HAMPDEN MEADOWS CONSERVATION AREA

NATURAL RESOURCES MANAGEMENT PLAN

FINAL

Prepared for the
Barrington Conservation Commission
By
Rhode Island Natural History Survey
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1. Introduction

This Natural Resource Management Plan is intended to guide the Town of Barrington in creating a comprehensive management plan for the Hampden Meadows Conservation Area (HMCA 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 HMCA management regarding natural resources.

This report includes a rapid ecological assessment (REA) of the Hampden Meadows Conservation Area conducted from June to November, 2008. The structure and content of the REA generally follows 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 Hampden Meadows Conservation Area is located in eastern Barrington, RI and is managed by the Barrington Conservation Commission under the ownership of the Town Of Barrington. The conservation area is a 1.2-mile-long linear greenbelt that covers 132 acres comprising a ditched and drained, 113-acre red maple swamp and bordering uplands. The properties are not entirely continuous, intersected by two paved roads, and are surrounded by residential development (Fig 1). The public can access the HMCA from Kent Road which bisects the properties latitudinally. A skating pond and tennis courts are at the access area. From there, a walking trail runs north and south along a wide, deep drainage ditch and atop a raised bed that covers a sewer line; these features run north-south through the entire run of the property, with the drainage ditch eventually entering Narragansett Bay through a pair of culverts with one-way scuppers.

2.1 History

The Hampden Meadows Conservation Area was designated to open space as a Greenbelt. The property conserves primarily a historically natural red maple swamp that grows on soils unsuitable for conventional agriculture or other development. A ditching program dug nearly two miles of deep and wide drainage ditches, likely for mosquito control, in the early part of the 1900s. The main ditch may have been originally dug (or widened) for transport of bricks during a short period of clay mining that also took place on the property during that time period. Currently, these ditches remain and continue to flow south to the Barrington River (Narragansett Bay) throughout the year, lowering the groundwater table, shortening the hydroperiod of wetlands, and affecting the habitats of the HMCA. The installation of a buried pipeline in the 1970s caused further disturbance to the wetland by raising the soil level, clearing a path of existing vegetation, and facilitating the introduction of upland and invasive species.

2.2 Current Use

The Conservation Area is open to the public and the trail is used primarily for passive recreation and commuting by local school children. The pipeline is maintained as a municipal facility. The skating pond and tennis courts on Kent Street are maintained by the Town of Barrington and used by the public.

3. Rapid Ecological Assessment

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

The objectives of the REA are as follows:

- 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), 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 field work, invasive plant species occurrences were documented.

3.1.2 Fauna Surveys

Three surveys of fauna were conducted; a breeding songbird survey, an amphibian larva survey, and an opportunistic 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 25, 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).

Opportunistic 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 2003-2004 land use / land cover data (RIGIS 2008) to represent the surrounding landscape only. The resulting clipped data were used to quantify the intensity of development in the surrounding 1 km by percentage of various land use and land cover types.

3.2 REA Results and Discussion

3.2.1 Flora

Habitat Inventory

The Hampden Meadows Conservation Area covers 132 acres comprising a 113-acre forested swamp, 12.5 acres of forested upland, and 3 acres of managed property. Forested lands cover 95% of the area total. A drainage ditch covers 2 acres total, while a skating pond covers 1 acre.

Six 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-maple Forest
An Oak-maple Forests grows on mesic Winsor loamy sand (WgB) soils occurring on the south end of the Conservation Area (Fig 3). The canopy is split between mixed oaks (*Quercus* sp.) and red maple (*Acer rubrum*) in these areas. Oak-maple Forest shrubs in the HMCA include sassafras (*Sassafras albidum*), red maple saplings, blueberry (*Vaccinnium corymbosum*), and greenbrier (*Smilax rotundifolia*). Invasive species occur along trail edges and include Oriental bittersweet (*Celastrus orbiculatus*; uncommon), multiflora rose (*Rosa miltiflora*; uncommon), autumn olive (*Elaeagnus umbellate,* scarce), and Morrow's honeysuckle (*Lonicera morrowii*; scarce).

In the summer of 2008, some of these areas were suffering from insect damage; the leaf area of broadleaf deciduous 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).

2. Hay Meadow
A 2.5-acre hay meadow lies along Sowams Road. This early successional habitat type is upland grassland containing native and agricultural grasses and forbs. This small area was not accessible for plant surveys. Expected characteristic species include switchgrass (*Panicum virgatum*), timothy (*Phleum pretense*), and hay (e.g. orchardgrass: *Dactylis glomerata*). Invasive plant species noted in this area were scattered tree of heaven (*Ailanthus altissima*) and the thorny shrub multiflora rose.

