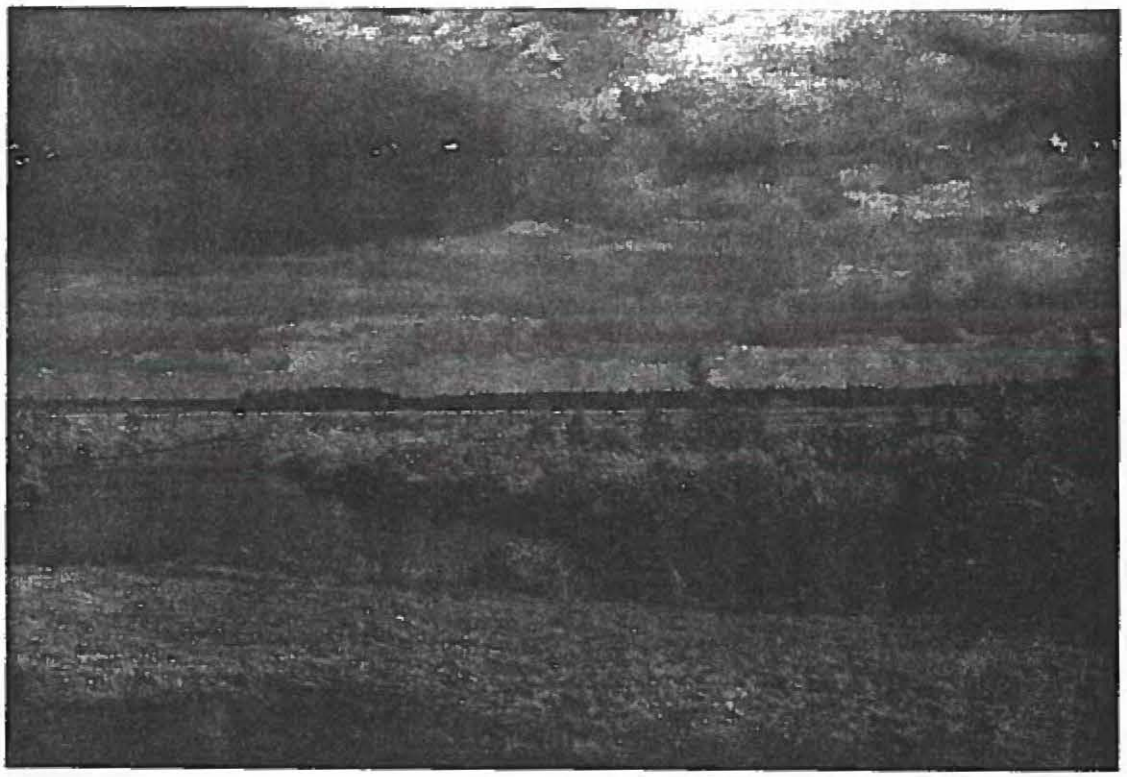
Colin MacKinnon

# Missaquash/East Amherst Wildlife Management Area Management Plan



Eastern Habitat Joint Venture

Produced by
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# Executive Summary

The vast dykelands at the head of the Bay of Fundy have sustained agricultural practises for 350 years. During the last 60 years, however, much of the land has become marginal for agriculture due to soil and economic conditions.

In the early 1960's, the potential for returning some of these dyked marshlands to productive waterfowl habitat was recognized. Securements of resource units was initiated in the Missaquash Marsh in the early 1960's, and habitat enhancement through impoundment construction and water control structures improved the productivity for waterfowl within a short time. The success of these initial practises, not only for waterfowl but for a wide diversity of plant and animal species, led to further land acquisitions, and more sophisticated and intensive conservation techniques.

By 1994, four marsh units within the area had been secured and were under various degrees of management. They are the Missaquash Marsh Unit (2430 ha), Amherst Marsh Unit (1530 ha), Eddy Road Cove (49 ha, surrounded by 1619 ha of hay and pasture land), and the Fort Lawrence Marsh Unit (70 ha surrounded by 1620 ha of unimproved pasture and hay land). In total, the Missaquash/East Amherst Wildlife Management Area comprises 4184 hectares of a wide diversity of habitat. In order to manage the area for optimum habitat conditions for wildlife, and for recreational and educational opportunities for people, the need for a management plan incorporating all four units was recognized.

The Missaquash/East Amherst Wildlife Management Area is owned by the province of Nova Scotia (with the exception of 372 ha in New Brunswick, and four impoundment units at Fort Lawrence and Eddy Road Cove presently owned by Ducks Unlimited Canada, but scheduled to be transferred to the province of N.S.) The area is under the management of the Eastern Habitat Joint Venture, consisting of the Nova Scotia and New Brunswick Departments of Natural Resources, Ducks Unlimited Canada, and the Canadian Wildlife Service. In a regional context, it is associated with more than forty conservation sites, owned and managed by various agencies. Together, these areas provide a mosaic of habitat types for wildlife, (especially waterfowl) all of which have benefited from conservation on these lands.

The Missaquash/East Amherst Wildlife Management Area will be managed primarily for the protection and enhancement of wetland habitat. Management practises will strive to provide optimum habitat conditions for a wide range of wildlife species as well as recreational and educational opportunities for people.

