GCN) by RIDEM (2005).

**Table 6 Bird tallies from opportunistic surveys conducted at the BPCA in November 2008.**

| Closest Sampling Location | Common Name               | Scientific Name              | State Abundance  | Status                      | Evidence | Number Observed |
|---------------------------|---------------------------|------------------------------|------------------|-----------------------------|----------|-----------------|
| Bike path (N-NW)          | Black-capped Chickadee    | <i>Parus atricapillus</i>    | Common           | Breeding; Migrant / visitor | Sound    | 3               |
| Bike path (NE)            | Red-bellied Woodpecker    | <i>Melanerpes carolinus</i>  | Present          | Breeding; Migrant / visitor | Sound    | 1               |
| Pond-west                 | American Crow             | <i>Corvus brachyrhynchos</i> | Common           | Breeding; Migrant / visitor | Sound    | 1               |
| Pond-west                 | Belted Kingfisher*        | <i>Megasceryle alcyon</i>    | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-west                 | Blue Jay                  | <i>Cyanocitta cristata</i>   | Common           | Breeding; Migrant / visitor | Sound    | 1               |
| Pond-west                 | Double-crested Cormorant* | <i>Phalacrocorax auritus</i> | Present / common | Breeding; Migrant / visitor | Sight    | 4               |
| Pond-west                 | Great Blue Heron*         | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 6               |
| Pond-west                 | Mallard                   | <i>Anas platyrhynchos</i>    | Common           | Breeding; Migrant / visitor | Sight    | 2               |
| Pond-west                 | Mute Swan                 | <i>Cygnus olor</i>           | Common           | Resident-introduced (1923)  | Sight    | 1               |
| Pond-north                | Belted Kingfisher*        | <i>Megasceryle alcyon</i>    | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-north                | Great Blue Heron*         | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 2               |
| Pond-north                | Mallard                   | <i>Anas platyrhynchos</i>    | Common           | Breeding; Migrant / visitor | Sight    | 2               |
| Pond-north                | Mute Swan                 | <i>Cygnus olor</i>           | Common           | Resident-introduced (1923)  | Sight    | 2               |
| Pond-south                | Great Blue Heron*         | <i>Ardea herodias</i>        | Present          | Breeding; Migrant / visitor | Sight    | 1               |
| Pond-south                | Hairy Woodpecker*         | <i>Picoides villosus</i>     | Present          | Breeding; Migrant / visitor | Sound    | 1               |
| Pond-south                | Mute Swan                 | <i>Cygnus olor</i>           | Common           | Resident-introduced (1923)  | Sight    | 1               |
| Pond-central              | Common Goldeneye          | <i>Bucephala clangula</i>    | Present          | Migrant / visitor           | Sight    | 10              |
| Pond-central              | Ring-billed Gull          | <i>Larus delawarensis</i>    | Common           | Migrant / visitor           | Sight    | 29              |
| Flight                    | Double-crested Cormorant* | <i>Phalacrocorax auritus</i> | Present / common | Breeding; Migrant / visitor | Sight    | 10              |
| Flight                    | Turkey Vulture            | <i>Cathartes aura</i>        | Present          | Breeding; Migrant / visitor | Sight    | 1               |

\*Identified as species of greatest conservation need (GCN) by RIDEM (2005).

**Table 7 Herptile data collected by RIDEM DFW at the BPCA.**

| Common Name            | Scientific Name            | State Abundance | Historic   | Breeding | Data Source | Survey dates    | Number Observed |
|------------------------|----------------------------|-----------------|------------|----------|-------------|-----------------|-----------------|
| Common snapping turtle | <i>Chelydra serpentina</i> | Common          | Native     | Breeding | RIDEM DFW   | May, 1991       | 1               |
| Common snapping turtle | <i>Chelydra serpentina</i> | Common          | Native     | Breeding | RIDEM DFW   | September, 2002 | 1               |
| Eastern painted turtle | <i>Chrysemys picta</i>     | Common          | Native     | Breeding | RIDEM DFW   | May, 1991       | 4               |
| Redback salamander     | <i>Plethodon cinereus</i>  | Common          | Native     | Breeding | RIDEM DFW   | April, 1987     | 3               |
| Red-eared slider       | <i>Trachemys scripta</i>   | Rare/unusual    | Introduced | Breeding | RIDEM DFW   | April, 2000     | 1               |

**Table 8 Mammals thought to occupy habitats of the BPCA.**

| Common Name           | Scientific Name                 | State Abundance | Historic              | Breeding | Data Source | Survey dates | Number Observed |
|-----------------------|---------------------------------|-----------------|-----------------------|----------|-------------|--------------|-----------------|
| American Mink         | <i>Mustela vison</i>            | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Common Gray Fox       | <i>Urocyon cinereoargenteus</i> | Present         | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Common Raccoon        | <i>Procyon lotor</i>            | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Coyote                | <i>Canis latrans</i>            | Common          | Recent arrival        | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Eastern Cottontail    | <i>Sylvilagus floridanus</i>    | Common          | Native                | Breeding | RINHS       | June, 2008   | 4               |
| Eastern Gray Squirrel | <i>Sciurus carolinensis</i>     | Common          | Native                | Breeding | RINHS       | June, 2008   | 2               |
| Eastern Chipmunk      | <i>Tamias striatus</i>          | Common          | Native                | Breeding | RINHS       | June, 2008   | 1               |
| Meadow Vole           | <i>Microtus pennsylvanicus</i>  | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Northern River Otter  | <i>Lontra canadensis</i>        | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Red Fox               | <i>Vulpes vulpes</i>            | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Striped Skunk         | <i>Mephitis mephitis</i>        | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Virginia Opossum      | <i>Didelphis virginiana</i>     | Common          | Recent arrival (1957) | Breeding | RIDEM DFW*  | N/A          | N/A             |
| White-footed Mouse    | <i>Peromyscus leucopus</i>      | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| White-tailed Deer     | <i>Odocoileus virginianus</i>   | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |
| Woodchuck             | <i>Marmota monax</i>            | Common          | Native                | Breeding | RIDEM DFW*  | N/A          | N/A             |

\*Anecdotal information (C. Brown, RIDEM DFW, Personal Communication).

