# 8 WILDLIFE HABITAT UNITS OF STRATHCONA COUNTY - DESCRIPTION AND OCCURRENCE

The ultimate aim of planning for habitats is the conservation of associated wildlife species. In the end, three main ingredients determine whether such a plan is successful: (1) the availability of habitats; (2) the behavior of individual animals; and (3) the dynamics of populations across the landscape. This Prioritized Landscape Ecology Assessment is the first step of that process and is required to ensure that the other two factors are allowed to proceed in as natural a manner as possible.

In an effort to provide an inventory of habitats in Strathcona County, remnant wildlife habitats were delineated and classified into three broad groups of Wildlife Habitat Units (WHUs) on the basis of physical landscape characteristics: Upland Wildlife Habitat Units, Wetland Wildlife Habitat Units, and Lake Wildlife Habitat Units. Each of these groups of WHUs has distinct characteristics regarding vegetation establishment and, thus, wildlife use. Table 11 below summarizes all of the WHUs delineated during the course of this study and the remainder of section 8 further details these units.

**Table 11: EXISTING WILDLIFE HABITAT UNITS IN STRATHCONA COUNTY**

| Wildlife Habitat Unit Code | Wildlife Habitat Unit Type | Description | Area (ha) | % of Area |
|---|---|---|---|---|
| **Ua** | Upland Poplar | Aspen - Balsam poplar | **11236.9** | **69.0** |
| **Ub** | Upland Mixedwood | Aspen - White spruce | **2144.6** | **2.0** |
| **Uc** | Upland Forest with Small Wetlands | Aspen - Sedge | **8216.6** | **6.9** |
| **Ud** | Corridor | Aspen - Willow | **424.0** | **0.4** |
| **Ue** | Upland Conifer | White spruce / Jack pine | **764.9** | **0.6** |
| **Wa** | Marsh | Sedge | **1485.3** | **1.2** |
| **Wb** | Bog | Black spruce - Scrub birch | **684.1** | **0.6** |
| **Wc** | Slough | Cattail - Bulrush - Sedge | **563.8** | **0.5** |
| **Wd** | Wetland complex without open water | Willow - Sedge - Black spruce | **1236.0** | **1.0** |
| **We** | Wetland complex with open water | Cattail - Willow - Sedge | **1354.0** | **1.1** |
| **Wf** | Drainage Course | Balsam poplar | **2476.0** | **2.1** |
| **Wg** | Swamp | Willow - Sedge | **2326.0** | **1.9** |
| **La** | Lake - emergent zone | Waterfowl breeding | **n/a** | **n/a** |
| **Lb** | Lake - emergent zone | Waterfowl brood-rearing | **n/a** | **n/a** |
| **Lc** | Lake - free floating / leaved zone | Waterfowl molting habitat | **n/a** | **n/a** |
| **Ld** | Lake - submergent / open water | Waterfowl feeding / staging / migration | **6072.4** | **5.1** |
| **Le** | Lake - emergent zone | Waterfowl breeding / brood-rearing | **n/a** | **n/a** |
| **La,b,c,e** [1] | Lake - all emergent zones | | **1559.3** | **1.3** |
| **La,b,c,d,e** | Lake - all zones | | **264.2** | **0.2** |

**1.** La,b,c,e refers to a complex of various lake emergent zones which are used for a combination of waterfowl life requisites, including breeding, brood-rearing, molting, feeding, and staging. La, Lb, Lc, and Le units were rarely, if ever, identified in isolation.

## 8.1 Upland Wildlife Habitat Units

Vegetation cover was the primary criteria used to determine upland wildlife habitat units in the Strathcona County study area. Forested zones, such as those described below, usually have the highest level of habitat diversity witnessed in the County. Forested habitats ranging from aspen and aspen-dominated mixedwoods to late-successional white spruce forests can be classified into the following Wildlife Habitat Units (WHUs):

- upland poplar forest;
- upland mixedwood forest;
- upland forest with small wetlands;
- corridor; and
- upland coniferous forest.

Following are brief descriptions of each of these upland WHUs.