Wetlands
3. Red Maple/shrub Swamp
Occurring throughout the HMCA, Red Maple/shrub Swamps comprise 98% of wetlands and 84% of all lands within the Conservation Area. This is the most common wetland habitat type in the State. These areas are temporarily to seasonally flood during the growing season and fall primarily on Scarboro muck soils (Fig 3). The canopy of this habitat type in the HMCA is dominated by red maple with scattered pin oak (*Quercus palustris*) and birch (*Betula* sp.). Sweet pepperbush (*Clethra alnifolia*) is abundant in the shrub layer, while greenbrier is also common. Cinnamon fern (*Osmunda cinnamomea*) is common in the herbaceous layer. The property contains invasive species along access trails including bittersweet and multiflora rose.

4. Vernal Pools
This habitat type falls within glacial depressions scattered in the southwestern corner of the Conservation Area. Seasonally flooded, Vernal Pools have a longer hydroperiod than the Red Maple/shrub Swamp habitats because they occur in depressions that intersect the water table for a longer period and they contain poorly-drained muck soils. The canopy is dominated by red maple and the shrub layer is scattered sweet pepperbush. The pools in the HMCA generally lack ground cover vegetation, likely due to a long hydroperiod and thick leaf litter. No invasive species were noted in HMCA Vernal Pools.

Waters
5. Manmade Drainage Ditches

These features were constructed to drain the swamp waters of the HMCA into the Narragansett Bay. These features are of significant ecological consequence to the habitats on these properties because they continually maintain an artificially low water table in the swamps. This directly affects vegetation structure and species composition. The ditches themselves contain little vegetation.

6. Shallow Manmade Pond
A 1-acre manmade skating pond along Kent Street provides semi-permanently flooded habitat for breeding amphibians and macroinvertebrates such as dragonflies (*Odonates*). The pond has a sand bottom covered by a thin layer of detritus and is managed to keep vegetation to a minimum. Some emergent vegetation grows within its boundaries during the growing season.

Plant Species of Conservation Concern

The habitats of the HMCA 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 4.2.5 for more information on rare species monitoring and to Appendix 1 for descriptions of historic element occurrences.

Invasive Plant Species

Invasive plant species tend to become established in highly disturbed areas. This is the case in the habitats within the HMCA. Invasive species are mainly present along open habitat edges (e.g. along roads) and along trails in interior areas. The trail lies on a raised pipeline that was installed during the late1970s. The disturbance of vegetation and soils from that project and since (Fig 4), including the raising of ground level, removal of canopy vegetation, and the use of trails by humans, likely were and are the main contributors to the establishment of invasive species. 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 17 bird species were observed during RINHS fieldwork, of which 4 were GCN species.

<u>Bird Point Count Survey</u>
Breeding songbird point count surveys were conducted to provide current information on bird species and habitat function. Fourteen species total, including four GCN species, were identified during breeding bird surveys at HMCA. Refer to Table 3 and Figure 5 for tallies and locations of species and for habitat associations.

Opportunistic Fauna Surveys

Opportunistic fauna surveys were also conducted during all field work. Four avian species were identified during these surveys, three of which were not found during the breeding bird survey. Refer to Table 4 for tallies of these species.

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 HMCA and adjoining areas (App. 2). This corroborates with numerous studies and theories on bird habitat selection. The current species inhabiting the HMCA 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 interior 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 were conducted in the skating pond only, since vernal pools of the HMCA were already dry during the sampling period. The surveys revealed that common bullfrogs (*Rana catesbeiana*) and spring peepers (*Pseudacris crucifer*) are breeding in the pond. RIDEM DFW notes that the East Bay peninsulas are severely lacking in amphibians. They theorize that intensive mosquito spraying in the early 1970s may have caused a decline of amphibians in the area and the population has not yet fully 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 Skating Pond area.

Other Amphibian and Reptile Data

RIDEM DFW has been conducting statewide surveys of amphibians and reptiles in Barrington for decades. Table 5 shows species tallies from those data and state abundance status. All herptiles receive *protected* conservation status in RI. The lack of expected species is not thought to be from deficient effort (C. Raithel, personal communication).

Fish

Dip net surveys revealed that the estuarine fish species fourspine stickleback (*Apeltes quadracus*) and juvenile American eels (*Anguilla rostrata*) were utilizing the skating pond. Apparently, fish species are able to utilize the drainage ditch as a riverine connection inland. The American eel's conservation status is in flux, as populations are recently rapidly decreasing. Sticklebacks are thought to be secure.

Macroinvertebrates

Sampling for dragonflies and damselflies (Odonates) was conducted at HMCA between May 1998 and June 2004 as part of the Odonata Atlas of Rhode Island. Over 30 separate sampling events, a total of 66 voucher specimens of 26 species were collected. This represents 53% of the total odonate species that have been recorded in Barrington. Refer to Table 6 for results.

