

**WILDLIFE AND  
NATURAL COMMUNITIES ASSESSMENT  
of the  
SOUTH EAST QUADRANT,  
SOUTH BURLINGTON VERMONT**

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**July 13<sup>th</sup>, 2004**



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## **1.0 Introduction**

Arrowwood Environmental (AE) was retained by the City of South Burlington to conduct a wildlife and natural communities inventory for the South East Quadrant (SEQ) of the City of South Burlington. The objective of this project was to identify the key ecological components in the SEQ; to characterize these areas through field investigations; and to make management recommendations for the SEQ which will protect and enhance the ecological functioning of these components.

The SEQ of South Burlington is defined as the area that lies between Spear Street and Muddy Brook, and south of Interstate 89 to the town boundary. See attached map for details. The SEQ contains a mix of residential, small commercial, old-field, agricultural and forested landscapes. Wetlands are found throughout the SEQ as headwaters of small streams, and along the drainages of those streams. Intact upland forests generally occur in small (under 20 acres) patches within a matrix of field and old field habitats.

The results of this inventory are detailed below. Specific ecological information is presented in Section 3.0 for many of the significant habitats identified in the SEQ. General information about wildlife habitats, natural communities and wetlands in the SEQ are given in sections 4.0, 5.0 and 6.0. Site-specific management recommendations are given for sites of primary and secondary importance in Section 7.0. Finally, Section 8.0 gives overall planning recommendations for the SEQ landscape that will enhance the ecological functioning of the area.

## **2.0 Methodology**

The natural resource inventory and analysis in the SEQ was accomplished in two phases, an office review of available databases and a field assessment of select sites. Methodologies associated with the inventory and assessments are discussed below.

### **2.1 Landscape Analysis**

Focus study areas within the SEQ were identified by AE working in conjunction with the City of South Burlington Planning Office and local land trusts.

A comprehensive review and interpretation of all available digital and paper databases was conducted to identify potentially significant areas in the SEQ. The following digital and hardcopy databases were acquired for the study area:

- Natural Resources Conservation Service (NRCS) soil survey maps,
- Vermont Significant Wetlands Inventory (VSWI) maps,
- Landuse/Landcover from Landsat Satellite Imagery,
- U.S. Geological Survey topographic maps,
- Non-Game & Natural Heritage Program (NNHP) database,
- Department of Fish and Wildlife Deer Wintering Habitat maps and Black Bear Habitat maps,
- 1990s Orthophotography,
- 1990's Color Infrared Aerial Photography,
- Conservation Lands database, and

- State Land use maps.

Mammal Citing Data from The Winooski Valley Park Authority was used to supplement the inventory.

The digital databases were incorporated in an ArcView platform (GIS) allowing for analysis of multiple data layers at the study sites. Wildlife habitat areas were preliminarily delineated from the GIS analysis.

## **2.2 Field Investigation**

Field investigations for this project were conducted in the fall and winter of 2003, and the winter and spring of 2004. Wildlife habitat was evaluated for each study area, including a compilation of wildlife sign and observations. Winter wildlife tracking activities allowed AE to supplement its findings regarding wildlife habitat with observations of species presence/absence and relative abundances.

For the natural community inventory, remote data sources were used to identify areas harboring potentially significant natural communities. Natural communities, however, can only be accurately assessed in the field. Field visits were restricted to the sites for which landowner permission was obtained. The inventory of these significant natural communities is therefore limited and it is likely that other sites of local or state significance exist in the SEQ that could not be surveyed. Community names and classifications are based on Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont (Thompson and Sorenson, 2000).

## **3.0 Study Areas**

For the purposes of this inventory, the SEQ was divided into six focus areas: (1) Muddy Brook Corridor; (2) Muddy Brook Basin; (3) The Great Swamp; (4) Spear Street; (5) The Bowl; and (6) City-Owned or Calkin's Land. These areas were selected based upon presence of natural land uses as compared to the remainder of the SEQ. The ecology of each of the study areas is described in detail below. Management recommendations are given for sites of primary and secondary significance in Section 7.0.

### **3.1 Muddy Brook Corridor (Please refer to project maps)**

The Muddy Brook Corridor sits in the northeast corner of the SEQ and includes Muddy Brook and its surrounding wetlands, upland forests and old fields. This area did not receive a field visit during this inventory due to lack of landowner permission. Some conclusions about wildlife, natural communities and ecological functioning can, however, be made based on remote sources and windshield surveys.

#### *3.1.1 Wildlife*

The various wetlands, fields and forestlands within the Muddy Brook Corridor provide a high vegetative diversity. This vegetative diversity is important for many species of wildlife. Associated with the Brook are likely mink, river otter, muskrat, and the occasional beaver. Whitetail deer, waterfowl, shorebirds, herons and heron-like birds also find habitat along the Brook's banks and in its associated wetlands. Fish such as minnows, dace, pan fish and/or trout are likely found in the Brook itself.

### 3.1.2 *Natural Communities*

A thorough assessment of natural communities was not possible because no fieldwork was conducted in the Muddy Brook Corridor. One site was assessed from the end of DuBois Road. This swamp, penned Dubois Swamp, is a flooded Red Maple-Black Ash swamp with a significant amount of white pine, much of it dead. Open water appeared to be common, presumably from beaver activity at the northern end of the wetland. These open water areas (at least near the end of the road) were colonized by cattails and other herbaceous vegetation.

This swamp forms the headwaters of a small drainage that flows north through old-field, under I-89 and into Potash Brook. Aerial photos indicate that this swamp may be more mature on the northern end. With the information available, this site is considered to be locally significant. A field visit is needed to fully assess the importance of this site to the ecological landscape of the SEQ.

Just to the southeast of Dubois Swamp is a site known as Van Sicklen Woods. This is a 12-acre Clayplain Forest that was assessed by the Nongame and Natural Heritage Program in 1991 as part of a statewide Clayplain forest inventory. It is dominated by green ash (*Fraxinus pennsylvanica*) and bur oak (*Quercus macrocarpa*) with lesser amounts of red maple (*Acer rubrum*) and basswood (*Tilia Americana*). It has a fairly diverse herbaceous layer and hummocks and hollows attest to the wetness of the site. The community, at least in 1991, appeared to be intact with no invasive species colonizing the interior. This site was given a state rank of C which denotes a site in moderate condition.