This management plan will be reviewed every five years, or as required and determined by managers.

This plan was initiated by the Eastern Habitat Joint Venture, with full cooperation of all agencies and partners.

## 1. Objectives for Management:

The Missaquash/East Amherst Wildlife Management Area will be managed primarily for the protection and enhancement of wetland habitat. Management practises will strive to provide optimum habitat conditions for a wide range of wildlife species as well as recreational and educational opportunities for people.

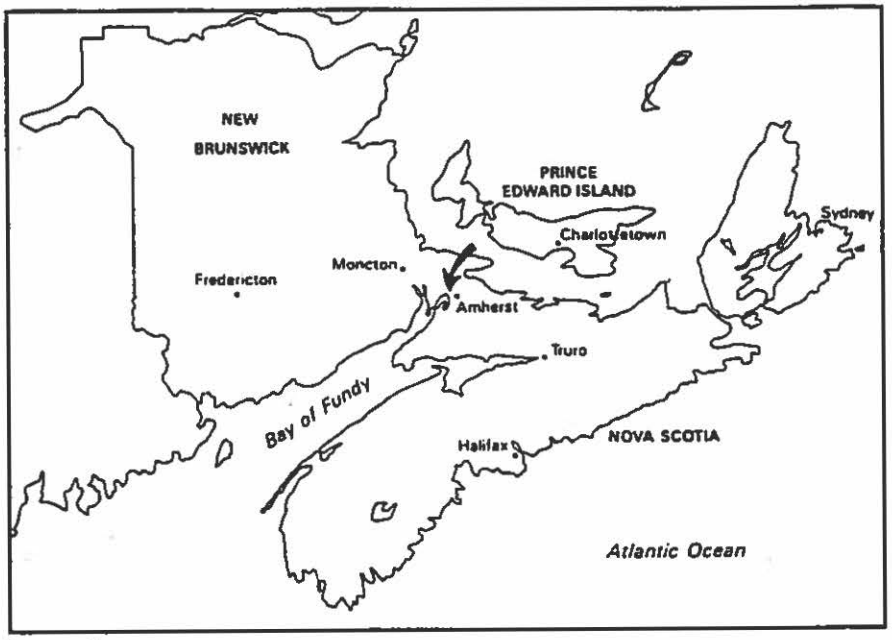



Fig. 1 Site Location

## 2. Resource Description:

**2.1** The Missaquash/East Amherst Wildlife Management Area is located within the low lying Isthmus of Chignecto connecting New Brunswick and Nova Scotia. The complex consists of 4184 hectares (10,338.6 acres), most of which is maintained in a flooded condition. Three thousand eight hundred and twelve ha (9416 acres) of the complex lies within Cumberland County, Nova Scotia (latitude 46° 00′ and 45′° 18′, longitutde 63° 14′ and 64° 57′), (Fig.1) while the remaining 372 ha (919 acres) are located along the northwest boundary of the Missaquash River in Westmorland county, New Brunswick. Prior to dyking, draining and ditching by the French Acadians in the 1670's, the area was part of a vast (150 square kilometer) salt marsh complex. The management area includes four units: 2530 hectares (6251.6 acres) along the

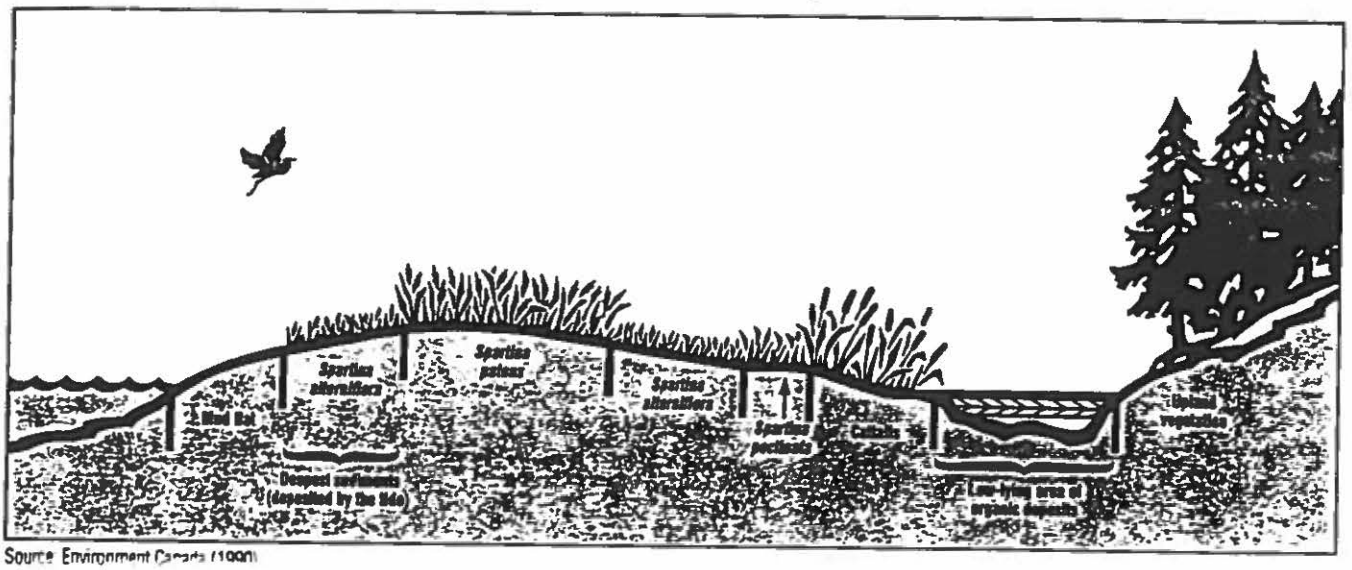
Upper Missaquash River, 1530 ha (3780.6 acres) at the Amherst Marsh, (plus 4 ha (9.8 acres) at the Sunrise Marsh), 71 ha (175.4 acres) at the Fort Lawrence Marsh, and 49 ha (121 acres) at Eddy Cove Road.