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. An analysis of the land use and land cover (LU/LC) surrounding the Area revealed that 66% of the land surrounding the HMCA is developed, while 4% is agricultural and 30% is natural. Refer to Table 7 and Figure 6 for areas and locations.

3.3 Areas of Special Consideration

One area of special concern is identified here. The area requires special management consideration because it is regionally unique, supports species of concern, and is particularly vulnerable to human impacts.

3.3.1 Kent Street Skating Pond

Although the Kent Street Skating Pond is a manmade and regularly maintained feature, it functions as a long-hydroperiod vernal pool. It is a breeding haven for amphibians, which are regionally scarce, and supports juveniles of the declining American eel population and diverse macroinvertebrates. With careful timing of maintenance, the pond may serve the dual purpose of wildlife habitat and recreational activity area. In fact, its utility to the public could be enhanced by the aesthetic benefits of managing wildlife uses during the warm seasons and recreation during the winter. Recommendations for management are offered in Section 4.2.3.

3.4 REA Conclusion

The Hampden Meadows Conservation Area is an important natural feature occurring within a highly developed landscape matrix. The main feature, a 113-acre Red Maple Swamp, has long been drained and is likely a considerably drier swamp than the original. But the wetland vegetation has adjusted to this persistent stress for close to a century, and has largely adjusted, now containing vegetation structure and composition that is more characteristic of a temporarily to seasonally flooded natural swamp. A slightly species poor understory and the occurrence of greenbrier may further indicate this disturbed hydrology. Invasive plants are abundant at the street edges and along stretches of the raised trail. Humans are likely the cause and custodians of this problem. While invasive species are difficult to control, small incursions can be mitigated before further damage is done to native habitats.

The skating pond is an unexpected ecological feature, acting as a breeding haven for amphibians, which are regionally scarce, likely due to historic mosquito spraying and limited immigration opportunity. It also may function in supporting juveniles of the declining American eel population and in supporting diverse macroinvertebrates. The swamp itself supports both edge- and interior-dwelling breeding songbirds, including four species identified as those of greatest conservation need in RI. The composition of songbird species has shifted since the development of the pipeline, but

this will likely stabilize as the vegetation reaches climax. Mammal data are unavailable for the HMCA, but the Area likely acts as best available habitat for a host of expected species.

4. Management Objectives and Actions

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

4.1 Overarching Actions for Resource Management

Three 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 Preserve or Strengthen the Property Designation as a Conserved Area

The objectives identified in Barrington's Draft Comprehensive Plan regarding the HMCA require its continued and strong designation as conserved land. Conservation of the properties contributes to the integrity of wildlife habitat and the recreational enjoyment of the land. It appears that the status of HMCA 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 HMCA'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 HMCA in the form of a conservation restriction is desirable and feasible. Other approaches to strengthening conservation status could include by-law or zoning modifications.

4.1.2 Manage Property Access and Use

Providing liberal access and use of the HMCA 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 and ultimately on public support for leaving undeveloped space for recreation. For example, dumping of trash or organic materials can introduce toxins, nutrients and pathogens to the surface waters and wetlands; trailblazing can directly impact habitats, cause fragmentation, and spread invasive species; and partying 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 for the properties to protect the resources and public support for this type of open space. The plan needs to include usage policies and rules and a feasible plan for maintenance and enforcement.

4.1.3 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 had 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. Like plants, invasive animal species can impact native species through competition for 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 HMCA 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 HMCA management objectives, are offered throughout section 4.2. A summary of general guidelines for invasive species management are offered in Section 4.2.6:

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, Preservation, or Improvement of Habitat Integrity for Wildlife

As detailed in Section 3, the HMCA is an important haven for wildlife and passive recreation within a heavily developed landscape matrix. Four bird and one fish 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:

- Preserve or strengthen the property designation as a Conservation Area. Minimize development of the properties and further 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 certain species, such as the Scarlet Tanager and the Wood Thrush; both are interior forest dwellers and GCN listed species inhabiting the HMCA.

- Control the spread of invasive plant species by following recommendations given in this document. Invasive species can degrade habitat integrity by changing the structure and composition of vegetation.
- Clearing and cutting of vegetation should be eliminated or minimized in the interior of the properties. Clearing and cutting of vegetation directly impacts habitats and can facilitate the establishment of invasive plant species. Removal of vegetation also contributes to erosion and sedimentation in wetlands 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 addressing the task at hand; all other vegetation should be left intact.
- 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 HMCA, leaf area was diminished by approximately 50% during the 2008 growing season. RIDEM has suggested that the introduction of a biological control agent may be effective at reducing their effects.
- Minimize impacts to areas of special concern. Specifically, develop maintenance protocols that enhance a dual use of the Kent Street Skating Pond by the public and wildlife (see Section 4.2.3).
- Minimize the use of pesticides in the area. Diverse odonate (dragonfly and damselfly) fauna have been inventoried at the Kent Street Skating Pond; some of these may be rare and further investigation may be needed. 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 decline of 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.
- Maintain and enforce the *no hunting* policies in the HMCA. Hunting can directly impact regionally scarce resources and poses a threat to other uses of the Conservation Area. In many forested areas in Rhode Island, hunting is needed to replace top predators in controlling white-tailed deer overpopulation that can overwhelm vegetation. HMCA habitats show no indications of over-browsing and hunting is not necessary.