Finally, along Muddy Brook there appear to be a wide variety of wetland communities including Alluvial Shrub Swamps, Emergent Marshes and perhaps hardwood swamps. These areas are buffered by upland forests composed of a mixture of hardwood and conifer trees. The Muddy Brook corridor as a whole is one of the most diverse landscapes remaining in the SEQ. Its wide variety of upland, wetland, stream and open water communities presumably provide for a large amount of plant diversity and significant wildlife habitat.

## 3.2 **Muddy Brook Basin**

The Muddy Brook Basin area is located in the southeastern corner of the SEQ. It consists of rural lands dominated by agriculture, small woodlots, the Muddy Brook and its wetlands.

### 3.2.1 *Wildlife*

During field visits to this area, evidence of use by mink, river otter, muskrat, red and gray fox and coyote were found. The water provides habitat for waterfowl, shorebirds, and heron and heron-like birds. White-tailed deer utilize this area and it is likely that bobcat use this area as well.

### 3.2.2 *Natural Communities*

Ecologically speaking, the Muddy Brook Basin extends well outside the boundaries of the SEQ. Within the SEQ, however, there appear to be few intact natural communities remaining. The few that remain most likely exist as small Emergent Marsh Wetlands immediately associated with Muddy Brook. This area did not receive a field visit during this inventory.

### 3.3 The Great Swamp

The Great Swamp area is centered on a large hardwood swamp east of Spear Street. It also includes upland forests, shrubby old fields, wetlands and residential use areas that surround it.

#### 3.3.1 Wildlife

The Great Swamp and surrounding upland forest and fields provide habitat for a wide variety of wildlife. Evidence of use by moose, whitetail deer, mink, coyote, red and gray fox was identified at this site. In addition, extensive (spring and winter) bobcat utilization of the site has been recorded. Bobcat are probably drawn to this site for its rich food base. In particular, eastern cottontail rabbits which also utilize the upland forests and overgrown agricultural fields now covered by extensive shrubby patches. Wild turkey utilize this area in all seasons. Woodcock also use the fields for breeding displays.

#### 3.3.2 Natural Communities

The Great Swamp is a large, significant Red Maple-Black Ash swamp. It flows north and east into a small, old-field wetland which eventually flows into Shelburne Pond.

There are five rare plant species that have been found in a swamp in South Burlington called Higbee Swamp. The Great Swamp appears to be the historic Higbee Swamp and habitat for these rare species. These species are *Arethusa* (*Arethusa bulbosa*), bog wintergreen (*Pyrola asarifolia*), bog willow (*Salix pedicellaris*), ram's-head lady-slipper (*Cypripedium arietinum*) and yellow bartonia (*Bartonia virginica*). These plants were all collected around the turn of the century and have not been seen since. It is likely that they have been extirpated from the site, but a thorough inventory of the Great Swamp is warranted.

According to the Nongame and Natural Heritage Program (HNHP) records, this swamp has been recently cut over and is dominated by young red maple trees. This appears to be a fairly standard example of this swamp community, though may be wetter than typical sites.

It also appears to be one of the few wetlands in the SEQ that does not have any invasive species. Significantly, the hydrology of this wetland appears to be undisturbed which is essential to the health of the natural community.

Overall, this is probably the most significant natural community within the SEQ. Despite logging, this swamp appears to be in very good condition. The swamp is large enough to retain natural characteristics and to be shaped by natural processes.

### 3.4 Spear Street

This area is located east of Spear Street and west of the Great Swamp. The Spear Street area is a mix of small wooded areas, old fields, residential land uses, and shrubby and emergent wetlands.

#### 3.4.1 Wildlife

Wildlife within the Spear Street area include large areas of cottontail rabbit habitat, gray and red fox, coyote, wild turkey, hawks, and small mammals.

In addition, fields near Spear Street have historical records indicating the presence of the Upland Sandpiper (Vermont Nongame and Natural Heritage Program).

### 3.4.2 *Natural Communities*

The intact natural communities in the Spear Street study area include a Red Oak-Northern Hardwood Forest and numerous Emergent Marshes along the western edge of the Great Swamp. The hardwood forest is dominated by red oak (*Quercus rubra*), beech (*Fagus grandifolia*), and red maple. There is some evidence that the invasive plant, buckthorn (*Rhamnus cathartica*) is colonizing parts of this forest. This site is of only minor significance from a natural community perspective but is most important acting as a buffer for the Great Swamp.

The Emergent Marshes and other wetlands along the western edge of the Great Swamp were not visited during this inventory due to lack of landowner permission. From remote sources, they appear to be in good condition and likely serve many functions on the landscape such as nutrient removal, wildlife, and open space.

## 3.5 **The Bowl**

The Bowl is located in the south-central portion of the SEQ and contains some of the greatest concentration of wetland and wildlife resources. It is the southern “wild” anchor for the connected lands that include the City-owned lands and the golf course to the north.

### 3.5.1 *Wildlife*

Field inventories revealed sign and appropriate habitat within the Bowl for the following species: bobcat, gray and red fox, coyote, white-tailed deer (non-winter use), wild turkey and ruffed grouse, cottontail rabbits, squirrels, small mammals, weasels, numerous songbirds, forest and field hawks, and the pileated woodpecker.

### 3.5.2 *Natural Communities*

Within the Bowl, Cheese Factory Swamp is one of the most dominant features on the landscape. It is located in the south-east portion of the SEQ near the intersection of Cheese Factory Road and Hinesburg Road. It is a relatively large (approximately 25 acres) swamp surrounded by forest and agricultural fields. This wetland was not visited during this inventory due to lack of landowner permission. Information from NNHP records, however, indicates that this is a Red Maple-Black Ash Swamp. The majority of the swamp was heavily cut over at the time of the NNHP inventory in 1991.

The area that remained undisturbed indicated that the site once harbored a very nice hardwood swamp with a diverse flora.

The hydrology of this site appears to have been slightly altered when the wetland was culverted across Cheese Factory Road. This may have created a wetter area that has become a small Emergent Marsh with sedges and cattails near the road. Despite this alteration of the local hydrology, this swamp is most likely large enough to retain a somewhat protected interior and has the capacity to recover from limited disturbance. If allowed to recover, this swamp would be a fine example of a Red Maple-Black Ash swamp.