## 2.2 Geographic and Habitat Classification.

The area is part of the Cumberland Plain (or Northumberland Lowlands {Roland, 1982}) which lies between Amherst, N.S. and Sackville, N.B. and is included in the broad description of the Maritime Plain on Canada's physiographic map of 1970. The gently undulating plain is underlain by Carboniferous sandstones and conglomerates. The area is drained in a more or less north south direction by four rivers, the LaPlanche, Missaquash, Aulac and Tantramar. Only the LaPlanche and Missaquash are found within the management area itself. The higher grounds at Fort Lawrence Ridge and Cumberland Ridge are gently folded anticlines of Pennsylvanian sandstone and quartz pebble conglomerates (Geological Highway Map of N.B. and P.E.I.,1985), trending in a general east west direction, and parallel to the more strongly folded anticlines to the south of the plain. The bedrock composition is seen best at road cuts through the anticlines; otherwise, the area is covered with locally derived glacial moraine (Soils of Cumberland Co.1973), overlain by varying depths of marine silts and sands. Prior to Acadian settlement,the low lying areas were mud flats, vast salt marshes, tidal estuaries,brackish ponds, and freshwater lakes and bogs created by the dynamic tidal forces of the Bay of Fundy. (Fig.2) The extreme forces of the tides created thick layers (up to 40 meters) of nutrient rich sediments (The State of Canada's Environment pg. 20-7). The original (pre-Acadian) wetlands were dominated by salt marsh Spartina species closest to the tidal front, cattails where freshwater accumulated, and in the oldest parts of the wetlands, sphagnum -sedge bog development with larch, alder, spruce and ericaceous shrubs intruding where moisture conditions permitted. In the older, peat areas, small dystrophic lakes were abundant. In younger tidal areas, salt marsh pannes were formed.

Fig. 2

**Landscape sequence in undiked salt marsh in the upper Bay of Fundy mudflat**

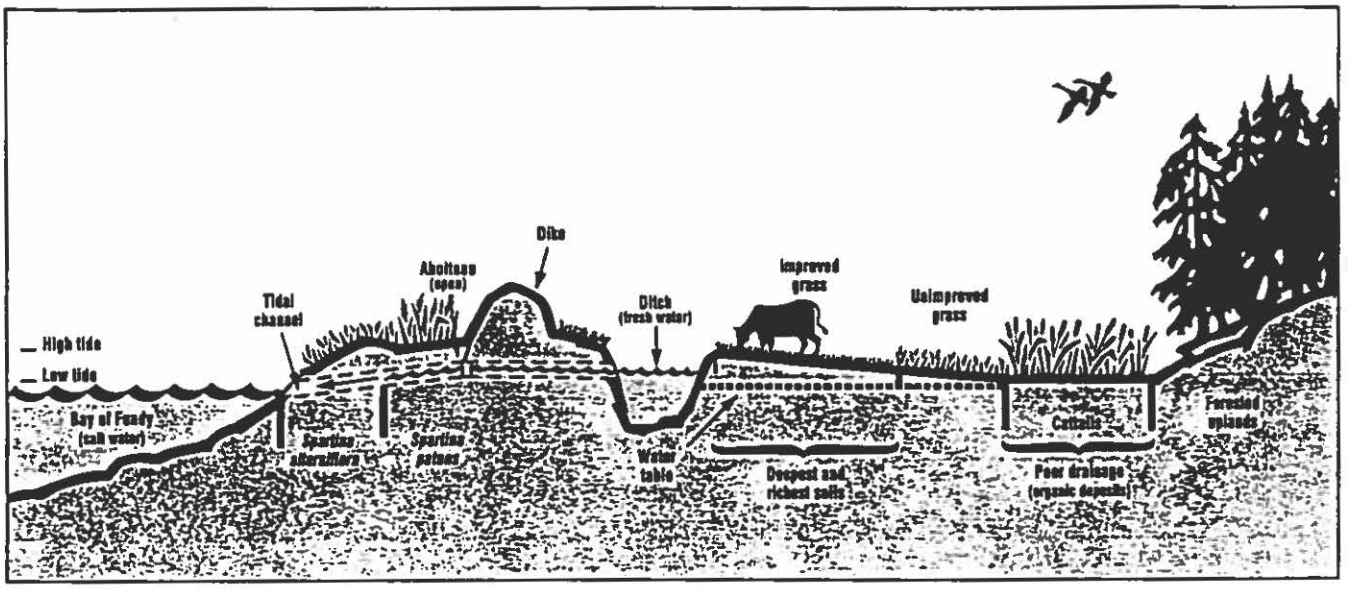



Source: Environment Canada (1990)