4.2.2 Management of Public Uses

The HMCA contains two activity areas and a linear foot trail running atop a buried sewer pipeline. The trail provides access for the public to enjoy the natural environs, a pathway for commuting school children, and access for pipeline maintenance. A managed skating pond and tennis court facilities at Kent Street provide public recreation opportunities. Recreational uses enhance public enjoyment and their appreciation and support for open space conservation. However, public use can directly and indirectly compromise the natural integrity of the conservation area. Thus, public use 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 public uses as they relate to natural resources:

- Protect public safety by following recommendations offered in Section 4.2.5.
- Control the spread of invasive plant species associated with public use 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: a ban on cutting, removing, or introducing live or dead vegetation in the area; regulation of mowing and brush-cutting protocols to include the cleaning of equipment between sites; discouraging trailblazing; etc.

- 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.
- Manage activities that may impact areas of special concern. Specifically, develop public use policies that enhance a dual use of the Kent Street Skating Pond by the public and wildlife (see Section 4.2.3).
- Maintain or increase measures to thwart illegal dumping within the HMCA to minimize erosion, the spread of invasive species, and the introduction of nutrients and other pollutants to the wetlands and surface waters. Dumping of yard waste into wetlands is illegal and it is destructive to wetlands because it introduces excess nutrients and affects substrates.
- Minimize the use of fertilizers in the HMCA. Best management practices (BMPs) should be applied in the maintenance of mowed areas, particularly in the application of fertilizers and schedule of watering. Contact the Cooperative Extension Education Center, URI for information on BMPs.
- 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.

4.2.3 Enhancement to the Uses of the Kent Street Skating Pond

Kent Street Skating Pond is a manmade and regularly maintained feature used for public ice skating during the winter. It is drained during the growing season to allow the town to remove vegetation from the substrate to maintain a clear surface for skating the following season. However, the pond functionally acts as a long-hydroperiod vernal pool; it is a breeding haven for amphibians and supports American eels and diverse odonate macroinvertebrates. With careful timing of maintenance, the pond may serve the dual purpose of wildlife habitat and recreational activity area. The pond's utility to the public could be enhanced by managing wildlife uses during the warm seasons. Enhancing wildlife use of the pond could encourage public appreciation, raise awareness, and increase support for the conservation of the HMCA.

Bull frogs and spring peepers breed in the pond and green frogs may as well (Section 3). Bull frogs and green frogs generally require two full seasons of flooding before emerging as adults, and semi-permanent to permanent flooding is considered obligate to their breeding success. Paton and Crouch (2000) found that in Southern RI, these species may adapt to shorter hydroperiods by undergoing metamorphosis earlier, but still require two seasons of flooding. American eels require permanent flooding as well. Ideally, the pond should never be fully drained to maintain its habitat viability for these species. If maintenance cannot be accomplished without draining, draining every two years would allow a portion of breeders to be successful.

Odonates vary in life history, but many rely upon emergent or woody wetland vegetation to complete their lifecycles, as aquatic larvae emerge to perch and metamorphose into winged adults. Allowing emergent vegetation to grow throughout the growing season will enhance the productivity of the pond for these species. A permanent fringe of wetland shrubs would further enhance the pond's quality as habitat for odonates and amphibians.

Considering the benefits of dual use and the life history factors for dependant species, RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the use of Kent Street Skating Pond:

- Revise or establish maintenance schedules to minimize impacts to wildlife using the pond as detailed below.
- All maintenance should be conducted after October 1 to maximize time available for amphibians and odonates to emerge.
- Maintenance should be conducted without draining the pond, if possible. If the pond needs to be drained, limit maintenance to every other year to allow a portion of amphibians to successfully emerge.
- Maintain pond levels so that the pond is flooded throughout the year in most years.
- Minimize disturbance of the substrate during maintenance activities, especially in deeper sections of the pond where first-year amphibians hibernate, to minimize mortality.
- Maintain a 10' wide fringe of woody wetland shrubs along at least one wooded (west or south) shore of the pond to enhance attachment, cover, and emerging habitat for larval fauna without greatly decreasing skating area.
- Develop and distribute informational literature highlighting the dual use of the facility to enhance public enjoyment and support.