**Table 9 Fish survey data provided by RIDEM Division of Fish and Wildlife.**

**Pond Name/Station No.:** Brickyard Pond/9.b.22  
**Station Location:** Barrington  
**Sample Date:** 1 May 01  
**Sampling Duration (s):** 5001  
**Land Use:** Suburban  
**Temperature (°C) Air/H2O:** 17/18.4  
**DO (mg/l):** 10.27 **pH:** 7.80 **Conductivity (uS/cm):** 3440  
**Dominate Substrate Types (%):**  
 Unknown because of high turbidity.

| <u>Species</u>   | <u>N</u> | <u>Total Length (mm)</u> |           |
|------------------|----------|--------------------------|-----------|
|                  |          | <u>Mean (Range)</u>      |           |
| bluegill         | 191      | 107                      | (44-160)  |
| pumpkinseed      | 21       | 101                      | (84-135)  |
| largemouth bass  | 18       | 315                      | (137-469) |
| alewife          | 12       | 264                      | (253-282) |
| common carp      | 11       | 564                      | (530-598) |
| yellow perch     | 9        | 183                      | (128-309) |
| American eel     | 4        | 246                      | (165-308) |
| black crappie    | 3        | 209                      | (184-252) |
| banded killifish | 1        | 86                       |           |
| brown bullhead   | 1        | 268                      |           |
| brown trout      | 1        | 362                      |           |
| chain pickerel   | 1        | 211                      |           |
| golden shiner    | 1        | 173                      |           |

**Table 10 Odonate data collected between May 1998 and June 2004 by Odonate Atlas of RI at the BPCA.**

| <b>Scientific Name</b>          | <b>Common Name</b>       | <b>BP</b> | <b>KS</b> | <b>Total</b> |
|---------------------------------|--------------------------|-----------|-----------|--------------|
| <i>Aeshna tuberculifera</i>     | Black-tipped Darner      |           | 2         | 2            |
| <i>Anax junius</i>              | Common Green Darner      | 1         | 1         | 2            |
| <i>Arigomphus villosipes</i>    | Unicorn Clubtail         |           | 1         | 1            |
| <i>Celithemis elisa</i>         | Calico Pennant           |           | 1         | 1            |
| <i>Celithemis martha</i>        | Martha's Pennant         |           | 2         | 2            |
| <i>Enallagma aspersum</i>       | Azure Bluet              |           | 5         | 5            |
| <i>Enallagma civile</i>         | Familiar Bluet           | 7         | 4         | 11           |
| <i>Enallagma durum</i>          | Big Bluet                | 1         |           | 1            |
| <i>Enallagma geminatum</i>      | Skimming Bluet           | 2         |           | 2            |
| <i>Enallagma signatum</i>       | Orange Bluet             | 2         |           | 2            |
| <i>Enallagma traviatum</i>      | Slender Bluet            | 1         |           | 1            |
| <i>Epithea princeps</i>         | Prince Baskettail        | 2         |           | 2            |
| <i>Erythemis simplicicollis</i> | Eastern Pondhawk         |           | 1         | 1            |
| <i>Erythrodiplax berenice</i>   | Seaside Dragonlet        | 1         | 3         | 4            |
| <i>Ischnura hastata</i>         | Citrine Forktail         | 1         | 4         | 5            |
| <i>Ischnura posita</i>          | Fragile Forktail         | 4         |           | 4            |
| <i>Ischnura ramburii</i>        | Rambur's Forktail        |           | 1         | 1            |
| <i>Ischnura verticalis</i>      | Eastern Forktail         | 1         | 1         | 2            |
| <i>Lestes congener</i>          | Spotted Spreadwing       |           | 7         | 7            |
| <i>Lestes forcipatus</i>        | Sweetflag Spreadwing     |           | 6         | 6            |
| <i>Lestes rectangularis</i>     | Slender Spreadwing       | 2         |           | 2            |
| <i>Leucorrhinia intacta</i>     | Dot-tailed Whiteface     |           | 2         | 2            |
| <i>Libellula cyanea</i>         | Spangled Skimmer         |           | 1         | 1            |
| <i>Libellula incesta</i>        | Slaty Skimmer            |           | 3         | 3            |
| <i>Libellula lydia</i>          | Common Whitetail         |           | 2         | 2            |
| <i>Libellula needhami</i>       | Needham's Skimmer        |           | 2         | 2            |
| <i>Libellula pulchella</i>      | Twelve-spotted Skimmer   |           | 2         | 2            |
| <i>Libellula quadrimaculata</i> | Four-spotted Skimmer     |           | 2         | 2            |
| <i>Pantala flavescens</i>       | Wandering Glider         |           | 1         | 1            |
| <i>Sympetrum internum</i>       | Cherry-faced Meadowhawk  |           | 2         | 2            |
| <i>Sympetrum vicinum</i>        | Yellow-legged Meadowhawk |           | 7         | 7            |
| <i>Tamea carolina</i>           | Carolina Saddlebags      |           | 1         | 1            |
| <i>Tamea lacerata</i>           | Black Saddlebags         |           | 2         | 2            |
| <b>Number of individuals</b>    |                          | <b>25</b> | <b>66</b> | <b>91</b>    |
| <b>Species Richness</b>         |                          | <b>12</b> | <b>26</b> | <b>33</b>    |