### 8.1.1 Upland Poplar Forest (Ua)

Closed deciduous forests form core habitats used by numerous wildlife species including ungulates, birds, and small mammals (Downing and Karpuk 1992). The Upland Poplar Forest Wildlife Habitat Units are located primarily in the Cooking Lake Upland Ecodistrict and occur least frequently in the Leduc Plain Ecodistrict. The Upland Poplar Forest WHU is characterized by mature stands of aspen and balsam poplar, with an understory shrub layer of prickly rose and western snowberry.

Upland poplar forest typically occurs in blocks of hummocky undulating moraine. These blocks are usually from 20-80 hectares in extent and are surrounded by agricultural and country residential land uses. In many cases, country residential subdivisions occupy all or part of these upland forest blocks. Remnant patches of upland poplar forest often encompass small sloughs and wetland complexes. These patches are usually less than 10 hectares in extent and are often separated from neighbouring patches by agricultural land-use. Upland poplar forest has been retained on sites where factors such as poor soil and steep slopes have prevented clearance of land for agriculture. Landforms on which these factors are persuasive, such as valleys, sand dunes, and hummocky moraine, support the vast majority of upland poplar forest in Strathcona County.

Upland Poplar, Conifer, and Mixedwood WHU were differentiated during the aerial photography interpretation phase of this study. These upland forest WHUs were separated by the presence or absence of coniferous tree cover within each unit into the WHU categories of Upland Mixedwood, Upland Poplar, or Upland Conifer. The Upland Poplar Forest WHU classification was applied to woodland where conifer cover comprised less than 5 percent of the total canopy cover.

### 8.1.2 Upland Mixedwood Forest (Ub)

Upland forest was given an Upland Mixedwood WHU designation when conifers comprised from 5-75 percent of the total canopy cover of coniferous and deciduous tree species. The Upland Mixedwood forest classification was applied to white spruce - poplar mixedwood, and jack pine - aspen mixedwood. The white spruce - poplar mixedwood is distributed throughout the Cooking Lake Upland Ecodistrict and Leduc Plain Ecodistrict, but comprises only a minor portion of the overall forest cover in these ecodistricts.

Mixedwood forest is located on islands in the larger lakes such as Big Island and Twin Island. These islands were excluded from the fires that occurred in 1895, 1923, and 1929 (Griffiths 1991). Mixedwood forest is often present on northerly aspects of incised stream valleys and occasionally in riparian zones. Where mixedwoods occur within identifiable drainage courses, especially incised valleys, it has been designated as a Drainage Course WHU.

Upland mixedwood forest is represented primarily by two community types: white spruce - poplar, and jack pine - aspen. The jack pine - aspen mixedwood is found exclusively on eolian sand deposits within Strathcona County. These open, dry forests are often interspersed with grassland. A mosaic of these two vegetation types is present on the sand dunes; grassland occupies depressional blowouts and southerly aspects, while aspen poplar is adapted to all other upland sand dune ecosites. Aspen poplar is co-dominant with jack pine on all aspects except south, where grassland or jack pine dominate.

The undulating sand dunes are separated by level areas that are not true wetland or upland vegetation communities. Level plains dominated by scrub birch have been coded as wetland wildlife habitat units due to the absence of jack pine forest. The narrow eco-tones of jack pine - aspen poplar forest, which separate wetland habitat and dry unforested sand dunes, have been included with the aforementioned wetland habitat units. Wildlife habitat units mapped for this study have a minimum area of one hectare.

### 8.1.3 Upland Forest - Small Wetland (Uc)

Upland forest - small wetland habitat complexes support a high diversity of species and supply a variety of habitats in an ecologically integrated unit, uninterrupted by agricultural or country residential land use (Griffiths 1991). This wildlife habitat unit typically contains much of the same vegetation type as the upland poplar forest described in the preceding section. Upland Forest - Small Wetland WHUs are distinguished, however, from other upland forested WHUs by a relative abundance of small wetlands within the forest stand. These wetlands are smaller than 1 hectare, therefore they are not classified as wetland wildlife habitat units in this study. Upland poplar forest on hummocky moraine landforms often include wetlands located in small depressions. These wetlands support willow (*Salix spp.*), sedges (*Carex spp.*), and where open water is present, cattails (*Typha latifolia*) and bulrushes (*Scirpus*).