4.2.4 Development of New Activity Areas

While it can enhance public enjoyment and use, development can potentially directly and indirectly compromise the natural integrity of the conservation area and must be balanced against objectives that incorporate conservation. The development of recreational facilities within the properties is contradictory to conservation and to objectives that require conservation. Thus, development should be minimized within the HMCA. If development is planned, every effort should be made to minimize impacts to wildlife, critical habitats, surface waters, 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. Because it is comprised primarily of wetlands, there are limited sections within the HMCA that could support conventional development without impacting the wetlands. Wetlands are protected by state law; according to RIDEM and RICRMC, development should specifically not be located 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 install parking facilities, consider using permeable surfaces such as gravel or semi-pervious pavers to minimize the runoff of automotive fluids into surface waters and wetlands.

4.2.5 Consideration of Public Safety

Public safety will likely be a key consideration in management planning for the HMCA. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding public safety as it relates to natural resources:

- Assess and mitigate hazards associated with forest fires. Consult with RIDEM Division of Forest Environment for regulations and risk assessment. While red maple swamps are generally considered low risk habitats, oak forest habitats are particularly susceptible to forest fire, especially in the summer and fall seasons (B. Payton, personal communication).
- 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 any snags that appear to pose a danger to humans using the HMCA, especially large debris that is leaning or hung on other trees. Standing dead snags are valuable wildlife habitat for avian and mammalian cavity nesters, including the resident GCN species Great Crested Flycatcher and resident woodpeckers. These should be preserved when they pose no threats to humans.
- Consult an attorney to see if an assessment and mitigation of drowning and pathogen transmission hazards associated with the drainage ditch and Skating Pond is necessary.

4.2.6 Management of Invasive Species

The effects of invasive species have been discussed in Sections 3, 4.1, 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 HMCA:

- Develop an overarching invasive species management plan for the HMCA.
- 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. Clearing and cutting of vegetation should be avoided or minimized. Clearing and cutting of vegetation can facilitate the establishment of invasive plant species.
- 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.
- Minimize development of the properties and fragmentation by roads, and trails. Even non-raised trails can introduce and facilitate invasive plant species.
- Avoid disturbing the substrate or exposing it to light, as this will increase the likelihood of invasive species establishment.
- Apply BMPs to minimize nutrient inputs into HMCA habitats. Invasive species thrive on increased nutrients.

- Work with adjacent landowners, DEM, and other stakeholders in the East Bay to develop an integrated, regional winter moth control strategy.
- Do not plant non-native vegetation within the HMCA.
- Maintain or increase measures to thwart illegal dumping within the HMCA to minimize the spread of invasive species.
- Develop an invasive species monitoring program to rapidly detect the introduction and spread of non-native species.

4.2.7 Preservation of Native Vegetation

Native vegetation provides necessary cover, structure, and forage to wildlife and maintains biological diversity. Because Hampden Meadows has been heavily modified by historic activities, the habitats have been changing over time through 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 systems and habitat types occurring within the HMCA in 2008.

Habitat Type	Area (acres)		Area (acres)
Uplands		***Cultural Cover***	
Oak-Maple Forest	12.5	Mowed Park	0.9
Hay Meadow	2.5	Tennis Court	0.3
Total Uplands	**14.9**	**Total Cultural**	**1.3**
Wetlands		**Total HMCA**	**131.9**
Red Maple / Shrub Swamp	110.2		
Vernal Pool	2.6		
Total Wetlands	**112.8**		
Waters			
Drainage Ditch	1.8		
Shallow Man-made Pond	1.1		
Total Waters	**3.0**		

Table 2 List of invasive plant species observed at the HMCA and associated habitats.

Ailanthus altissima (tree of heaven)
- Hay Meadow

Celastrus orbiculatus (Oriental bittersweet)
- Oak-maple Forest
- Red Maple / shrub Swamp

Eleaegnus umbellata (autumn olive)
- Oak-maple Forest

Lonicera morrowii (Morrow's honeysuckle)
- Oak-maple Forest

Rosa multiflora (multiflora rose)
- Oak-maple Forest
- Red Maple/shrub Swamp
- Hay Meadow

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

Bird Code	Location						Bird Species Name
	GB1	GB2	GB3	GB4	GB5	Total	
AMRO		1	1		1	3	American Robin (*Turdus migratorius*)
BCCH	3	2	4	1	3	13	Black-capped Chickadee (*Poecile atricapillus*)
BLJA	2					2	Blue Jay (*Cyanocitta cristata*)
CAWR		1		3		4	Carolina Wren (*Thryothorus ludovicianus*)
DOWO		1	1			2	Downy Woodpecker (*Picoides pubescens*)
GCFL*	1		1	1		3	Great Crested Flycatcher (*Myiarchus crinitus*)
GRCA			2	3	3	8	Gray Catbird (*Dumetella carolinensis*)
HOFI		1				1	House Finch (*Carpodacus mexicanus*)
NOCA	1	1	2		1	5	Northern Cardinal (*Cardinalis cardinalis*)
RBWO			1			1	Red-bellied Woodpecker (*Melanerpes carolinus*)
RSTO*	1					1	Rufous-sided Towhee (*Pipilo maculatus/erythr*)
SCTA*		1	1			2	Scarlet Tanager (*Piranga olivacea*)
TUTI	2	2		1		5	Tufted Titmouse (*Baeolophus bicolor*)
WOTH*	1		1	2		4	Wood Thrush (*Hylocichla mustelina*)
Richness	7	8	9	6	4	14	
Tally	11	10	14	11	8	54	