The original salt marsh complex has been profoundly altered by human activity during the last 300 years (Fig.3). It now consists of a nearly completely managed environment of dykelands in various classes of agricultural capability. These dykeland soils (polders) are broadly classified as the Acadia Soil Complex, however: "The range in characteristics of Acadia soils is too wide for them to be designated as a soil series." (Soils of Cumberland county, N.S.. 1973). The Canada Land Inventory (1975) rates the dykeland soils as Class 1 to 3 for agriculture. The organic peat areas in the upper areas of the Missaquash and Amherst Marsh Units are within Classes 3 to 7 for ungulates and waterfowl.

Fig. 3

**Landscape sequence in upper Bay of Fundy wetlands after diking**




Source: Environment Canada (1990).

Natural and man-made wetlands within the management area reflect the substrate type, age, and drainage patterns and range from eutrophic freshwater marshes to dystrophic sphagnum/sedge bogs. In general, habitat types and species diversity has increased since settlement by the Acadians.

Forests within the management area are restricted to the uplands and small "islands" within the bog complex. Loucks (1962) includes these in the spruce -fir coastal zone, characterized by white and black spruce, balsam fir, and white birch. Small portions of the forested islands consist of older trees; most of the area has been cut and/or burned. Bog forest communities include larch (hackmatack), stunted black spruce, and ericaceous shrubs.

## 2.3 Conservation Status:

The Missaquash/ East Amherst Wildlife Management area is entirely owned by the Province of Nova Scotia[1] and under the jurisdiction of the Nova Scotia Department of Natural Resources. Consumptive (hunting, trapping and fishing) and non-consumptive uses, ( walking, canoeing, and birdwatching) are permitted and encouraged.

With the possible exception of some of the bog areas, there is little "natural" (i.e. untouched) representation within the management area. Nonetheless, there are large areas of the management area that are not easily accessible, and which represent the aesetics of "wilderness". In addition, the large flocks of migrating waterfowl and shorebirds, and the year- round presence of a wide variety of wildlife are aesthically pleasing for the hundreds of visitors to the more accessible areas of the wetlands. Freshwater (lotic and lentic, eutrophic and dystrophic) habitats are well represented, and there are glacial "islands" of till within the wetlands that support old growth stands of spruce, larch, and some hardwoods. Sphagnum/sedge bogs are also well represented.

Potential threats to the management area include localized problems such as possible water pollution from nearby developed areas, dyke failure, camp/cottage development on adjacent lands, damage from uncontrolled public use of fragile bog communities, commercial peat extraction, and indiscriminate cutting of firewood. In addition, many agronomists believe that the dykelands which are currently abandoned because of economic factors, may someday offer a solution to world hunger problems. Intensive crop husbandry on now abandoned dykelands or hay and pasture lands adjacent to freshwater impoundments need not be detrimental to waterfowl brood production. At present, the techniques necessary to farm these soils are too expensive and intensive to be cost efficient. However, in future these areas may have to be co-operatively managed for the benefit of both agricultural and wildlife interests.

Larger scale threats include global climate change and continued land subsidence in the area under management.

Some potential threats are local and can be mitigated: others, such as global warming, are impossible to gauge or control, but need to be monitored.

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[1] That portion lying north of the Missaquash River in New Brunswick is currently under review.

## 2.4 Access and Regional Context:

Map 1.indicates access roads to the various units of the Missaqaush/East Amherst Management Area. At present, the access road to the Amherst Marsh is maintained for a wide variety of users. All other access roads are, at present, very rough and seasonally closed due to mud or snow. The more remote areas are accesssible by canoe in summer, or by snowmobile in winter.

In a regional context, the Missaquash/East Amherst complex is a part of the Upper Bay of Fundy Dykelands. Since the 1960's, dykeland aquisition for wildlife conservation has often proceeded with great difficulty. Eighty per cent of the vast saltmarshes of the Upper Bay of Fundy Region have been dyked and drained for agriculture for over 300 years. However, in the last 30 years, some of the dykeland has been converted to fresh water marsh through aquisition by government and non-government agencies, and some sites have been designated through the Ramsar Convention. It should be noted that of the lands newly converted to conservation purposes (principally by constructed wetlands), 5% were derived from cropland, 17% from grazing land, 52% from abandoned agricultural lands, and 25% from areas where there was no perceived prior activity (Environment Canada, 1990). Within the Upper Bay of Fundy region there are fifty one sites (including the Missaquash/East Amherst complex) under various jurisdictions with differing conservation management mandates (see Appendix 1 for list of sites and map). These sites range in size from the 12,200 ha Shepody Bay N.B. site, to the 4 ha site at Zwickers, N.S. Waterfowl and shorebirds in particular, use various sites at various times, and the conservation areas provide a mosaic of habitat types important for these species. The mudflats and saltmarshes associated with the Minas Basin and other sites along the New Brunswick and Nova Scotia shoreline of the Bay of Fundy are also important in a regional context (those sites are not identified within this plan).