If a wetland within an upland forest is mapped as a wetland wildlife habitat unit and surrounding upland forest lacks any other unmapped wetlands, that upland forest is classified appropriately as one of the upland forest wildlife habitat units.

### 8.1.4 Corridor (Linking Forest Units) (Ud)

Corridors are narrow strips of land which differ from the matrix on either side, where the matrix is the most extensive and most connected element in the landscape (Forman and Godron 1986). Corridors are important in providing both protection and resources for wildlife populations. It is important to stress that landscape elements that function as corridors under a certain set of conditions may act as a barrier in others (Forman and Godron 1986). Linear corridors of wildlife habitat, linking larger or smaller blocks, facilitate the movement and dispersal of species (Griffiths 1991).

Corridors linking Upland Poplar and Upland Mixedwood Wildlife Habitat Units are comprised of several vegetation types. Often, drainage courses with willow shrub cover (*environmental resource corridors*) provide travel corridors for ungulates moving between forest patches. Frequently, narrow strips of upland poplar forest are retained as *remnant corridors* in the surrounding disturbed matrix. These may be of sufficient width (i.e., 100 m or more) to provide movement cover for species adapted to upland forest patch interiors. The primary criteria for designation of a vegetation type as a *corridor* is that it links upland forest patches with an area of 10 of more hectares (Griffiths 1991).

Corridor Wildlife Habitat Units provide an essential role in retaining species biodiversity through allowing flows of nutrients, bird and mammal populations, and plant species propagules to continue within a highly disturbed landscape matrix. The pre-settlement poplar forest - grassland

matrix of Strathcona County has largely been replaced with non-native vegetation. This mixture of agricultural and infrastructure land-use which comprises the modern landscape matrix of Strathcona County further serves to emphasize the ecological significance of corridors as a means of movement for native plants and animals. The roles that these corridors serve for the conservation and management of regional wildlife populations is further detailed in sections 9.0 and 10.0 of this report.

### 8.1.5 Upland Coniferous Forest (Ue)

Coniferous forest habitats provide the life requisites for several bird and mammal species such as northern three-toed woodpecker (*Picoides tridactylus*) and white-tailed deer. Ungulates such as deer and elk obtain thermal cover in winter beneath dense white spruce canopies (Redgate 1979). The Upland Coniferous Forest Wildlife Habitat Unit classification applies to both jack pine and white spruce dominated forest. Jack pine coniferous forest is restricted to eolian sand dune deposits within the study area. This forest type has no more than a 5 percent cover of aspen poplar and white birch (*Betula papyrifera*). White spruce dominated coniferous forest are represented by a few small (< 30 hectare) patches in the Leduc Plain Ecodistrict. These mature stands occupy slight north-facing slopes within the agricultural land matrix. Coniferous forest forms nodes along environmental resource corridors such as the Point-aux-Pins Creek valley. Within this stream corridor, conifers primarily occupy steep north-facing slopes, but also form stands on level alluvial deposits in the riparian zone. Nyland (1969) reported extensive stands of white spruce to be present in the southern portion of the County prior to 1900 but fires have removed most of these stands, effectively relegating large patches of coniferous-dominated woodlands to the large islands in lakes such as Cooking Lake.

## 8.2 Wetland Wildlife Habitat Units

Several types of wetland wildlife habitat are found in Strathcona County, ranging from small isolated sloughs with an area of a few hectares to wetland complexes with several wetland types covering over 100 or more hectares. Numerous wetland classification systems are in existence, as described previously in section 7.1, however wetland classes that reflect parameters of water level, water permanence, and associated vegetation are most useful for assessing the overall value of wetlands as wildlife habitat for terrestrial mammals, semi-aquatic mammals, and waterbirds.

On the basis of previous attempts to inventory and classify wetlands in portions of Strathcona County (Ducks Unlimited 1986, Griffiths 1987, Griffiths 1992) and in other areas of Alberta (Green et al. 1984, Alberta Water Resources Commission 1993, D.A. Westworth and Associates

Ltd. 1993, Strong et al. 1993), wetlands in Strathcona County have been classified into the following Wildlife Habitat Unit types:

- large marsh;
- large bog;
- large slough;
- wetland complex without open water;
- wetland complex with open water;
- drainage course; and
- swamp - shrub wetland.