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

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

Common Name	Scientific Name	Count
American Robin	*Turdus migratorius*	5
Barn Swallow	*Hirundo rustica*	1
Brown-headded Cowbird	*Molothrus ater*	1
Mallard	*Anas platyrhynchos*	3

Table 5 Amphibian* and reptile* species observed in Barrington RI by RIDEM DFW.

Genus	species	Common Name	Year	Status	location	age/sex
Bufo	*fowleri*	Fowler's toad	1985	Uncommon	Nockum Hill	adult
Bufo	*americanus*	American toad	1990	Common	0.6 SW Prince Pond	adult male
Bufo	*americanus*	American toad	1990	Common	0.6 SW Prince Pond	adult male
Bufo	*americanus*	American toad	1990	Common	Echo Lake	adult male
Chelydra	*serpentina*	common snapping turtle	1982	Common		
Chelydra	*serpentina*	common snapping turtle	1991	Common	Brickyard Pond	
Chelydra	*serpentina*	common snapping turtle	1991	Common	Runnins River	
Chelydra	*serpentina*	common snapping turtle	2002	Common	vic Brickyard Pond	
Chrysemys	*picta*	painted turtle	1983	Common	41	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Clemmys	*guttata*	spotted turtle	1982	Common	Hunderd Acre Cove	
Clemmys	*guttata*	spotted turtle	2003	Common	Lincoln Ave @ Peck Ave.	male
Lampropeltis	*triangulum*	Eastern milk snake	1990	Common	New Meadow Neck 0.3 SW Sowams School	juvenile male
Malaclemys	*terrapin*	Northern Diamondback Terrepin	0	Rare	vic Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	0	Rare	vic Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1993	Rare	Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1993	Rare	Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1997	Rare	Hundred Acre Cove	adult male
Malaclemys	*terrapin*	Northern Diamondback Terrepin	2005	Rare	Mouth of Warren River	juvenile
Nerodia	*sipedon*	Northern Watersnake	1991	Common	Runnins River	
Nerodia	*sipedon*	Northern Watersnake	1992	Common	Haines Park Road at Annawomscutt Road	
Opheodrys	*vernalis*	Smooth Greensnake	2002	Common	Haines State Park	
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	New Meadow Neck	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	New Meadow Neck	adult
Plethodon	*cinereus*	Northern Redback Salamander	1990	Common	Echo lake	adult
Plethodon	*cinereus*	Northern Redback Salamander	1990	Common	Kent Street	adult
Pseudacris	*crucifer*	spring peeper	1990	Common	Echo Lake	adult
Pseudacris	*crucifer*	spring peeper	1990	Common	Haines State Park	adult
Rana	*clamitans*	Green Frog	1987	Common	New Meadow Neck	
Rana	*catesbeiana*	Common Bullfrog	1990	Common	Haines State Park	juveniles
Rana	*catesbeiana*	Common Bullfrog	1990	Common	Haines State Park	juveniles
Rana	*clamitans*	Green Frog	1991	Common	Runnins River	adult
Rana	*palustris*	Pickerel Frog	1991	Common	Runnins River	adult
Rana	*sylvatica*	Wood Frog	2006	Common	near East Providence border	adult
Storeria	*dekayi*	Northern Brown Snake	1983	Common	41	
Trachemys	*scripta*	red-eared slider	2000	Rare	Brickyard Pond	juvenile

*These are state protected species; please do not distribute these data.

Table 6 Odonate data collected between May 1998 and June 2004 by the Odonate Atlas of RI.

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

BP: Brickyard Pond
KS: Kent Street Skating Pond

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

Land Use / Land Cover	Area (acres)	% of Total	Land Use / Land Cover	Area (acres)	% of Total
Developed Land			***Agricultural Land***		
Medium Density Residential	611.1	52.5	Orchards, Groves, Nurseries	20.3	1.7
Medium High Density Residential	111.5	9.6	Cropland	19.5	1.7
Developed Recreation	14.4	1.2	Pasture	4.0	0.3
Institutional	11.8	1.0	**Agricultural Total**	**43.8**	**3.8**
Commercial	10.3	0.9			
Power Lines	7.7	0.7	***Natural Land***		
Low Density Residential	3.0	0.3	Wetland	162.3	13.9
Medium Low Density Residential	0.8	0.1	Deciduous Forest	139.1	11.9
Developed Total	**770.6**	**66.2**	Mixed Forest	43.1	3.7
			Water	2.2	0.2
			Beaches	1.9	0.2
			Brushland	1.2	0.1
			Natural Total	**349.7**	**30.0**

Figures

Figure 1 HMCA points of reference.