BP: Brickyard Pond

KS: Kent Street Skating Pond

**Table 11 Land use and land cover occurring within 1.0 Km of the BPCA in 2004. Data derived from RIGIS 2003-04 LCLU (2008).**

| <b>Land Use / Land Cover Class</b> | <b>Area (acres)</b> | <b>% of Buffer</b> | <b>Land Use / Land Cover Class</b> | <b>Area (acres)</b> | <b>% of Buffer</b> |
|------------------------------------|---------------------|--------------------|------------------------------------|---------------------|--------------------|
| <b><i>Developed Land</i></b>       |                     |                    | <b><i>Natural Land</i></b>         |                     |                    |
| High Density Residential           | 26                  | 2                  | Brushland                          | 6                   | 0                  |
| Medium High Density Residential    | 490                 | 29                 | Deciduous Forest                   | 274                 | 16                 |
| Medium Density Residential         | 398                 | 24                 | Softwood Forest                    | 11                  | 1                  |
| Medium Low Density Residential     | 4                   | 0                  | Mixed Forest                       | 5                   | 0                  |
| Low Density Residential            | 4                   | 0                  | Fresh Water                        | 47                  | 3                  |
| Commercial                         | 67                  | 4                  | Wetland                            | 67                  | 4                  |
| Industrial                         | 5                   | 0                  | Beaches                            | 12                  | 1                  |
| Waste Disposal                     | 9                   | 1                  | <b>Total Natural Land</b>          | <b>421</b>          | <b>25</b>          |
| Developed Recreation               | 138                 | 8                  | <b><i>Barren Land</i></b>          |                     |                    |
| Vacant Land                        | 2                   | 0                  | Mixed Barren Areas                 | 14                  | 1                  |
| Cemeteries                         | 19                  | 1                  | <b>Total Barren Land</b>           | <b>14</b>           | <b>1</b>           |
| Institutional                      | 41                  | 2                  |                                    |                     |                    |
| <b>Total Developed Land</b>        | <b>1203</b>         | <b>71</b>          |                                    |                     |                    |
| <b><i>Agricultural Land</i></b>    |                     |                    |                                    |                     |                    |
|                                    | <b>Area (acres)</b> |                    |                                    |                     |                    |
| Pasture                            | 41                  | 2                  |                                    |                     |                    |
| Cropland                           | 4                   | 0                  |                                    |                     |                    |
| <b>Total Agricultural Land</b>     | <b>45</b>           | <b>3</b>           |                                    |                     |                    |

## Figures



**Figure 1 BPCA points of reference.**

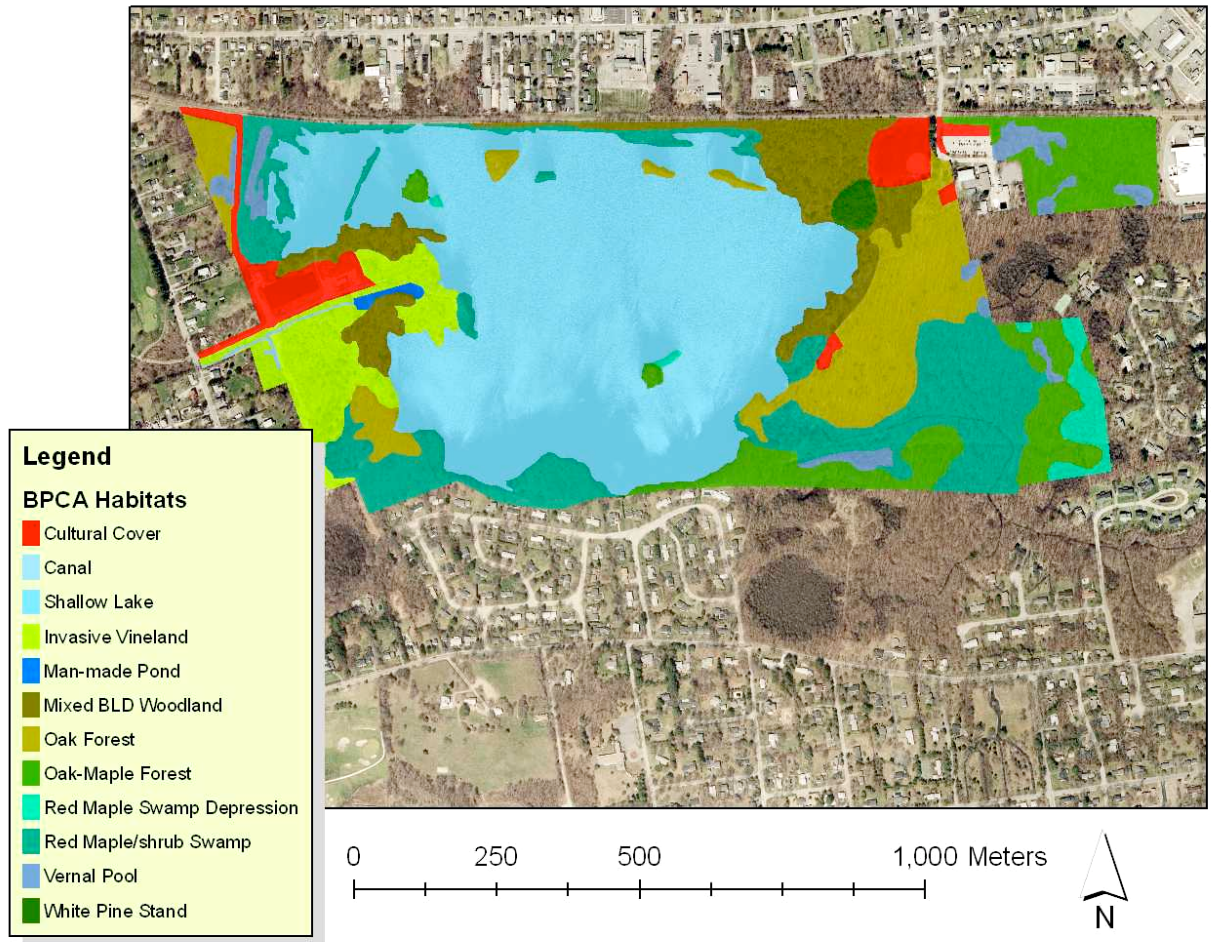


Figure 2 Habitat types and cultural land cover occurring within the BPCA in 2008.