The other prominent wetland in the Bowl lies just west of Cheese Factory Swamp and consists of an open, Emergent Marsh. This is part of a drainage that flows south into Shelburne Pond. This wetland appears to be somewhat disturbed, has a history of being grazed by cows and is in part colonized by reed canary grass (*Phalaris arundinacea*), an invasive plant species.

In addition to these wetlands, there are upland forests worthy of note within The Bowl area. These mixed woods (named Cheese Factory Woods) sit just north of Cheese Factory Road and on either side of the Emergent Marsh wetland mentioned above. This area is a mix of Northern Hardwood Forest and Hemlock-Northern Hardwood Forest. Both of these communities appear to be in very good condition. There are some large trees remaining and the forests seem free from any major recent cutting. This not only preserves the natural processes that are controlling these ecosystems, but also minimizes the opportunity for invasive species colonization. Unlike many forested systems in the SEQ, these woods appear to be largely free from invasive species. The northern hardwood forest also appears to be slightly enriched, providing habitat to some spring wildflowers and other nutrient-dependent species. Among these is Glade Fern (*Diplazium pycnocarpon*), which is considered uncommon in the state (S3 rank).

Hemlock-Northern Hardwood Forests and Northern Hardwood Forests are both very common in the state. On a statewide scale, these are both small, typical examples of these communities. On a local scale, however, these communities are exceptional in their size and their undisturbed nature and are therefore considered Locally Significant.

### **3.6 City-Owned Land (including the Calkins land)**

This site is located roughly in the middle of the SEQ and is comprised mainly of the large City-owned lands in the north (see attached map). The land consists of small patches of forest, wetlands, and old fields. This area has a mix of residential uses as well as open land uses such as a golf course and recreational trails.

#### *3.6.1 Wildlife*

The watercourses and wetlands within this area are a haven for wildlife, including beaver, mink, raccoon, waterfowl, and reptiles and amphibians. Herons and fish utilize the habitat provided in the larger ponds and streams. Waterfowl, including Canadian geese have used the area's ponds (even the manmade ones) for breeding habitat. Coyote, red fox, cottontail rabbit, and squirrels also use its forests, fields, and streams. The City-owned lands are also home to whitetail deer in the non-winter months.

#### *3.6.2 Natural Communities*

The forest that sits in the middle of the City property (the City Woods) consists mainly of a Northern Hardwood Forest. It is dominated by sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*). Some more "southern" species such as bitternut hickory (*Carya glabra*) and bur oak (*Quercus macrocarpa*) also occur in the canopy. The herbaceous flora is typical for Northern Hardwood forests but in localized areas includes some species indicative of mineral enriched sites. These include maidenhair fern (*Adiantum pedatum*) blue cohosh (*Caulophyllum thalictroides*) and wild leeks (*Allium tricoccum*). This forest is surrounded by old-field habitat where buckthorn (*Rhamnus cathartica*) is prevalent. There are some areas within the forest where buckthorn has become established as well. The invasion of this forest by buckthorn is the biggest threat to the integrity of this natural community.

A small tributary of Potash Brook flows north through the City Owned Land. Where this stream flows through the upland old-field habitat, numerous small Emergent Marsh wetlands occur along its banks. These wetlands harbor a fair amount of plant and animal diversity. North of the old field and just east of the housing development this stream has been dammed by beaver. The resulting beaver wetland consists of areas of open water, Emergent Marsh and Shrub Swamp. This diverse wetland sits in a matrix of Hemlock-Northern Hardwood Forest. The forested matrix and varied wetland give the site a remote feel uncommon in the northern SEQ.

The Hemlock Northern Hardwood Forest at this site is in fair condition but is most notable for the many Seep communities that are interspersed throughout the area. These seeps are variable in vegetation and size but add to the diversity of habitats in this small area.

## **4.0 Wildlife in the SEQ**

In the short discussion that follows, some of the types of gross vegetative life forms and more specific landscape features and plant species that comprise wildlife habitat in the SEQ are discussed.

### **4.1 Wildlife Habitats in the SEQ**

Wildlife habitat in the SEQ represents a mix of the more agricultural, small woods, and mildly fragmented habitats of Vermont. The bobcat(s) that visit the southern SEQ (there probably is not a population of breeding bobcats in the SEQ) tend to live in wild and at most moderately fragmented landscapes. Bobcat require landscapes where landscape movements are still possible and a variety of habitat types can be accessed.

Predators, in general, require space as their prey are most often spread across the landscape in differing locations and habitats. Many of these species are known as habitat specialists, such as the bobcat, fisher, coyote (to a lesser extent), river otter, mink, and even some squirrels. That is, they have specific and relatively narrow requirements for life, e.g. certain types of food (like hard mast for squirrels), the presence of free standing water, and ledgy or hollow tree protective cover, and these specific features must often be present for the species to be found there.

Habitat specialists are the species of wildlife that most often suffer population declines with the progression of fragmentation. For some species, in certain locales, such as the bobcat in the northwestern SEQ, levels of disturbance and corridor loss may already exclude these species entirely, or, in some cases, only the most opportunistic individuals may enter these areas.

The SEQ wildlife inhabitants are characterized as habitat generalists. Species such as the raccoon, red fox, and the skunk, have variable diets, are omnivores and opportunists, and can live in many different environments and utilize a broad range of habitat and habitat elements. Habitat generalists are typically the species that are in least danger of suffering significant population losses when areas and regions experience severe fragmentation and habitat loss.

Populations of most wildlife species in the SEQ are probably not evenly distributed across the SEQ. As wild landscapes become fragmented by non-wild land uses (such as residential development and accompanying infrastructure) forested, wetland, and other open habitats are unevenly distributed as well. What remains on the landscape are habitat patches (or clumps) of differing sizes, some connected to other habitat patches, some not. The larger patches often become what biologists call “source habitats” where the biggest, best, and often the areas with the highest reproductive or survival rates occur.

These larger patches often become the source habitats for other, connected habitats which may not contain breeding individuals or only small reproductive populations. Recognizing the importance of keeping these larger potential source areas intact, the importance of clusters of

habitat such as The Bowl, City-Owned Property, The Great Swamp, and the Muddy Brook Corridor becomes apparent.