## Section 2.5 History and Development:

### 2.5.1 Archaeology

Roland (1982) gives a good account of the drowned forests that have been discovered buried in the mud and silt of the salt marshes at the head of the Bay of Fundy. One of these lies at the end of the Fort Lawrence Ridge between the LaPlanche and Missaquash Rivers. Discovered in 1854, stumps of this forest were rooted in 60 centimetres (23.4 in,) of gravel and sand, underlain by boulder clay and approximately 10 meters (132 ft.) below the level of the marsh. Species identified included larch, pine,hemlock, elm, ash, black spruce and birch. Another prehistoric forest was located just across the Missaquash River, again 10 meters (32 ft.) below high tide. Stumps from this forest included pine and beech.

Clearly, the marshlands were at a much higher elevation in the past, and most authors agree that land submergence, sea level rise and subsequent marsh formation has been continuing for at least 4000 years. Land submergence is calculated at about 30 centimetres (11.7 in.) per century (although there were periods of rebounding). In addition the eustatic level of the sea has risen about 6 centimetres (2.3 in.) per century (Roland, 1982). Taken together, these factors may have implications for management of the freshwater wetlands of today. Seaward dykes especially may be breached as these processes continue.

The dynamic nature of the upper Bay of Fundy tides explains why evidence of early native occupation could be difficult to find in situ. Two prehistoric sites have been located on the Tantramar, and one may be early Archaic (pers comm. Colin McKinnon). Prior to European settlement, the native people probably took advantage of the non-spawning shad run in the upper areas of the Bay in June and July, and the avifauna attracted to the great salt marshes at various times of the year. However, due to the high erosional stresses in the area, much evidence of occupation has been washed away or, as is the case with a ground slate bayonet found just south of Fort Beausejour, buried in mud (Turnbull,1988). On the Northumberland side of the Isthmus of Chignecto, a post-European native grave site in the cliff-face above the Shinimicas River yielded some interesting artifacts from both cultures (Whitehead, 1993).

Overall, the salt marshes probably offered seasonal food resources for the native people, but long term occupancy was reserved for areas of less environmental stress and higher species diversity. Although there is little evidence, common sense dictates that the native people used the Missaqaush River in order to move from the Northumberland Straight to the Bay of Fundy (the Missaquash may have been the closest route to Baie Verte).

It is interesting to reflect that the salt marshes were probably not that valuable for the native culture (in terms of food resources), but they were to become the basis for an entirely new and very successful occupation by the Acadian Culture.

### 2.5.2 Historical Relics

With the exception of the native culture, evidence of the various cultural groups and their activities on the dykelands abounds. Anyone with a practised eye could stand almost anywhere in this region and spot evidence of Acadian, New England Planters and Yorkshiremen activity in reclaiming salt marsh from the sea. (See Appendix 1 for diagrams of early dyke construction techniques). The Missaqaush River was used as a trade route by the native people and the early French soldiers, and a 1752 map by Franquet indicates the presence of "Cabane sauvage", "quatre tome plus ancienne Tombe sauvage", and the approximate location of what may have been a small trading post at " chemin ou conduit par les bois a Beausejour". There may be archaeological remains of this site near Portage Lake (pers. comm. C.McKinnon,1994). Fort Beausejour stands as testament to the struggles between the English and French to lay claim to "Acadie".

The French Acadians who first settled the dykelands were content with snatching small bits of salt marsh from the sea, and the rich soils produced good crops and abundant hay. In 1750, the Acadian population of the Cumberland Basin was about 1600. The New England Planters and the Yorkshiremen who took up these lands after 1755 were much more ambitious. Not content with small parcels of dykelands, they constructed huge dykes and drainage system, and succeeded in claiming at least 80% of the upper Bay of Fundy salt marshes for farm land (Although the Acadians had been expelled, they were permitted to come back, in two's and three's, in order to oversee the construction!). While the ancient Acadian dyking and draining techniques were followed by the newcomers, this culture added a new feature to dykeland management. "Tiding" was a process that involved digging new canals and ditches and allowing the Fundy tides to sweep over the land, depositing the rich silts that gave life to agriculture. This was done in order to revitalize older dykelands that had "run out", but it was also done in an effort to flood bog lands with silt laden tidal water. After ten or fifteen years of deposition, these areas were dyked, ditched, and turned into pastureland. Some of the great hayfields around the Tantramar River were created by Tolar Thompson in 1815 by "tiding". The success of his effort was due, in no small part, to the fact that the mouth of the Tantramar had never been dyked, and the full force of the enormous tides was permitted to flow up the river and channelled into the bogs.

On the Amherst Marsh, the Page Canal was constructed from the LaPlanche to the town of Amherst, in order to flood the upper bog lands and turn them into hayfields. The canals quickly silted up and the effort was a failure.