## Brickyard Pond Conservation Area Soils

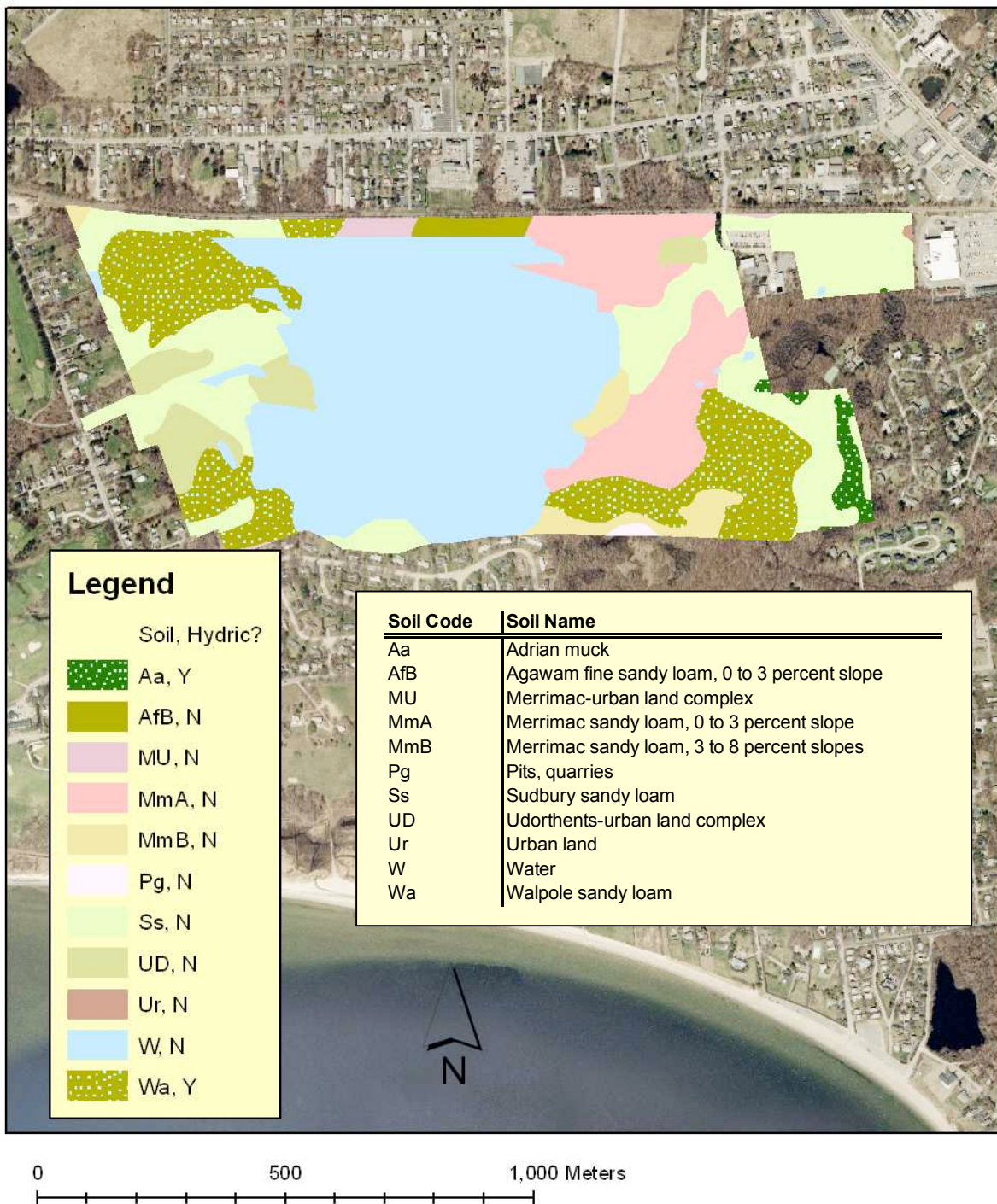


Figure 3 Soils of the BPCA (RIGIS 2008).



Figure 4 1972 aerial photo depicting sites of relatively recent habitat disturbance at BPCA.