Following are brief descriptions of each of these wetland Wildlife Habitat Units.

### 8.2.1 Large Marsh (Wa)

Marshes are wetlands that are periodically or permanently inundated by standing or slowly moving water and, hence, are rich in nutrients. Griffiths (1991) defined marshes as "wetlands with permanent shallow standing water (0.3 - 0.6 metres) and a variable cover of emergent vegetation throughout an area of 5 - 99 hectares. They are characterized by emergent vegetation such as reeds, rushes, cattails, and sedges (Bond et al. 1992) and it is this feature that gives marshes a considerable water retention capacity. Marshes have an important function in regulating and maintaining stream flow (Gooselink and Turner 1978). A common feature of marshes in the Strathcona County study area is that they have little upland vegetation separating them from agricultural land and, in many cases, they have been partially converted to agricultural land uses such as hay production.

### 8.2.2 Large Bog (Wb)

Bogs are peat-covered wetlands in which the vegetation reflects the high water table and a general lack of nutrients (Bond et al. 1992). The surface waters of bogs are strongly acidic, creating a niche for sphagnum mosses and ericaceous shrubs such as Labrador tea (*Ledum groenlandicum*). Bogs are easily recognized through the presence of black spruce.

Black spruce bogs occupy depressions in glacial moraine landforms and less frequently within eolian sand dunes in the study area. Often a small pool of open water in the center of the bog is surrounded by concentric rings of scrub birch, black spruce, and balsam poplar. Most bogs in the study area, however, are covered with dense black spruce forest and lack open water.

### 8.2.3 Large Slough (Wc)

Large sloughs are shallow water bodies that commonly represent a transitional stage between lakes and marshes (Bond et al.1992). The Large Slough Wildlife Habitat Unit classification applies to water bodies having these characteristics with an area greater than 1 hectare (Griffiths 1991). Sloughs were distinguished from lakes where open water widths were less than 100 m. Lakes were defined by Griffiths (1987) as water bodies 5 - 40 hectares in area.

As the most frequent wetland type in the study area, sloughs are very important for breeding and staging waterfowl. Shallow sloughs with littoral zones of emergent vegetation support a greater diversity of wetland bird species than do deeper sloughs with steep-sided basins (Griffiths 1987). Although sloughs often occur individually, their most common configuration is as complexes within upland forest or cleared agricultural land. Most sloughs have a zone of emergent vegetation, mostly cattails and bulrushes, surrounding open water less than 2 metres deep (Bond et al. 1992). The open water zone, emergent zone and draw-down zone are classified within the Large Slough WHU type. For the purposes of this study, the division between Wetland and Upland WHU's is mapped at the lowest limit of upland vegetation dominance. This narrow eco-tone from upland to wetland vegetation is discerned on air photographs through tonal differences.

Slough buffer zone vegetation composition and ecological integrity are strongly influenced by surrounding land-use. In the Leduc Plain Ecodistrict, intensive agricultural land use has resulted in the widespread clearing of buffer zones around sloughs. In the Cooking Lake Ecodistrict, in comparison, slough buffer zones are often impacted by country residential infrastructure (roads, septic fields) and land clearance associated with small-holdings and mixed farming operations. The Upland Poplar WHU that forms buffer zones around sloughs is often negatively impacted by intensive grazing and conversion of native low shrub and herb understories to exotic plant species. Blocks of upland forest containing sloughs are concentrated on the Cooking Lake Upland Ecodistrict.

### 8.2.4 Wetland Complex Without Open Water (Wd)

Wetland complexes are cohorts of wetlands, each wetland providing slightly different wildlife habitat than the next (Griffiths 1991). The high levels of diversity found in wetland complexes derives mainly from the number of wetlands within the complex and is not strongly size-dependent. The combination of upland wildlife habitat (usually upland poplar forest) and a variety of wetland types gives wetland complexes the highest species diversity of any wildlife habitat unit. Tall shrub wetlands bordered by mature mixedwood forests provide the greatest diversity of communities within wetland complexes (Strong 1992).