In 1894, a similar but larger scale tiding operation began on the Missaquash River by the Missaquash Marsh Company. In 1897, a newspaper account optimistically proclaimed "An Advance {in the length of the canal} of About Two Hundred Feet Made Every Twenty-four Hours - Faith in the Ultimate Success of the Scheme is Daily Increasing." However:

> "...it worked but only partly and for the wrong reason. After digging the canal 36 ft. wide. 15 ft. deep and five miles long, the farmers discovered thet {sic} tide wasn't strong enough to carry the silt that far. The original goal of filling the bog was not attained but the canal did offer excellent drainage along the way. Rather than increasing the amount of hay acreage...the farmers improved already productive fields."
>
> W.W.Baird, Report on Dykeland Reclamation, 1913 to 1952

Perhaps the grandest scheme of all (apart from the establishment of the dykelands themselves) was to build some form of shortcut from Baie Vert to the Bay of Fundy, in order to save the time and money required to sail around the entire peninsula of Nova Scotia, and somewhat later in order to ship produce, salt and coal to other parts of the world from the local area.

The idea of building a ship canal across the Isthmus is attributed to Abbe de la Loutre in the early days of Acadian settlement. The route for this canal was surveyed and re-surveyed for 150 years; various physical dimensions for the canal were proposed and dismissed; engineers and governments fought over how deep it needed to be, how wide, and how much it was going to cost. In the end. all agreed that the difference in the height of tide between the two bodies of water would necessitate the building of some sort of construction to lift ships out of the water at some point along the canal. H.G. Ketchum however, was to come up with a better idea, circa 1870.

"The author found a difficulty in working out the problem at the Bay of Fundy *without using some sort of a railway* to transfer these pontoons from the ship Lift to the proposed shallow canal. This idea led to the present Ship Railway in construction at Chignecto. It became apparent that vessels might as well be lifted to the surface of the ground and hauled across the neck of land on steel rails, thus avoiding all the question of water supply and its various perplexities in this particular locality."

H.G. Ketchum, Paper #58
Canadian Society of Civil Engineers
(on file, Fort Beausejour Nat. Hist. Site.)

Work began on this enormous pioneering effort in 1886. It was to be a double line, perfectly straight and almost without gradient, running 17 miles from Tidnish to Fort Lawrence (see Appendix....for a detailed map of the planned railway). At each end, basins were to be excavated to hold waiting ships, and huge hydraulic lifts were to be installed. There were enormous technical problems to be overcome, as well as the more immediate problem of weather and of trying to build solid track bed through soggy bogs. Despite the difficulties, work continued steadily and required only one more summer of effort until 1891, when Ketchum's company ran out of money. The "First Fixed Link" was declared a magnificent failure. Today, few remnants of this project can be found. In 1902 the government purchased rails and fastenings for use on the Intercolonial Railway, some of the bricks used for the construction of the powerhouse were used to build a firewall in the Fort Beausejour Museum. The heavy rock used in the railway bed construction was taken to Cape Tormentine and Borden for ferry approaches. The arched stone bridge at Tidnish still survives and is part of a Provincial Historic site. Near the Missaquash River, there are still a few piles of blocked stone, strangely out of place. Sections of the railway bed are evident within the management area. The Public Archives of Fredericton has an excellent collection of photographs which graphically depict the enormous amount of work and effort that went into this magnificent failure.

These are a few of the highlights of history that have taken place on the marshlands. In a quirk of history, the conservation efforts within the Missaqaush/ East Amherst Management Area are, in effect, undoing all that went before in order that the marshes will again be the Tantramar "a place of great noise ".

### 2.5.3 Written and oral history:

The Public Archives at Fredericton, the library at Fort Beausejour, and various municipal libraries in Amherst and Sackville provide many accounts of the early European and recent (i.e. within the last 100 years) human history of the dykelands.

## 2.6 Physical Features:

### 2.6.1 Coastal Landforms

Although tidal influences have been cut off within the Missaquash/East Amherst Wildlife Management area, the dykeland units are considered to be coastal formations, since they were shaped by the action of the Bay of Fundy. This deep basin has, at its upper end, the highest tidal range in the world,averaging 11 meters (35.2 ft.), with the highest recorded at 15 meters (48 ft.)(Canada's State of the Environment, 1991). Prior to dyking and draining, the intense tidal forces flooded river estuaries and ran up the small rivers, depositing tons of sediments as the waters flowed and slowed in velocity across the flood plains. On undyked marshes in the upper regions of the Bay of Fundy, a 2 to 3 centimetre (approx. 1 in.) sediment layer can be transferred by a single tide (Papadopoulos, 1993). The effects of past tidal deposition still determine soil chemistry and productivity within the management area. Fig.2 and Fig.3 are simplified diagrams of the morphological processes that have shaped the present landform. Smith (1967), Roland (1982), and Papadopoulos ((1993) give detailed descriptions of saltmarsh formation and also address the characteristics of the Upper Bay of Fundy dykeland soils.

### 2.6.2 Water Depth and Quality

Smith (1967) details selected water quality data from several lakes within the Missaquash Marsh, and there is limnological information for Long Lake, Smith Lake, and LaPlanche (Big Sand) Lake in Cumberland County (1979, on file with N.S.D.N.R.) In general, water control structures maintain low levels (between 46-50 cm..or 18-20 in.) in the impoundments (all constructed on previously dyked lands). The upper areas of the Missaquash and Amherst marshes are characterized by shallow, dystrophic bog lakes. Round Lake and the main canal (Upper Missaquash) are the deepest water bodies (approximately 2 meters (6.4 ft.), and 1.5 meters (4.8 ft.) respectively, although these values fluctuate according to management and precipitation, as do all water bodies within the management area). Average pH is 6.85 within the Missaquash Unit (Smith, 1967), but discreet areas show some variation from the norm.