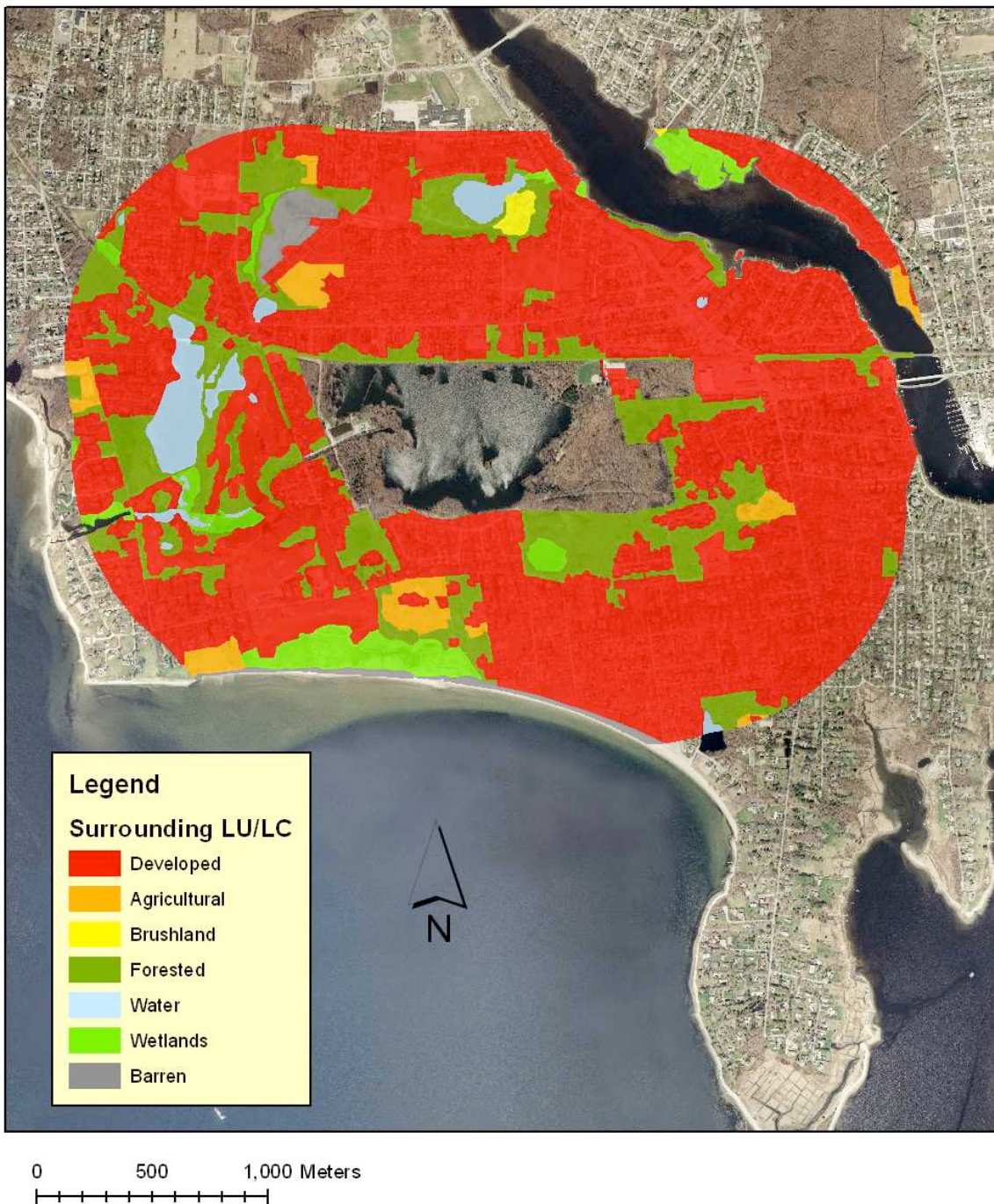


Figure 5 Red dots indicate small incursions of the invasive grass common reed (*Phragmites australis*).



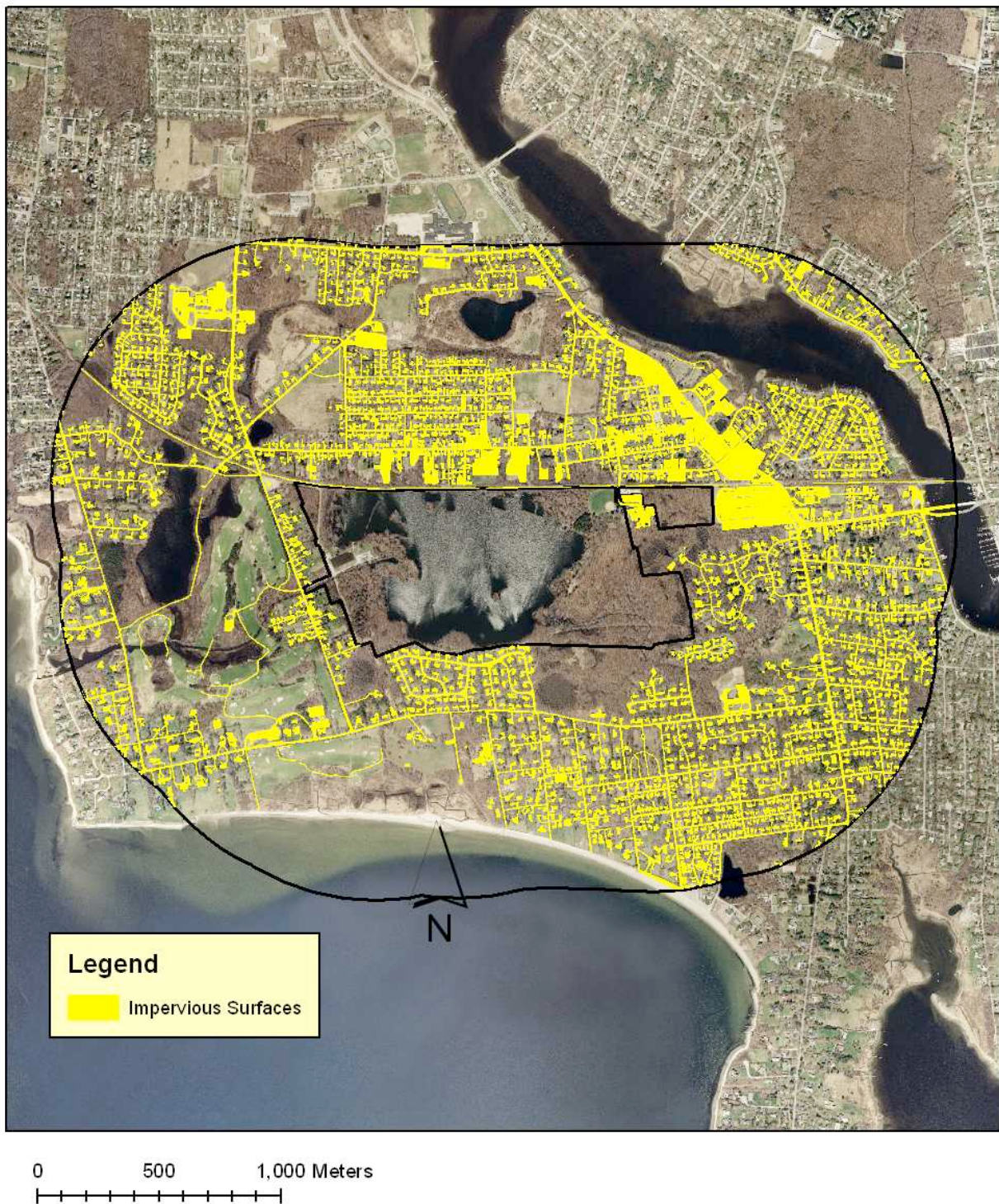
**Figure 6 BPCA 2008 breeding songbird point count sample stations.**

## Brickyard Pond Conservation Area Surrounding Land Use / Land Cover



**Figure 7** Land use and land cover occurring within 1.0 Km of the BPCA in 2004. Data derived from RIGIS 2003-04 LCLU (2008).

## Brickyard Pond Conservation Area Surrounding Impervious Surface



**Figure 8** Impervious surfaces occurring within 1.0 Km of the BPCA in 2004. Data derived from RIGIS 2003-04 Impervious (2008).