In many cases, the smaller habitat patches that are scattered throughout the fragmented landscape are vulnerable to disturbance. Most animals in small patches have to travel to meet their habitat needs and more frequently encounter roads and cars, people and pets, predators, severe weather events and other pitfalls while traveling across sometimes hostile environments.

Even while at home in these smaller patches of semi-wild and wild landscapes, many individual animals are harassed by these same pitfalls (such as dogs) as their habitat provides a smaller and less safe home than do bigger, wild areas. In these fragmented areas, the need for stepping stone habitats (areas of secure cover within the smaller patches) becomes paramount.

In order to promote the broader population in regions with connected patches of habitat, retaining as many smaller habitat patches as possible is critical.

#### **4.2 Specific Vegetative and Structural Wildlife Habitat Elements in the SEQ**

Within the varied habitats scattered across the SEQ landscape various types of vegetation, such as shrubs, trees, and herbaceous plants are of different value to different wildlife. Some generalizations can be made regarding the value of different plant associations, and the presence of other landscape features that can be important to wildlife.

Forested uplands have important cover value for a wide-variety of wildlife, including whitetail deer, wild turkey, fox and coyote, forest hawks, many predators, and small mammals. Forest areas with hard mast producing trees, such as American beech, red and white oak, hickories, pines and hemlock, are important food sources for many of these same wildlife species. The softer fruits of ash, cherry, and maple, hop hornbeam and the like are also seasonally important foods for many species of wildlife.

Structure within the forest can provide cover, such as rocks, ledges, hollow or dying trees (standing or on the ground), trees with cavities, and large bole trees. These features often provide nest sites, resting sites, and den and perching sites for birds, insects, small mammals and large mammals. These structural features are also important when located in non-forest environments.

Young, dense vegetation such as brambles, and old-field dogwoods, willows, and dense aspen stands are tremendously important and provide cover and food for species such as the cottontail rabbit, mice, and voles. Field hawks, gray and red fox, coyotes, and bobcats are attracted to these environments in search of prey. Environments such as these provide ideal and inviting habitat for predators, especially when in close proximity to forested areas and other areas that provide cover for predator movements.

Wetlands located in a matrix of woods, fields and other wild lands, provide water, food and cover for a wide-variety of SEQ wildlife. Wild turkey, bobcat, moose, wintering and summer deer, coyote, fox, mink, river otter, fisher, a variety of birds and amphibian have been noted in SEQ wetlands.

The wetter areas including open water wetlands, ponds of all types, and rivers and streams provide wildlife habitat for a variety of species and free water for drinking. These sites provide habitat for fish, mink, muskrat, river otter, waterfowl, shorebirds, and heron and heron-like birds.

Agricultural lands, abandoned farmlands and old fields provide food, cover, and crucial habitat connections. The red fox, coyotes, wild turkey, and whitetail deer are often observed in these environments. Grassland birds in the SEQ are inhabitants of these areas as well. In fact, records of unusual and declining species (such as the upland sandpiper) of grassland birds still exist for the SEQ.

### 4.3 Critical Area Designation

In identifying critical ecological areas, in many cases clusters of land including forest, wetlands and fields have been grouped together as critical wildlife habitats. This was done because the SEQ is already moderately-to highly fragmented and large, broad landscapes with relatively wild lands and land-uses are rare in South Burlington.

To protect species of wildlife in the SEQ which require large, diverse areas, landscapes that combine relatively wild (forest and wetland) and semi-wild (such as hay lands and old fields) lands must be protected. This diversity of habitats is essential to meet the varied and sometimes scattered needs of wildlife in search of food, cover, water and finding a mate.

Wild turkey, whitetail deer, bobcat, and the coyote are examples of species of wildlife which still occur in the SEQ and exemplify this need for broad semi-wild and wild habitats. If the clusters listed below, or their landscape connections become further fragmented or developed over time, the likelihood of the continued persistence of these animals in the SEQ diminishes.

Species such as the deer, coyote, and wild turkey roam between habitat elements across hundreds, and at times, thousands of acres. Some of these habitats may only provide seasonally important resources such as important foods, or breeding areas. However, once these habitats become isolated, over-run by dogs, or dominated by human activities, they may no longer be viable to wary species. Over time, these habitats will be abandoned, and the SEQ wildlife resource will be diminished.

The groundhogs, skunks, raccoons, and squirrels found in other parts of the City of South Burlington will dominate the SEQ as well if no planning action is taken and development is allowed to occur in an unmanaged fashion.

It is up to the City of South Burlington and its people to decide what type of wildlife resource the SEQ will have in the future. Recognizing the importance of the natural environment and wildlife to the overall quality of life in South Burlington, careful design, and proactive measures, can result in the flourishing of wildlife into the future.

Growth is possible in the SEQ without major ramifications for wildlife because species adapt to the human presence overtime. Almost all species, however, have thresholds of tolerance to the loss of habitat and the fragmentation of the resources it requires. Continued fragmentation, the outright loss of habitat, and buffer intrusions beyond this tolerance level will result in the continued loss of wildlife populations, and species diversity, in the SEQ.

South Burlington is at a crucial junction in terms of its natural communities and wildlife resources. Decisions regarding growth made now in the SEQ will determine what sorts of wildlife reside and visit the SEQ in the future. It is quite likely, for instance, that the bobcat in the SEQ is near that threshold level. Species such as the black bear, and the fisher are both probably past that level in the SEQ and are infrequent visitors only.

A future vision of the SEQ that includes wildlife species such as the bobcat, coyote, and river otter demands a creative and protective approach to South Burlington's land use planning. Natural areas must be protected now. Sensitive environments such as wetlands, drainages, important natural communities, and forests, must be respected for what they are: natural features with only a limited tolerance for disturbance and resources for the entire SEQ community to grow by. It is important to remember that South Burlington's SEQ contains many natural resources by which people define their visions and values, not just resources that provide the raw materials for our residential and commercial environment.

## **5.0 Natural Communities in the SEQ**

The natural communities in the SEQ are highly variable, both in terms of their community type and their condition. The condition of a natural community is often a function of its size, its landscape setting and the amount of disturbance that has occurred within it.