The criteria used to define a Wetland Complex Without Open Water WHU is the presence of two or more wetland types with less than 0.25 hectares of open water. Wetlands smaller than this size are not readily visible on the aerial photography utilized in this study. The Wetland Complex Without Open Water WHU includes several vegetation community assemblages: willow shrub wetland - black spruce bog, willow swamp - sedge marsh, and scrub birch - sedge fen. These community types are often adjacent to, or include, stands of balsam poplar and/ or white spruce.

### 8.2.5 Wetland Complex with Open Water (We)

Wetland complexes with areas of open water greater than 0.25 hectares typically contain a mosaic of community types and support a greater diversity and number of wetland species than do deeper, individual sloughs (Griffiths 1987). This wildlife habitat unit classification is applied to slough complexes where each slough is linked to the next by a series of emergent vegetation and willow shrub corridors. Wetland complexes are often buffered from surrounding agricultural and country residential land-use by upland mixedwood and poplar forest. Where wildlife habitat is impacted only in a limited number of sloughs comprising the wetland complex, the ecological integrity of the wetland complex will be maintained by other sloughs nearby until a threshold area is reached. It follows that the impacted slough within the wetland complex will still provide more usuable habitat than would a single slough removed from neighbouring wetlands.

Wetland complexes receive water through ephemeral streams and groundwater seepage. Large wetland complexes result when meandering creeks are not restricted within valley walls. The largest of these within the study area is fed by Astotin Creek which meanders through extensive areas of willow shrub, scrub birch, and sedge wetlands adjacent to a biologically diverse sand dune complex. Other, more linear wetland complexes are restricted to the incised valley of Point-aux-Pins Creek. The vegetation communities within these sites are a mixture of sedge wetlands, balsam poplar - white spruce woodland, and lotic (meandering stream) systems.

Larger waterbodies within wetland complexes have been assigned the lake wildlife habitat unit designation ("L-", as described in section 8.3). This approach is consistent with other lake wildlife habitat unit designations in the study area, specifically those for lakes without associated wetlands.

### 8.2.6 Drainage Course (Wf)

Stream corridors consist of a band of vegetation bordering drainage courses. This often woody vegetation generally differs from the surrounding dominant land-use matrix. These map units may include the perimeter of the stream channel, the floodplain, the banks above the floodplain, and part of the upland above the banks. Drainage courses in the study area that are designated as wildlife habitat units flow either intermittently or permanently and usually support a narrow strip of woody vegetation. Griffiths (1991) defined streams as drainage courses which contain water for at least 50 percent of the time in an average open-water season. Wildlife habitat units classified as Drainage Course WHU's can include the Upland and Wetland WHU's discussed earlier in section 8.2.

The complex physiographic features of stream valleys result in a mosaic of vegetation types, each having unique microclimatic and physiographic characteristics (Forman and Godron 1986). Upland vegetation is influenced by stable landform attributes such as slope steepness and aspect, while riparian vegetation is subject to ongoing processes such as flooding, ice scouring, beaver activity, and sedimentation. As an example, Point-aux-Pins Creek is one of the more diverse habitat assemblages in the study area, containing upland coniferous, upland poplar, and upland mixedwood forest within the mapped Drainage Course WHU. Wetlands, predominantly beaver ponds, are also found in this environment. Periodic disturbances, both biotic and abiotic, maintain the floodplain in a dynamic equilibrium, which increases habitat diversity and species diversity, further signifying the importance of these landscape elements as environmental resource corridors for plants and animals (Godron and Forman 1986).

The use of central concepts of landscape ecology, such as connectivity, is implied in the classification of stream corridors. The movement corridor concept, so essential to landscape connectivity, is applicable to this wildlife habitat unit because wildlife cover is present, the feature is largely linear, and patches of habitat, called nodes are attached along the corridor. Nodes, which provide interior species with feeding and resting habitat, in addition to acting as movement conduits, are commonly associated with drainage courses.

Upland forest, when it is retained adjacent to drainage courses, allows for the movement of interior upland species, while buffering wetland species from disturbance associated with the agricultural matrix. The value of valleys as wildlife habitat increases if upland forest is maintained as a buffer, instead of allowing agricultural land-use to extend to the valley rim.