## Appendices

### Appendix 1. Water Impairments

[http://oaspub.epa.gov/waters/enviro.control?p\\_list\\_id=RI0007020L-02](http://oaspub.epa.gov/waters/enviro.control?p_list_id=RI0007020L-02)

Listed Water Information

CYCLE : 2006

Click [here](#) to see metadata for this report.

Cycle: 2006 State: RI List ID: RI0007020L-02

Waterbody Name: BRICKYARD POND

State Basin Name: NARRAGANSETT BASIN

Listed Water Map Link: [MAP 303\(d\)](#)

Other Impaired Water 303(d) List Information

The most current report available for this water body is 2006.

Data are also available for these years: [2004](#) [2002](#)

Comments:

GROUP 2

State List IDs:

| Cycle | State List ID |
|-------|---------------|
| 2002  | RI0007020L-02 |
| 2004  | RI0007020L-02 |

State Impairments:

| State Impairment     | Parent Impairment                   | Priority | Rank | Targeted Flag | Anticipated TMDL Submittal |
|----------------------|-------------------------------------|----------|------|---------------|----------------------------|
| LOW DISSOLVED OXYGEN | ORGANIC ENRICHMENT/OXYGEN DEPLETION |          |      |               |                            |
| PHOSPHORUS           | NUTRIENTS                           |          |      |               |                            |

Total Maximum Daily Load (TMDL) Information:

| TMDL Document Name             | Status               | Actual TMDL Establishment Date | TMDL Pollutant Description | TMDL Pollutant Test   | Cycles Listed    | State Impairment     |
|--------------------------------|----------------------|--------------------------------|----------------------------|-----------------------|------------------|----------------------|
| <a href="#">BRICKYARD POND</a> | APPROVED/ESTABLISHED | SEP-27-2007                    | TOTAL PHOSPHORUS           | POINT/NONPOINT SOURCE | 2006, 2004, 2002 | LOW DISSOLVED OXYGEN |
| <a href="#">BRICKYARD POND</a> | APPROVED/ESTABLISHED | SEP-27-2007                    | TOTAL PHOSPHORUS           | POINT/NONPOINT SOURCE | 2006, 2004, 2002 | PHOSPHORUS           |

Watershed Information:

| Watershed Name | Watershed States           |
|----------------|----------------------------|
| NARRAGANSETT   | MASSACHUSETTS RHODE ISLAND |

## Detailed TMDL Report

### TMDL Document Information

TMDL ID: 33491 TMDL Name: BRICKYARD POND  
TMDL Status: APPROVED/ESTABLISHED EPA Action: EPA APPROVED  
Lead State: RI TMDL Date: 09/27/2007

No TMDL Documents have been uploaded for this TMDL.

### TMDL Pollutants

Pollutant: TOTAL PHOSPHORUS TMDL Type: POINT/NONPOINT SOURCE  
Total Waste Load Allocation: Total Load Allocation:  
Margin Of Safety: Implicit Margin Of Safety: Not Reported  
Units for Total Waste Load Allocation, Total Load Allocation, and Margin of Safety:  
TMDL End Point: 20 UG/L PHOSPHORUS

There was no detailed NPDES Waste Load Allocation entered for this TMDL. Detailed information may be present in the actual TMDL Document

Listed Water Causes of Impairment for TOTAL PHOSPHORUS  
Click on the underlined List ID for a Listed Water Information Report.

| List ID                       | State List ID | Waterbody Name | Listed Water Map           | Cycles Listed    | Cause of Impairment  |
|-------------------------------|---------------|----------------|----------------------------|------------------|----------------------|
| <a href="#">RI0007020L-02</a> |               | BRICKYARD POND | <a href="#">MAP 303(d)</a> | 2006             | PHOSPHORUS           |
| <a href="#">RI0007020L-02</a> |               | BRICKYARD POND | <a href="#">MAP 303(d)</a> | 2006, 2004, 2002 | LOW DISSOLVED OXYGEN |

### Metadata Page for TMDL\_REPORT

| Column Name    | Definition                                                                                                                                                                                                                    |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cycle          | The year associated with the list or assessment (e.g., 1996, 1998, 2000).                                                                                                                                                     |
| Impairment     | Description of the cause of impairment (or TMDL pollutant). This value is reported by the state.                                                                                                                              |
| List ID        | Unique ID assigned to each state listing. The first two characters are the state abbreviation. The middle characters are the water's Waterbody System ID, another state-derived ID, or an arbitrary ID assigned by the state. |
| Pollutant      | Pollutant for which the TMDL has been developed.                                                                                                                                                                              |
| Waterbody Name | The name of the waterbody (e.g., Mississippi River).                                                                                                                                                                          |

## Appendix 2. Historic Rare Plant Species of BPCA

### *Aletris farinosa* (Colic-root, Stargrass)

| Species Status     | Population Status | Last Observed | Last Survey |
|--------------------|-------------------|---------------|-------------|
| Species of Concern | Historical        | 07-1906       | 07-1906     |

Specimen was collected in July 1906 by E.S. Reynolds and deposited at Brown Herbarium. Locality notes for this specimen read: “grassy banks of railroad.” The population was mapped along the railroad line north of Brickyard Pond, although the exact location of the original collection site is unknown.

It is recommended that a thorough search for this species is conducted to determine if this population, or adequate habitat for these plants, still exists.

**Preferred Habitat:** Grows in moist or dry peat and sandy soils (Foster and Duke 1990). It is found in rich sandy woods and thickets and dry to mesic prairies (NatureServe, 2008).

**Threats:** Commercial interest in this slow-growing species as a medicinal plant may be a threat to wild populations. Some cultivated material is traded, but a majority of the supply of roots is wild-collected. This species is also threatened by land conversion and accompanying hydrologic changes. (NatureServe, 2008).