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

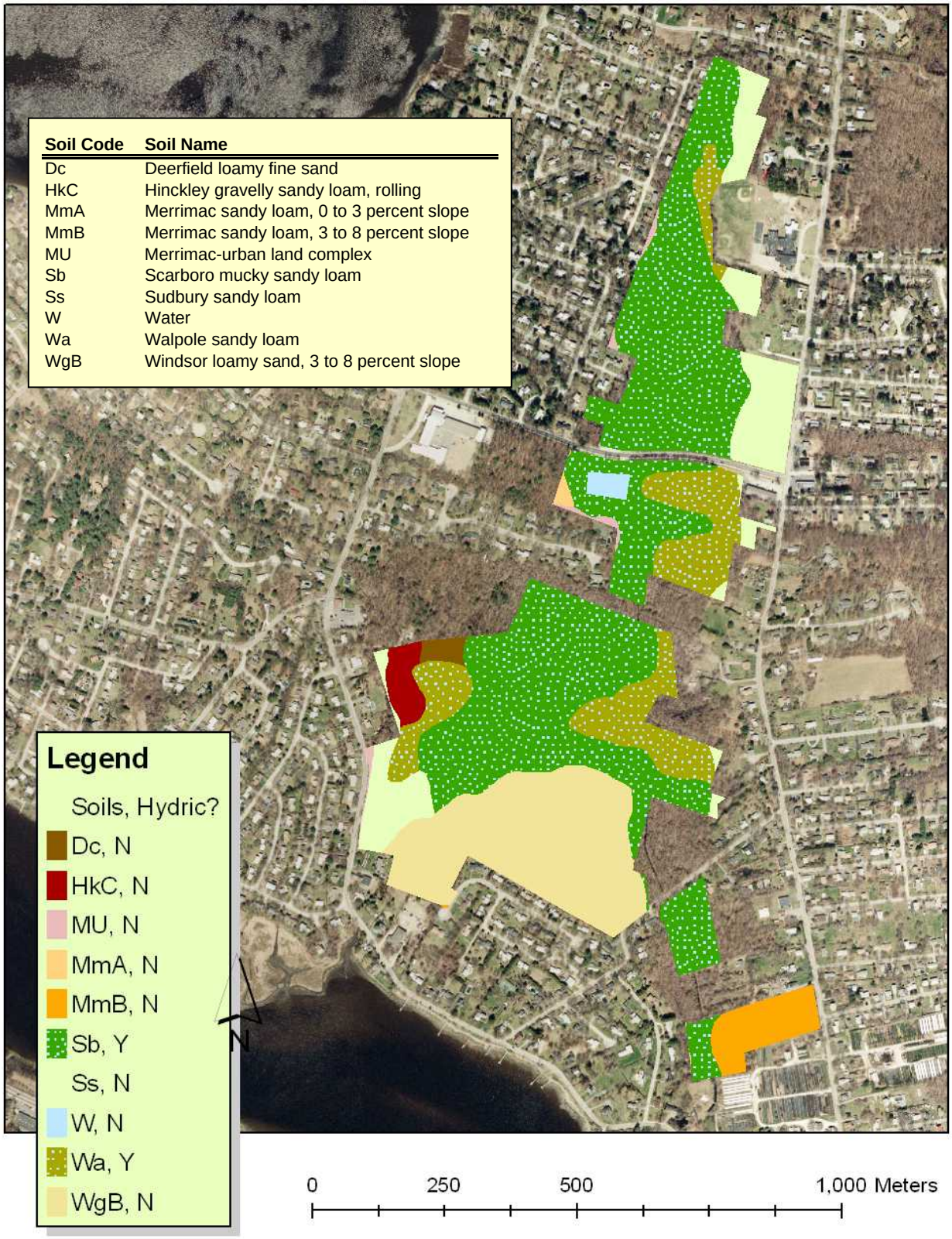

Figure 3 Soils of the HMCA (RIGIS 2008).

Figure 4 1981 aerial photo depicting sites of relatively recent habitat disturbance at HMCA.

Figure 5 HMCA 2008 breeding songbird point count sample stations and habitat associations.