Drainage features where woody vegetation has been removed for distances of a kilometre or more or have been subject to other intensive human disturbance were not assigned a wildlife habitat unit designation. Watercourses in areas of intensive agricultural land-use in the Leduc

Plain Ecodistrict often lack a riparian vegetation zone of sufficient width and continuity to be considered as viable wildlife habitat. Small ephemeral drainage courses within fields and subdivisions were also not mapped on aerial photographs because of their low value as wildlife habitat. These drainage courses were mapped using arrows indicating probable flow direction because they likely contribute more to the region's hydrological regime than to wildlife habitat *per se* in the area.

### 8.2.7 Swamp - Shrub Wetland (Wg)

Swamps are nutrient-rich wetlands where standing or gently moving water occurs seasonally or persists for long periods, leaving the subsurface continuously waterlogged. Swamps differ from marshes in that they support tall shrub communities and even coniferous and deciduous forest (Bond et al. 1992). The Swamp - Shrub Wetland WHU is comprised primarily of willow shrub-dominated wetlands. This vegetation type is usually restricted to small depressions in morainal uplands, although it does also encompass extensive areas where permanent streams have created wetland complexes. The best example of this wildlife habitat unit type within Strathcona County is the Astotin Creek wetland complex, which contains large areas of willow shrub in association with bog and marshland vegetation. Where more than one wetland type occurs, the wildlife habitat unit designation "Wetland Complex Without Open Water" or "Wetland Complex With Open Water" is used.

Willow, balsam poplar, and tamarack form vegetation mosaics within swamps. Physiographically, swamps are similiar to bogs, both wetland types having well-developed woody vegetation and often having a small pool of open water in the center of the unit. Bogs, however, are dominated by black spruce (*Picea mariana*), a species that tolerates nutrient-poor conditions.

## 8.3 Lake Wildlife Habitat Units

A water body termed a "lake" has a relatively narrow littoral (shallow-water) zone with emergent bulrushes and cattails and a limnetic (open-water) zone of sufficient depth (1.5 - 2.0 metres) to exclude light necessary for the vigorous growth of submergent plants (Smith 1966, Smith 1990). Griffiths (1987) defined a lake as a body of water having an area greater than 40 hectares, while also offering a 100 metre width as the minimum required for a water body to be termed a "lake" (Griffiths 1991). Lakes are strongly influenced by nutrient inputs from sources outside the lake basin, an area termed the "watershed". Nutrients are circulated through the lake basin as a result of seasonal variation in lake temperature; those deposited on the lake bottom are displaced upward at fall freeze-up while oxygen moves to deeper levels. This process, called "turning over" makes nutrients available to phytoplankton for production (i.e., the accumulation of

organic material by organisms) which, in turn, support the high diversity of consumer wildlife species associated with wetlands (Forman and Godron 1986). This process also oxygenates water below the ice, allowing fish species to overwinter.

Habitats in, or near, lakes provide a transition from water to land and usually support a high diversity of wildlife species (Mitchell and Prepas 1990). Within Strathcona County, these habitats have been classified by Griffiths (1991) and, more recently, by Ducks Unlimited Canada (A. Richard, personal communication). In order to preserve consistency of methodologies, the Lake Wildlife Habitat Unit classification developed by Griffiths (1991) is the one utilized during this study and is outlined in the following sections (8.3.1 - 8.3.5). The Ducks Unlimited Wetland Classification includes two lake classes - "open fresh" and "open turbid" - and two wetland classes - "deep marsh" and "shallow marsh". However, these wetland classes were derived from Landsat imagery by Ducks Unlimited Canada and were too general to be applied to water-based features on large-scale aerial photographs required in this prioritized landscape ecology assessment.

Griffiths (1991), however, included a categorization of shoreline environments such as mudflats, shallow marshy wetlands, and open-water habitats in a five-class delineation of existing Lake Wildlife Habitat Units in the Lakes Management Plan area in the southern portion of the County. These classes, identified solely on the basis of their ability to provide critical life requisites for waterfowl, were defined by Griffiths (1991) as:

- lake breeding habitat;
- lake brood rearing habitat;
- lake molting habitat;
- lake feeding / staging / migration habitat; and
- lakeshore buffer habitat.