The size of a natural community is important because very small patches of a community may be dominated by edge habitat. This edge habitat is very different than interior habitat in terms of plant diversity, sunlight penetration (in forested communities), nutrient cycling, and wildlife habitat.

Nearly all of the remaining natural communities within the SEQ are small patches surrounded by old-field habitats, roads or development. The combination of this fragmented landscape setting and small size results in communities that are, to varying degrees, somewhat disturbed. The most obvious sign of this disturbance is the presence of non-native, invasive plant species. These plant species have the ability in some cases to colonize an area forming a monoculture. This dense monoculture usually chokes out native vegetation and decreases the quality of the natural community.

Intact natural communities provide habitat for a wide variety of flora and fauna. When adjacent to more residential areas, they also provide important recreational and educational opportunities. The loss of intact natural communities means not only the loss of natural plant and animal habitat but also the opportunity for this recreation and education. There are three main threats to the remaining natural communities in the SEQ: continued fragmentation, invasion by non-native plant species and, in a few cases, improper logging practices.

## **6.0 Wetlands in the SEQ**

AE performed a detailed functions and values assessment for seven wetlands in the SEQ. All of these wetlands have already been mentioned previously in this report and are not individually identified on the report map. These wetlands included most of the wetland types found within the SEQ and consist of marshes, shrub swamp wetlands associated with surface water, an old field wetland, and treed swamps.

Several wetland functions and values within the SEQ take on greater significance in the SEQ rural suburban mix with numerous impervious surfaces, roads, houses, and construction activities. Wildlife values of SEQ wetlands can be high both for habitat value itself as well as movement corridors. In the environmental setting of the SEQ wetlands are often the only wild and semi-wild land-uses remaining on the landscape. This makes these wet, undeveloped spaces, even more significant for wildlife.

Floodwaters are often higher in areas with impervious surfaces and these same waters often contain the contaminants associated with road runoff, construction activities and the other pollutants that come with a rural-suburban mix. Wetlands in these areas can be important in terms of cleansing water and decreasing flood peaks which ultimately lessens the potential damaging effects of nutrients, sediments, toxicants, and high water in the SEQ.

Wetlands that are visible and offer distinct views such as open water, tall trees, showy colorful flowers, and distinct vegetative differences with the surrounding landscape are important for aesthetic and open space values. Some of these same wetlands are possible educational sites (i.e. boardwalks) as well as areas where neighborhood people build tree houses, or fish, and otherwise seek recreational opportunities such as bird and wildlife watching.

Wetlands make an overall contribution to the quality of life of the SEQ. As mentioned above, they provide important ecological functions such as contributing to wildlife habitat and values, modify hydrology, and clean water. A few details of specific functions are discussed below.

### **Flood Control**

South Burlington wetlands which have expandable basins and are connected to brooks and streams are generally effective at dampening peak flood flows in the SEQ. This is very important in areas of the SEQ where human investments and sensitive ecological environments are present such as culverts under roads, houses, and areas where fish are present.

### **Water Quality Enhancement**

Wetlands in the SEQ with persistent (lasting through the winter) vegetation which are connected to brooks and streams were effective at removing sediments, nutrients, and toxicants where present. Many of the shrub wetlands along Muddy Brook were particularly significant at cleansing waters. This function is critical in keeping surface waters relatively clean and not clogged by sediment and algal growths.

### **Wildlife Habitat**

Most SEQ wetlands provide habitat for wildlife. The larger wetlands (more than 1 acre) provide habitat for a greater number of species, although many of the smaller ones (less than 1 acre) also provide habitat for amphibians and reptiles. Wetlands with open water provide habitat for waterfowl, herons, shorebirds, river otter, mink and raccoon, and deer.

Many old field wetlands with shrubby habitat provide excellent cover for cottontail rabbits and are visited by coyote, bobcat, and hawks throughout the SEQ.

### **Open Space and Recreation**

Visible wetlands near transportation corridors provide open space benefits. Certain features such as open water and the presence of sinuous water courses add to that value.

Wetlands that are accessible and have a diversity of vegetative forms, unique formative process (such as floodplains or beaver influenced areas) or unique wildlife (such as Greta Blue Herons) present are great places for recreation or education opportunities.

## **7.0 Critical Ecological Lands and Site Specific Recommendations**

Remote and field assessments conducted during this inventory have resulted in a list of sites that are critical to the ecological functioning of the landscape in the SEQ. These sites are divided into Primary and Secondary Ecological Lands.

The Primary Ecological Lands are those sites that must be maintained or improved if the ecological functioning of the SEQ landscape is to remain at its current level. Following the recommendations put forth below would ensure that: 1) the natural communities of the Primary Ecological Area will not be degraded beyond the current condition; 2) these natural communities will continue to provide adequate habitat for the wildlife currently present in the SEQ; and 3) natural processes such as mineral cycling and the flow of energy and water throughout the system will be maintained in a functioning state.

Recommendations for Wildlife Habitat and Natural Communities protection are presented separately.

## **7.1 Primary Wildlife Areas**

### **7.1.1 The Great Swamp Region: Wetlands, Upland Forests, Shrubby Fields, And Open Space**

The Great Swamp, and the upland forest and shrubby fields that surround it comprise a 400-500 acre cluster of contiguous and varied wildlife habitat. It is the anchor, the source habitat for the western SEQ and must remain unfragmented if the level of current wildlife array is to be maintained in the SEQ. Wildlife, within the region need to be able to continue to access the food, cover, and space resources of this area.

#### ***Recommendations:***

1. The Great Swamp should be protected from development by a minimum of a 300-foot isolation buffer.
2. The Upland Forest surrounding the Great Swamp should have no paved roads, or development within its current boundaries. It should remain unfragmented.
3. The shrubby fields to the west of the Great Swamp should be managed as early succession habitat and not be fragmented by paved roads or development.
4. Open space, including the large fields west of Dorset Street should remain as unfragmented as possible and kept as open space.

### **7.1.2 Muddy Brook Corridor and Basin: The Brook, it's Tributaries and it's Contiguous Wetlands**

The wetlands along the Muddy Brook Corridor provide food and cover for fish, waterfowl and shorebirds, songbirds, mink and river otter, and whitetail deer. Muddy Brook and its wild and semi-wild linear corridor also facilitate the north-south movement of these and other species of wildlife along the eastern edge of the SEQ.