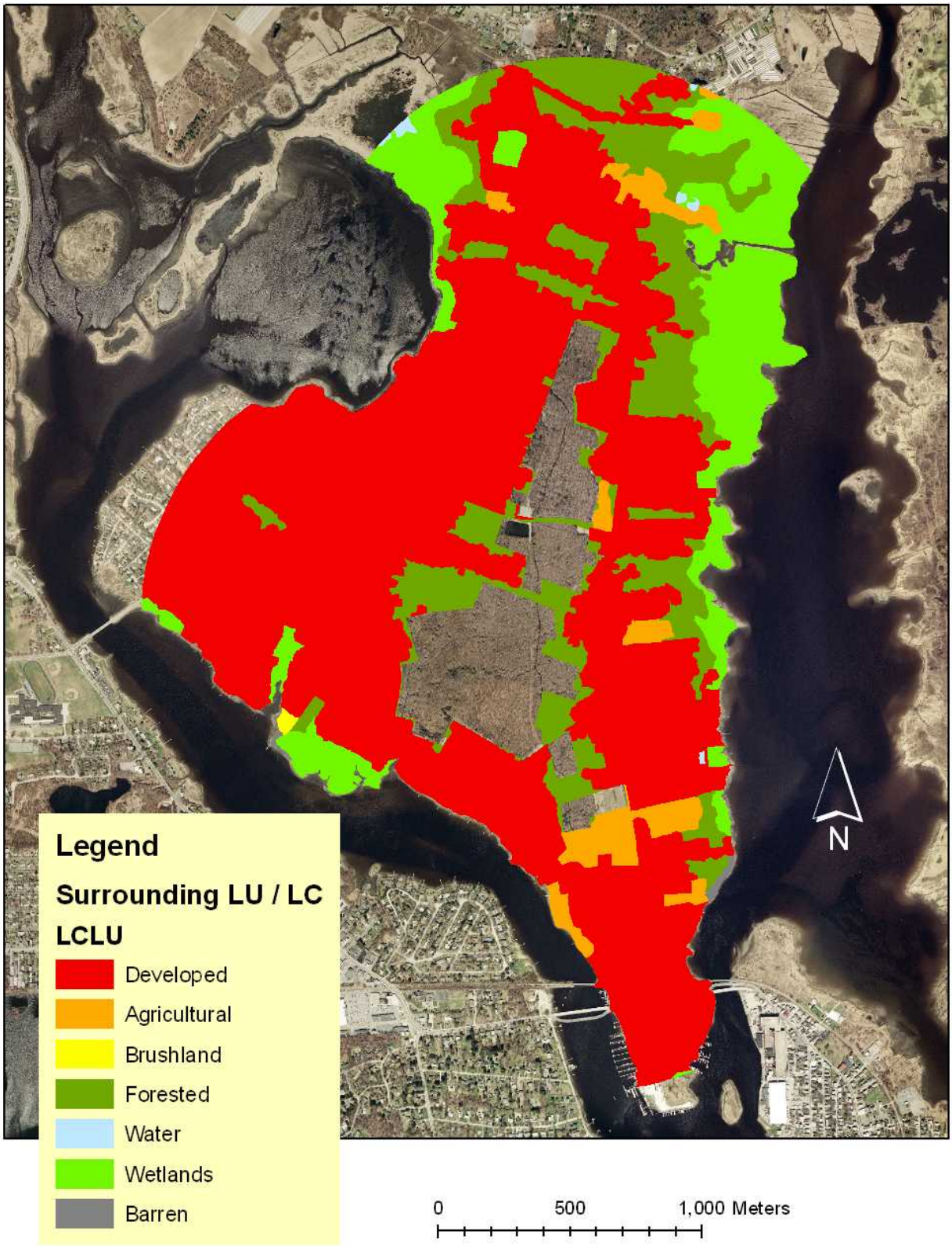

Figure 6 Land use and land cover occurring within 1.0 Km of the HMCA in 2004. Data derived from RIGIS 2003-04 LCLU (2008).

Appendices

Appendix 1. Historic Rare Plant Species of HMCA

Platanthera blephariglottis (White-fringed Orchid)

Species Status	Population Status	Last Observed	Last Survey
State Threatened	Historical	07-1921	07-2005

History:
Plant was initially collected by R. Sweet (specimen deposited in Brown Herbarium), in 1921, in New Meadow Neck area of Hampden Meadows, approximately ½ mile north of Rt. 114 on land between Palmer and Barrington Meadows. Since then it has been unsuccessfully searched for on three occasions (8-2001, 7-2004, and 7-2005).

This population is listed as historic because the population, or preferred habitat for this population, has not been discovered despite repeated surveys. This area has undergone considerable change since the population was initially observed, and the most suitable extant habitat for this species is the pond which is dug out intermittently to promote its use as an ice-skating area.

Preferred habitat: In full sun or semi-shade in damp acidic situations, especially sphagnum, cranberry or tamarack bogs (NatureServe 2008).

Threats: Somewhat threatened by land-use conversion, habitat fragmentation, and forest management practices (Southern Appalachian Species Viability Project 2002). Other threats include alteration of water supply, over-shading by woody growth, horticultural collection (NatureServe 2008).

Appendix 2 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)