Although this classification system has some merit and utility, it is flawed by the lack of a quantitative physically or vegetationally-based criteria and was, thus, considered to be inconsistent with other Wildlife Habitat Units described and implemented previously for upland and wetland habitats. The "ecological community" concept has a particularly strong application to wetland and lake ecosystems, as vegetation associations are often clearly identified, creating zonation patterns with sharp, abrupt boundaries. Furthermore, the delineation by Griffiths (1991) of these Lake Wildlife Habitat Units in the Lakes Management Plan area, and the subsequent prioritization of lake habitats on this basis, was based on unpublished and observational data which is not actively available for application to other areas such as the remainder of the County (J. Martin, L. Girvan, D. Griffiths, personal communication). Therefore, the Lake Wildlife Habitat Units were slightly refined for this project in order to reflect an emphasis on the physical qualities of the lake zones rather than on potential waterfowl use.

Waterfowl use patterns were inferred from these physical habitat qualities and correlations drawn between these habitat attributes and actual waterfowl use. The Lake Wildlife Habitat Units identified and used for this project include:

- Lake - emergent zone;
- Lake - free floating / leaved zone; and
- Lake - submergent / open water zone.

### 8.3.1 Lake - Emergent Zone (La, Lb, Lc, Le)

Emergent zones, comprised of dense aquatic macrophytic plant species, provide shelter and food for many wildlife species (Mitchell and Prepas 1990). Waterfowl, especially, utilize this habitat for breeding, brood-rearing, and molting. Emergent zones, being distinct from the open-water zones of lakes, are readily identifiable on aerial photographs and, therefore, provide a feature-based classification consistent with others used throughout this study.

Several physical attributes, and at least one disturbance type, have been defined as determining utilization levels of lake habitat by staging and breeding waterfowl (Griffiths 1991). The presence of dense emergent vegetation and diverse species of plants and small organisms are all good indicators for waterfowl use (Mitchell and Prepas 1990). Cover from predators is provided by vegetation such as cattails, while freshwater shrimp and a host of invertebrates support both dabbling ducks such as mallard, American wigeon (*Anas americana*) and northern shoveler (*Anas clypeata*). Other bird species such as red-winged blackbird (*Agelaius phoeniceus*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and short-billed marsh wren (*Cistothorus platensis*) breed in emergent zones, and several bird species such as great blue heron (*Ardea herodias*) prey in these areas.

Buffer zones of upland vegetation are particularly important physical features associated with wetlands. These upland forest landscape elements must have a width of at least 40 metres (where they are adjacent to emergent zones) in order for the marshy wetland habitat to be effectively utilized by breeding waterfowl (Griffiths 1991). The upland forest margins, themselves, are utilized by the tree cavity nesting waterfowl species such as common goldeneye and bufflehead.

Emergent zones, termed Lakeshore Buffer Habitat WHU (Le) by Griffiths (1991) were mapped as Lake Breeding Habitat WHU (La), Lake Brood Rearing Habitat WHU (Lb), and Lake Molting Habitat WHU (Lc) in addition to being classified Lakeshore Buffer Habitat WHU in this study. Classification of wildlife habitat units from air photographs, a process which is constrained by the identification of physical attributes visible on the photographs, meant that

non-spatial attributes could not be classified. Known habitat requirements of waterfowl populations for brooding, staging, and breeding were, therefore, spatially linked to the two attributes of lake habitat visible on aerial photographs - open water and emergent vegetation.

### 8.3.2 Lake - Free-Floating / Leaved Zone (Lc)

This zone is characterized by plants rooted to depths of 0.5-3.0 m such as water lily (*Numphar variegatum*) and macrophytes such as duckweed (*Lemna minor*), floating in the water column or on the surface (Mitchell and Prepas 1990). Lake Molting Habitat WHU is found primarily in the free-floating leaved zone, although the littoral zones of lakes complement this through providing cover from predators for waterfowl unable to fly during the molting period.

### 8.3.3 Lake - Submergent / Open Water Zone (Ld)

The open-water (limnetic) zones of lakes provide important staging (resting and feeding) areas for migratory ducks and geese (Mitchell and Prepas 1990). Submergent macrophytes, such as northern watermilfoil (*Myriophyllum exalbescens*) rooted to the lake bottom, provide food for populations of migratory waterfowl staging in the limnetic zone during migration. These zones are readily identifiable on aerial photographs of the study area.