#### ***Recommendations:***

1. The wetlands along the Muddy Brook corridor should be protected with a 300-foot isolation buffer from intensive development activities (such as multiple houses), and a 100-foot buffer from less intensive development (such as single homes).
2. Intrusions that enter into the Muddy Brook Corridor should be greatly restricted.
3. Culverts and bridges should be greatly restricted on and over Muddy Brook and it's tributaries.
4. Activities in this region should remain agricultural, and in terms of wildlife, and water quality, hay land is preferable to row crops.

### **7.1.3 City Owned Land and Wetlands to East and North**

The City-owned land has some of the largest upland forested areas in the SEQ. These forests provide undeveloped space, cover, water, and food for a wide variety of wildlife in the SEQ. In addition, when combined with the wetlands to the east and north, they create a large pocket of semi-wild and wild lands. Gray and red fox, coyote, whitetail deer, beaver, mink, wild turkey, amphibians, a varied birdlife and other species make their home here. This area contains highly accessible areas that give the public opportunity for wildlife viewing.

#### ***Recommendations:***

1. The forests within the City Owned Land should not be fragmented. Roads and development should be prohibited in these forests.
2. Route Trail system additions within the City Owned Land should be constructed away from waterways, significant wetlands, and the middle of the large forest section.
3. Streams and brooks within the City Owned Land should be protected by a naturally vegetated 100-foot riparian buffer zone.
4. The streamside riparian corridor should be restored to provide cover where it is currently not present.
5. The spread of buckthorn and other invasive plants (such as honeysuckle) should be controlled within the upland Northern Hardwood Forest in the City Owned Land.

### **7.1.4 Upland Forest, Cheese Factory Swamp, and Other Wetlands in the Bowl**

The forests and wetlands in the Bowl region cluster provide a healthy mix of hardwood and coniferous forest communities as well as marsh and pond habitats. These areas are habitat to coyote, bobcat, whitetail deer, wild turkey, many hawks and many species of songbirds. This cluster of 300-400 acres of undeveloped land is often the point of entry of wildlife moving north from Shelburne and is a pivotal connecting point in wildlife movements throughout the southern SEQ.

The swamp north of Cheese Factory Road plays an important role in the overall wildlife habitat picture within the southern SEQ. Wildlife such as deer, turkey, and bobcat utilize the forests, fields, and wetlands of The Bowl, Shelburne Pond, and The Great Swamp, and possibly as far away as the City-owned parcels to the north as well as the Cheese Factory Swamp.

#### ***Recommendations:***

1. The Bowl cluster should not become further fragmented by scattered development and road.
2. Roads and driveways constructed within this cluster should remain unpaved, narrow, vegetated up to the road shoulder, and short in length.

3. The Cheese Factory Swamp should be protected with a 300-foot isolation buffer. Other wetlands in this cluster should be protected with 100-foot isolation buffers. The Swamp and its buffer should be excluded from any logging activity.
4. Forest and shrub plantings on the south side of Cheese Factory Road near this wetland would enhance wildlife crossings in this area and provide more secure crossing areas for shy species such as the bobcat.
5. The wild and semi-wild connection between this swamp, The Bowl and Shelburne Pond should remain as unfragmented as it is currently.

## **7.2 Primary Natural Communities**

### **7.2.1 Great Swamp**

As mentioned in Section 3.0, the Great Swamp is a large, relatively undisturbed Red Maple-Black Ash swamp. The hydrology of this site appears to be undisturbed and the site is not yet colonized by invasive, non-native species. It appears to be a very diverse site, both in terms of flora and fauna and may be home to five historic populations of rare plants. The Great Swamp is likely the largest, most significant intact natural community occurring in the SEQ. Preserving the integrity of this natural community should be a priority for conservation in South Burlington.

#### ***Recommendations:***

The recommendations outlined for this site under the wildlife section (Section 7.1.1.) are very important for preserving this community. In addition to those outlined in Section 7.1.1, the following two actions are also recommended.

1. Exclude the Swamp and a 100-foot isolation buffer from any logging activity.
2. Monitor the Swamp for the spread of invasive plant species. If any invasive species become established, a control program should be implemented.

### **7.2.2 Cheese Factory Swamp**

Cheese Factory Swamp is large Red Maple-Black Ash swamp that is considered a Locally Significant natural community. This area was not visited during this inventory due to lack of landowner permission, but according to NNHP records, is in fair to moderate condition.

#### ***Recommendations:***

The recommendations outlined for this site under the wildlife section (Section 7.1.5) are very important for preserving this community. In addition to those outlined in Section 7.1.5, the following two actions are also recommended.

1. This swamp should be excluded from logging. Logging in especially wet sites such as this often disrupts local hydrology and disturbs the fragile soils. Disturbance of wetland soils often results in the colonization of non-native invasive plant species.

2. Monitor the Swamp for the spread of invasive plant species. If any invasive species become established, a control program should be implemented.

### **7.2.3 Van Sicklen Woods**

The Clayplain forest of Van Sicklen Woods is a locally significant site and the only Clayplain forest in South Burlington. This Clayplain forest is surrounded by emergent marsh wetland and agricultural field. The following recommendations are intended to preserve the integrity of this unique natural community.

#### ***Recommendations:***

1. Exclude this site from logging. Even though there may be trees of marketable size within this forest patch, logging would likely disturb the soils and open up the site to invasion by non-native plant species. In addition, examples of this community are much more rare than they once were in Vermont and preserving examples of this communities is therefore important.
2. This site should be protected from any development activity by a 200 foot buffer.

### **7.3 Secondary Wildlife Areas**

By protecting the areas identified as Secondary Ecological Lands, and implementing the General Recommendations on these lands, the SEQ stands the chance of inviting new wildlife species and maintaining viable natural communities and populations of wildlife species into the future.

#### **7.3.1 Golf Course Woodlot, Wetlands and Fields**

This approximately 220 acre series of woodlots, wetlands, drainages, and fields (both overgrown and in current agricultural land use) are important habitat for wild turkey, fox, cottontail rabbits, and seasonally for coyote and whitetail deer. They also function ecologically as a corridor of undeveloped land that provides the most significant link (outside of the Muddy Brook linear corridor) between the northern SEQ and the southern SEQ. This corridor links the City Owned cluster to the north, with the Bowl and associated open land to the south.