***Anemone cylindrica* (Thimbleweed, Long-headed or Long-fruited Anemone)**

| Species Status     | Population Status | Last Observed | Last Survey |
|--------------------|-------------------|---------------|-------------|
| Species of Concern | Historical        | 06-1906       | 06-1906     |

Specimen was collected in June 1906 by E.S. Reynolds and deposited at Brown Herbarium. Locality notes for this specimen read: “along railroad.” The population was mapped along the railroad line north of Brickyard Pond, although the exact location of the original collection site is unknown.

It is recommended that a thorough search for this species is conducted to determine if this population, or adequate habitat for these plants, still exists.

**Preferred Habitat:** Dry open woods, slopes, prairies, along RR grades (NatureServe, 2008).

**Threats:** Commercial interest in this slow-growing species as a medicinal plant may be a threat to wild populations. Some cultivated material is traded, but a majority of the supply of roots is wild-collected. This species is also threatened by land conversion and accompanying hydrologic changes. (NatureServe, 2008).



***Calopogon tuberosus* (Grass-pink, Swamp-pink)**

| Species Status     | Population Status | Last Observed | Last Survey |
|--------------------|-------------------|---------------|-------------|
| Species of Concern | Historical        | 07-1906       | 07-1906     |

Specimens were collected in July 1906 by E.S. Reynolds and deposited at Brown Herbarium and the New England Botanical Garden. Locality notes for this specimen read: “Nayatt station, railroad ditch”, though the population was mapped along the railroad line north of Brickyard Pond.

It is recommended that a thorough search for this species is conducted to determine if this population, or adequate habitat for these plants, still exists.

**Preferred Habitat:** A diverse range of open, wet situations w/ only apparent common factors being full sun light & constant water supply (NatureServe, 2008).

**Threats:** Habitat destruction and over collection (NatureServe, 2008).



**Appendix 3 Historic trends in Barrington avifauna from 1981-2000  
(Starring 2008).**

**Non-Migratory Species  
Increasing / Decreasing  
(1981-2000)**

| INCREASING SPECIES      | NAI | DECREASING SPECIES | NAD |
|-------------------------|-----|--------------------|-----|
| GREAT HORNED OWL        | 1   | AMERICAN KESTREL   | 1   |
| RED-BREASTED NUTHATCH   | 1   | BOBWHITE           | 1   |
| RED-TAILED HAWK         | 2   | CANADA GOOSE       | 1   |
| BLUE-JAY                | 3   | CHICKADEE          | 1   |
| CANADA GOOSE            | 4   | DOWNY WOODPECKER   | 1   |
| HOUSE FINCH             | 4   | FLICKER            | 1   |
| MOCKINGBIRD             | 4   | MARSH HAWK         | 1   |
| MOURNING DOVE           | 4   | RED-TAILED HAWK    | 1   |
| MUTE SWAN               | 4   | FIELD SPARROW      | 2   |
| STARLING                | 4   | PURPLE FINCH       | 2   |
| FLICKER                 | 5   | RB NUTHATCH        | 2   |
| SONG SPARROW            | 5   | TUFTED TITMOUSE    | 2   |
| DOWNY WOODPECKER        | 6   | BLACK-BACKED GULL  | 3   |
| RED-BELLIED WOODPECKER  | 6   | SONG SPARROW       | 3   |
| TUFTED TITMOUSE         | 6   | BLUE-JAY           | 4   |
| CHICKADEE               | 7   | HOUSE FINCH        | 4   |
| HOUSE SPARROW           | 7   | MOCKINGBIRD        | 4   |
| MALLARD                 | 7   | MOURNING DOVE      | 4   |
| WHITE-BREASTED NUTHATCH | 7   | STARLING           | 4   |
| CARDINAL                | 8   | BLACK DUCK         | 5   |
| CAROLINA WREN           | 8   | HAIRY WOODPECKER   | 8   |
| CROW                    | 8   | HERRING GULL       | 8   |
| GOLDFINCH               | 8   | RN PHEASANT        | 8   |
|                         |     | ROCK DOVE          | 8   |

LEGEND: NAI=Number areas increasing; NAD=Number of areas Decreasing. (SEE TABLES 12,15,18,21,24,27,30 AND 33 FOR MORE SPECIFIC DATA ON IDENTIFIED NON-MIGRATORY SPECIES AND THEIR COUNTS)

North American Migrants  
Increasing / Decreasing  
(1981-2000)

| INCREASING SPECIES       | NAI | DECREASING SPECIES     | NAD |
|--------------------------|-----|------------------------|-----|
| AMERICAN BITTERN         | 1   | AMERICAN WIDGEON       | 1   |
| AMERICAN COOT            | 1   | BLACK-HEADED GULL      | 1   |
| AMERICAN WIDGEON         | 1   | BROWN CREEPER          | 1   |
| CEDAR WAXWING            | 1   | EASTERN PHOEBE         | 1   |
| DOUBLE-CRESTED CORMORANT | 1   | EVENING GROSBEAK       | 1   |
| GADWALL                  | 1   | GREATER YELLOWLEGS     | 1   |
| GRACKLE                  | 1   | GREEN WINGED TEAL      | 1   |
| GREATER YELLOWLEGS       | 1   | IBIS                   | 1   |
| GREEN HERON              | 1   | KING RAIL              | 1   |
| JUNCO                    | 1   | LEAST BITTERN          | 1   |
| LESSER SCAUP             | 1   | LESSER YELLOWLEGS      | 1   |
| LESSER YELLOWLEGS        | 1   | LITTLE BLUE HERON      | 1   |
| RED-BREASTED MERGANSER   | 1   | MARSH WREN             | 1   |
| RED-WINGED BLACKBIRD     | 1   | RB MERGANSER           | 1   |
| SHOVLER                  | 1   | RUDDY DUCK             | 1   |
| SNOWY EGRET              | 1   | SHORT BILLED DOWITCHER | 1   |
| SPOTTED SANDPIPER        | 1   | SNOW GOOSE             | 1   |
| WHITE-EYED VIREO         | 1   | WHITE-EYED VIREO       | 1   |
| WOOD THRUSH              | 1   | BLUE-WINGED TEAL       | 2   |
| YELLOW WARBLER           | 1   | BROWN THRASHER         | 2   |
| COMMON MERGANSER         | 2   | CANVASBACK             | 2   |
| GREAT BLUE HERON         | 2   | CAPE MAY WARBLER       | 2   |
| IBIS                     | 2   | CATTLE EGRET           | 2   |