### 2.6.5 Geology

The Northumberland Lowlands are composed of Pennsylvanian, or Upper Carboniferous sandstones and conglomerates, and extend from Chignecto Bay across the north-central part of Nova Scotia and south-central New Brunswick. Two main anticlines run east and west across Cumberland County: one from Pugwash Harbour west to Nappan, Amherst Point, and the base of Minudie; the

other from Malagash Point past Oxford, then plunging downward just east of Springhill. The crests of these anticlines have become eroded away to expose the underlying early Carboniferous Windsor evaporites or the slightly younger Canso deposits. In addition to the two main anticlines, there are many minor folds which extend in an east-west direction for some distance and then plunge downward. Streets Ridge, east of Oxford, is one of the more prominent of these folds.

The long slopes of the ridges are especially evident in the low lying marshlands at the head of the Cumberland Basin. Amherst is situated on a low elevation which plunges downward at Amherst Point and rises again along the southeast side of River Hebert. The short Fort Lawrence ridge is on the Nova Scotia side of the provincial boundary, and the long, parallel Fort Cumberland ridge lies across the Missaquash River on the New Brunswick side. Perhaps the best view of the undulating nature of the lowlands is to be obtained just east of Aulac on the Port Elgin road. (Roland, 1982). Road cuts through the Cumberland Ridge at Aulac also offer a good exposure of sandstone and quartz-pebble conglomerates. At its tip, the Cumberland Ridge provided an ideal site for the establishment of Fort Beausejour in the 1750's. In Sackville, N.B. many of the buildings are made of quarried sandstones from the "Sackville Freestone Quarry". Stone from this quarry found its way to Moncton, Amherst, Boston and Toronto (Geo.Hgwy Map, N.B. & P.E.I.,1985).

The cover of glacial till on the Cumberland Lowland is deeper than that on the Cobequid Mountains. It is lodgement till (ground moraine) derived mainly from the underlying bedrock, and little appears to have been transported far from its source. Much of the till is stony, but stoniness decreases toward the north of Cumberland county and south Westmorland County. The dominant texture is sandy loam, but there are substantial areas of sandy clay loam. (Soils of Cumberland Co., 1973).

### 2.6.6 Soils

The Acadia soil complex is composed of young dykeland soils formed from a parent material of silty clay loam laid down by the Bay of Fundy. There has been almost no horizon development in the soils, but different coloured deposits may be encountered. A reddish brown or dark brown upper layer generally overlies a dark gray to bluish gray subsurface layer at depths from 30 cm. (11.7 in.) to 90 cm. (35 in.) or more. (Soils of Cumberland Co.,1973) The best drained and most valuable soils (for agriculture) are referred to as red marsh, whereas the more poorly drained soils are designated as blue marsh. The red marsh derives its colour from a hydroxide of iron, while the blue marsh soils are

gley soils, a type which is structureless, sticky and usually water-logged. These form only under anaerobic conditions and the iron becomes reduced by the action of micro-organisms and the organic acids formed by decaying organic material, (in this case, the original salt marsh vegetation ). When exposed to air, these soils form ferric hydroxides which are poisonous to plants. Therefore, newly reclaimed blue marsh is rather unproductive. The partially leached surface soils of the dyked marshes are acidic, with a pH of about 5; the poorly drained waterlogged soils are still alkaline (due to the presence of marine silts) with a pH ranging from 6.4 to 7.4. (Roland, 1982) The soils are unique in Nova Scotia because they contain sufficient levels of major plant nutrients for most needs; however, more acid soils require liming in order to release phosphorous. (Soil Survey of Cumberland Co., 1973). Papadopoulos (1993) compares upland and dykeland soils for selected nutrient values. They are similar in organic matter, total nitrogen content and available calcium. However, dykeland soils contain nearly double the amount of CaO and MgO, and available Mg and K were two to five times greater in dykeland soils.

The Acadia soils are given three sub-classes, based very broadly on the drainage of each type. As mentioned previously, soil capability within the Acadia group is extremely varied. This variation is due to depth and type of sediments, but also in large part to past land use. Discreet areas of dykeland soils within the management area may react very differently to draw down or planting.

Organic or peat soils are found on the older wetlands of the upper Missaquash and Amherst Marshes. Permanent saturation has resulted in the accumulation of poorly decomposed remains of water-tolerant plants, which are classified as peat when the thickness exceeds 40 cm. (15.6 in.) and the fibre content is 30% or more. In upland areas the peat is derived chiefly from sphagnum mosses, and bogs are gently domed. In valley bottoms in the lower lying lands, the peat may have been derived from a wider variety of plant species such as sedges, and tends to be more decomposed and amorphous. (Soil Survey of Cumberland Co., 1973).