#### ***Recommendations:***

1. The small-forested woodlots and wetlands should remain undeveloped.
2. The wetlands, open and old fields, and agricultural fields south and southeast of the golf course and north of the Bowl should remain unfragmented by development and paved roads.
3. These same wetlands, and woodlots should have protective isolation buffers of at least 100 feet.
4. The corridor value of this cluster of relatively undeveloped lands should remain intact with a minimum 300 ft wide corridor.

5. Fencerows, hedgerows, drainages, meadows and other wetlands that are found within the corridor should be protected.
6. If this corridor is broken by roads or other development, the use of wide, vegetated overpasses or underpasses should be implemented.
7. Unnecessary fencing should be removed in these areas.

### **7.3.2 Forest, Wetlands, and the Southern Muddy Brook Corridor**

This 20-25 acre cluster of upland forest, wetlands, and Muddy Brook provides habitat for fish, amphibians, waterfowl, mink, river otter and other wildlife. It is part of the corridor extending south to Shelburne Pond.

#### ***Recommendations:***

1. This cluster of land should be protected from paved roads, bridges and other intensive development activities.

## **7.4 Secondary Natural Communities**

### **7.4.1 City Woods**

This small island of upland forest sits in the middle of the city-owned property. The most undisturbed part harbors a Northern Hardwood Forest. The edges of this forest, however, are thick with the invasive buckthorn. In some areas, buckthorn has established a tentative foothold within the forest. If this plant is to be eradicated from the small interior of the forest, steps should be taken immediately to control its spread. The plant is so well established around the perimeter of the forest that completely eradicating it from this site would be unfeasible.

#### ***Recommendations:***

1. An aggressive invasive plant control program should be instituted. This should include the eradication of buckthorn and honeysuckle from the interior of the Northern Hardwood forest on this property.
2. This site should be monitored on a yearly basis for further establishment of non-native plants.

### **7.4.2 Dubois Swamp**

As mentioned above, Dubois Swamp is a flooded hardwood swamp with a significant amount of white pine (*Pinus strobus*), much of it standing dead wood. This site is likely flooded by beavers on the northern end and appears to contain a fair amount of open water, even on the south end where it was viewed from the end of Dubois Road. This swamp is connected to the Van Sicklen Woods Clayplain forest to the south (see Section 7.2.3).

***Recommendations:***

1. Dubois Swamp should be protected by a 200-foot isolation buffer from any development activity.
2. Dubois Swamp should not be fragmented from Van Sicklen Woods by the construction of a road which runs between the two. This is currently a dirt path and should remain undeveloped.
3. The beaver that have colonized Dubois Swamp should not be removed from the site.

**7.4.3 Cheese Factory Woods**

These woods are a mix of Northern Hardwood Forest and Hemlock-Northern Hardwood Forest. They are the best examples of undisturbed upland natural communities remaining in the SEQ.

***Recommendations:***

1. The upland forests should be monitored for the presence of non-native invasive plant species such as buckthorn, honeysuckle and barberry.
2. Logging in these forests should be done with great care, if at all. Logging, if conducted, should take place in the winter when soils are frozen and there is adequate snow cover. Logging should only be done on a selective scale. Only diseased beech trees should be removed. Any healthy beech or other mast producing species should remain.

**8.0 Planning Recommendations**

The current nature of wildlife habitat in the South East Quadrant (SEQ) provides adequate habitat and connections on the landscape for whitetail deer, coyotes, grey fox, red fox, raccoons, squirrels, mink, beaver, wild turkey, and small mammals to live and most likely breed, wherever there is available habitat.

The SEQ also provides seasonal home for the bobcat, moose, river otter, and perhaps, fisher. To maintain the presence of these animals in the long term, further fragmentation of open, undeveloped, roadless, and culvertless landscapes must be prevented.

To that end, we address several planning and zoning issues that have bearing on the integrity of natural communities and wildlife habitat in the SEQ.

**8.1 General Recommendations**

There are several concepts arising out of the field of landscape ecology that help maintain the integrity of natural communities, ecological functioning, and wildlife habitats. These concepts are aimed at maintaining a diversity of wildlife and adequate populations to maintain wildlife in the SEQ over the long term. They recognize that larger areas may be the source for much of the SEQ's wildlife and that movements of wildlife in and out of these areas and throughout the landscape are critical to the maintenance of wildlife populations.

***Recommendations:***

1. Do not dissect the remaining open spaces (especially woods, wetlands)
2. Give extra protection to larger wild parcels
3. Maintain natural corridors on the landscape
4. Maintain stepping stone small wildlife habitats
5. Maintain wide wildlife corridors
6. Do not surround important habitats with development
7. Protect natural corridors such as wetlands, streams, and ridges
8. Protect with protective buffers caves and other bat

**8.2 Transportation**

The large scale movement of wildlife in the SEQ is primarily north to south, parallel to the major traffic arteries (Spear and Dorset Streets). Wildlife movements include dispersal by young of the year, movements to fill in empty habitats (resulting from death), and movements in search of mates and seasonal food resources. The more an animal moves across the landscape the more vulnerable the animal is to the effects of fragmentation. This applies to bobcats, fisher, coyotes and moose in particular.

Along with roads generally come culverts and this has the potential to limit fish passage, as well as mink, muskrat and river otter movements.

***Recommendations:***

1. Restrict the development of east to west roads and transportation corridors.
2. Encourage shrub and forest (combined) vegetation up to road and driveway to facilitate wildlife crossings.
3. Incorporate road signage which warns of “Wildlife Crossing” and encourages drivers to “Slow Down for Wildlife” at key crossing locations.
4. Consider road Overpasses/ Underpasses where east to west road or trail crossings are considered or where critical crossing areas exist.
5. Require wide, vegetated, corridors associated with culverts.
6. Require flattened or bottomless culverts or bridges which facilitate fish and wildlife movements though and under them.
7. Discourage road placement that parallels waterways and other nearby roads (it discourages crossing by wildlife).
8. Keep driveways unpaved, vegetated on both sides, narrow, and short.