|              |   |                      |   |
|--------------|---|----------------------|---|
| KILLDEER     | 2 | CLAPPER RAIL         | 2 |
| ROBIN        | 2 | COMMON MERGANSER     | 2 |
| TOWHEE       | 2 | COWBIRD              | 2 |
| WOOD DUCK    | 2 | GADWALL              | 2 |
| BUFFLEHEAD   | 3 | GREATER SCAUP        | 2 |
| KINGFISHER   | 3 | GREEN HERON          | 2 |
| GREAT EGRET  | 4 | LESSER SCAUP         | 2 |
| PINE WARBLER | 4 | PINE WARBLER         | 2 |
| COWBIRD      | 5 | REDHEAD DUCK         | 2 |
| OSPREY       | 5 | SEASIDE SPARROW      | 2 |
|              |   | SHARP-TAILED SPARROW | 2 |
|              |   | B-C NIGHT HERON      | 3 |
|              |   | BLACKPOLL WARBLER    | 3 |
|              |   | GREAT BLUE HERON     | 3 |
|              |   | JUNCO                | 3 |
|              |   | LAUGHING GULL        | 3 |
|              |   | SNOWY EGRET          | 3 |
|              |   | TREE SPARROW         | 3 |
|              |   | WOOD THRUSH          | 3 |
|              |   | TOWHEE               | 4 |
|              |   | KILLDEER             | 5 |
|              |   | RING-BILLED GULL     | 5 |
|              |   | CEDAR WAXWING        | 6 |
|              |   | RED-WINGED BLACKBIRD | 6 |
|              |   | ROBIN                | 6 |
|              |   | SAVANAH SPARROW      | 6 |
|              |   | D-C CORMORANT        | 7 |
|              |   | GRACKLE              | 7 |
|              |   | YELLOW WARBLER       | 7 |

(SEE TABLES 13,16,19,22,25,28,31,AND 34 FOR MORE SPECIFIC DATA ON IDENTIFIED NORTH AMERICAN MIGRANT SPECIES AND THEIR COUNTS)

**Neo-Tropical Migrants  
Increasing / Decreasing  
(1981-2000)**

| INCREASING SPECIES       | NAI | DECREASING SPECIES      | NAD |
|--------------------------|-----|-------------------------|-----|
| AMERICAN REDSTART        | 1   | B-T BLUE WARBLER        | 1   |
| B-T BLUE WARBLER         | 1   | BLACKBURNIAN WARBLER    | 1   |
| B-T GREEN WARBLER        | 1   | BOBOLINK                | 1   |
| INDIGO BUNTING           | 1   | BROAD-WINGED HAWK       | 1   |
| KINGBIRD                 | 1   | CANADA WARBLER          | 1   |
| LEAST SANDPIPER          | 1   | CATBIRD                 | 1   |
| MAGNOLIA WARBLER         | 1   | CERULEAN WARBLER        | 1   |
| NORTHERN PARULA          | 1   | HOUSE WREN              | 1   |
| ROSE-BREASTED GROSBEAK   | 1   | LEAST SANDPIPER         | 1   |
| RUBY-CROWNED KINGLET     | 1   | LEAST TERN              | 1   |
| SCARLET TANAGER          | 1   | OVENBIRD                | 1   |
| SEMI-PALMATED SANDPIPER  | 1   | RED-EYED VIREO          | 1   |
| WHITE-CROWNED SPARROW    | 1   | ROSE-BREASTED GROSBEAK  | 1   |
| WORM EATING WARBLER      | 1   | SCARLET TANAGER         | 1   |
| YELLOW-RUMPED WARBLER    | 1   | SEMI-PALMATED SANDPIPER | 1   |
| BLACK-BILLED CUCKOO      | 2   | VEERY                   | 1   |
| CHIPPING SPARROW         | 2   | WARBLING VIREO          | 1   |
| EASTERN WOOD PEWEE       | 2   | BLACK-BILLED CUCKOO     | 2   |
| TREE SWALLOW             | 2   | B-T GREEN WARBLER       | 2   |
| YELLOWTHROAT             | 2   | GC FLYCATCHER           | 2   |
| RED-EYED VIREO           | 3   | ORCHARD ORIOLE          | 2   |
| WARBLING VIREO           | 3   | ROUGH-WINGED SWALLOW    | 2   |
| BANK SWALLOW             | 4   | W-T SPARROW             | 2   |
| BLUE-WINGED WARBLER      | 4   | TREE SWALLOW            | 3   |
| GREAT CRESTED FLYCATCHER | 4   | AMERICAN REDSTART       | 4   |
| NORTHERN ORIOLE          | 4   | BANK SWALLOW            | 4   |
| HOUSE WREN               | 6   | B&W WARBLER             | 4   |
| WHITE-THROATED SPARROW   | 6   | MAGNOLIA WARBLER        | 4   |
| CATBIRD                  | 7   | NORTHERN ORIOLE         | 4   |
|                          |     | WHITE-CROWNED SPARROW   | 4   |
|                          |     | BARN SWALLOW            | 5   |
|                          |     | NORTHERN PARULA         | 5   |
|                          |     | YELLOW-BILLED CUCKOO    | 5   |
|                          |     | CHIPPING SPARROW        | 6   |

|  |                       |   |
|--|-----------------------|---|
|  | KINGBIRD              | 6 |
|  | YELLOWTHROAT          | 6 |
|  | YELLOW-RUMPED WARBLER | 7 |
|  | CHIMNEY SWIFT         | 8 |
|  | COMMON TERN           | 8 |

(SEE TABLES 14,17,20,23,26,29,32, AND 35 FOR MORE SPECIFIC DATA ON IDENTIFIED NEO-TROPICAL SPECIES AND THEIR COUNTS)