**8.3 Vegetation Management**

Dead wood provides habitat for many small and medium size mammals, birds, and amphibians. Dead wood that remains standing, called snags, provides perches and nests for birds. Dead decomposing wood on the ground mediates hydrology, adds nutrients to the soil and provides habitat for many species of wildlife.

The quality of many natural communities are threatened by the invasion of exotic plant species. In some situations, the control of these species is critical to maintaining functioning natural communities.

***Recommendations:***

1. Restrict, where safety permits, the cutting/removal of dead trees on public property
2. Restrict the clearing/removal of downed dead wood on public property
3. Monitor and control the spread of exotic, invasive plant species.

## 8.4 Fencing

The presence of fencing limits wildlife movements and causes wildlife injury.

### *Recommendations:*

1. Restrict or limit new fence construction outside of agricultural areas on public and private lands.
2. Encourage the removal/cutting of existing unneeded fencing.
3. Where fencing is necessary, create breaks that allow wildlife passage.
4. Prohibit the fencing of stream/rivers/wetlands.
5. Promote fencerow vegetation.

## 8.5 Design Elements for Development

There are various techniques and methods to minimize the negative influence that development activities can have on wildlife. One can plant vegetation to attract wildlife, locate development in relatively benign environments, or use earth-tone paints for the development. Below, are some design recommendations for protecting wildlife and wildlife habitat.

### *Recommendations:*

- A. Vegetative Screening on Public and Private Development Activities
  1. Require multi-tiered planting schemes utilizing herbaceous, shrubby, and large & small trees.
  2. Require a hardwood-conifer mix to provide all season habitat and cover.
  3. Require the use of native species for all plantings.
- B. General Plantings-Public and Private Development Activities
  1. Require substantial areas of open space associated with development.
  2. Orient open space in ways to facilitate wildlife habitat and movements.
  3. Require plantings to incorporate wildlife food species such as: hard and soft mast producing trees such as oak, hickory, American beech, pine, black cherry, and white ash.
  4. Require plantings to consist of berry-producing shrubs such as blackberry and raspberry.
  5. Tree plantings should be wide enough to withstand wind damage (2-3 tiers thick).
  6. Incorporate wooded paths within developments.
  7. Lighting associated with human activities should be minimally intrusive and focused downward and away from potential wildlife habitats.
- C. Other Recommendations
  1. Restrict pets (in particular cats and dogs) in developments located near important wildlife habitats (wetlands and forests).
  2. Maintain 100-foot buffers around vernal pools.
  3. In Grassland areas, check for early successional birds such as the Grasshopper Sparrow and Upland Sandpiper.
  4. Maintain some shrublands as non-forested.
  5. Protect all mature stands of trees (hardwood and softwood).
  6. Protect identified deer winter yards with a protective 300-foot buffer.

7. Promote the contiguity and the connections of wildlife habitats to and between nearby towns.

## **8.6 Ponds**

Ponds within the SEQ provide habitat for fish, waterfowl, amphibians, shorebirds, aquatic mammals and other wildlife. They also provide wildlife viewing opportunities in the SEQ.

### ***Recommendations:***

1. Provide an isolation buffer from housing units and other human activities.
2. Require wildlife plantings, including
  - a. Submerged aquatics
  - b. Floating Leaved aquatics
  - c. Emergent aquatics
3. Require gradual slopes on ponds (10 % or less, so vegetation grows) and create islands in ponds for bird nesting).
4. Require tree and shrub plantings for wildlife cover on adjacent uplands.
5. Fencing should not be used to surround ponds where possible.
6. Create small vegetated islands in ponds.

## **8.7 Streams and Rivers**

Streams provide habitat for fish, amphibians, waterfowl and songbirds, wild turkey, shorebirds, muskrat, mink, otter, raccoon, bobcat and other species. A natural vegetative riparian buffer is important in maintaining the value of these streams and streamside environments.

### ***Recommendations:***

1. Allow beavers to dam where possible (creates wildlife habitat and diversity).
2. Minimize stream fragmentation, limit culverts, streamside intrusions.
3. Maintain, enhance, and restore riparian vegetation with at least 50 feet either side of small streams and 100 feet either side of larger streams throughout the SEQ.
4. Maintain dead tree snags near water (for nests and perches).

## **9.0 Conclusions**

South Burlington's Southeast Quadrant is a landscape of open space, woodlots, and a relatively low population density in the midst of Vermont's most populous region, Chittenden County and the Greater Burlington area.

Wild animals such as white-tailed deer, the occasional moose, coyote, bobcat, river otter, and aerial predators such as hawks and the aquatic beauties such as the Great Blue Heron still reside. Wild turkey are found throughout the SEQ.

Natural Communities such as swamps and Northern Hardwood and Eastern Hemlock forests are scattered throughout the SEQ providing habitat for orchids, maidenhair ferns, and other species of plants.

Streams and brooks, wetlands, and ponds provide habitat for fish, amphibians, and waterfowl which share the landscape and enrich the lives of citizen's of the SEQ.

The SEQ's natural history, and the function of its ecosystems make important contributions to the quality of life in the SEQ. People enjoy the SEQ's walking paths, they are enthralled at the site of a deer, or beaver, and people are excited at the site of an orchid or the beautiful flower of any plant. The natural systems provide the air that we breathe, the water that we drink, and the soils that we garden and farm. These are products of our natural environment, including the local environment.

The water, air, wildlife and plants that we tend to take for granted, are of course, vulnerable to the strong pressures of suburbanization that are common in Chittenden County. Roads, housing, pets, commercial enterprises, lights and the noise that accompanies an increase presence in our communities takes its toll on wildlife and wildlife movements. The dissection of our natural communities, the building of new roads in these areas, and soil disturbances enhance the spread of non-native plant species and loss of integrity and possibly ecological functioning of our natural system.

The City of South Burlington has begun the process of determining the status of the natural environment within the SEQ. It's recognizing the importance of protecting what still remains.

This project provides a snapshot in time of some of its natural resources, in particular, the SEQ's wildlife and natural community base. We offer many recommendations to protect, and enhance, the SEQ's natural resources base. We believe that with the implementation of these recommendations-the SEQ can begin to stem the tide of fragmentation and a diminished resource base so common in the Greater Burlington region.