### 2.6.7 Freshwater sources and drainage:

Within the management area, freshwater input is from precipitation, and springs in some of the lakes and adjoining uplands. The Missaquash and the LaPlanche are the major drainage systems. The velocity of stream flow is an important characteristic for the establishment of vegetation. Too high a velocity of moving water prevents the establishment of emergent vegetation; too slow, or no velocity results in a lack of nutrient cycling. Both extremes are represented within the management area.

## 2.7 Climate

Table 2 summarizes climate data from Nappan Agricultural Research Centre which is within the Cumberland Lowland district. Locally, the Bay of Fundy has a moderating influence on the climate of the marshlands and temperatures do not show the extremes of more inland areas.

The climate is characterized by short, cool summers, and long, moderately cold winters. Average precipitation values do not reflect the year to year conditions within the management area, since these values can change with drastic consequences for water levels within some areas. Smith (1967) notes that the summers of 1965 and 66 were exceptionally dry. These conditions have been repeated during the last ten years in particular, and may be indicative of global changes in weather patterns. Computer-based general circulation models (GCM's) suggest a shorter, wetter winter, a longer growing season, and changes to the hydrologic cycle, such as higher and earlier spring flood peaks, longer ice-free perods, and warmer water temperatures for Canada in general. Within the Maritimes. some GCM's project decreases in precipitation during the summer and fall, and major species shifts due to warmer air and water temperatures (Canada's National Report on Climate change, 1994).

The wind is a major factor within the management area, not only for wildlife but for human activities. The prevailing westerlies sweep up the marsh valley from the Bay of Fundy, cooling the air. During many months of the year, these afternoon winds are strong enough to be a limiting factor on exposed shorelines where wave action prevents the establishment of vegetation.(Smith, 1967). Localized rain squalls often occur, especially in the Missaquash River area.

Ice in the lakes and ponds usually breaks up by mid April, with the deeper canals and other flowing water areas opening sooner (Smith, 1967).

## 2.8 Plants

In 1973, Dr. H. Harries compiled a check list of wild and cultivated vascular plants in the Chignecto Area (see Appendix 3 for this list). Of particular interest are the annotations of rare species, although their exact location is not described. Although not specific to the management area. this list may be used as a baseline to measure the status of certain species in future.

Prior to impoundment and water control, Smith (1967) and Melanson (1986) reported similar vegetation associations for the Missaquash and the East Amherst marsh. Vegetative cover in fresh marsh areas was

# Table 2
# Summary of Climate Data
# Missaquash/East Amherst Wildlife Management Area

**NAPPAN CDA**

45°46'N 64°15'W/O, 20m, 1890 to/à 1990

| | Jan<br>Janv | Feb<br>févr | Mar<br>mars | Apr<br>avr | May<br>mai | Jun<br>juin | Jul<br>juill | Aug<br>août | Sep<br>sept | Oct<br>oct | Nov<br>nov | Dec<br>déc | Year<br>année | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | | | | | | | | | | | | | | Température |
| Daily Maximum (°C) | -2.6 | -2.2 | 2.1 | 7.8 | 15.1 | 20.4 | 23.7 | 23.2 | 18.7 | 13.0 | 6.6 | 0.1 | 10.5 | Maximum quotidien (°C) |
| Daily Minimum (°C) | -12.1 | -12.3 | -6.8 | -1.2 | 3.9 | 8.9 | 12.4 | 11.8 | 7.9 | 3.5 | -1.1 | -8.5 | 0.5 | Minimum quotidien (°C) |
| Daily Mean (°C) | -7.3 | -7.2 | -2.3 | 3.3 | 9.5 | 14.7 | 18.1 | 17.6 | 13.3 | 8.3 | 2.8 | -4.1 | 5.6 | Moyenne quotidien (°C) |
| Extreme Maximum (°C) | 16.0 | 15.6 | 18.9 | 26.1 | 29.4 | 31.7 | 32.2 | 34.4 | 32.2 | 26.7 | 23.5 | 17.2 | | Maximum extrême (°C) |
| Date | 990/26 | 976/02 | 936/31+ | 921/28 | 977/23 | 948/30+ | 952/23+ | 944/16+ | 942/02 | 930/13 | 982/05 | 957/11+ | | Date |
| Extreme Minimum (°C) | -36.7 | -37.2 | -29.5 | -21.1 | -6.7 | -3.3 | -1.1 | 0.0 | -4.5 | -12.2 | -18.9 | -34.0 | | Minimum extrême (°C) |
| Date | 925/19 | 922/18 | 985/07 | 923/02 | 977/01+ | 914/04 | 890/20 | 982/30+ | 978/30 | 925/13+ | 921/27 | 989/30 | | Date |
| Degree-Days | | | | | | | | | | | | | | Degrés-jours |
| Above 18 °C | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 6.8 | 32.5 | 29.8 | 4.6 | 0.2 | 0.0 | 0.0 | 74 | Au-dessus 18°C |
| Below 18 °C | 786.1 | 713.3 | 631.9 | 440.2 | 263.2 | 106.7 | 30.7 | 43.7 | 144.6 | 301.4 | 457.9 | 688.6 | 4608 | Au-dessous 18°C |
| Above 5 °C | 1.0 | 1.0 | 4.4 | 23.3 | 145.6 | 290.2 | 404.8 | 389.1 | 250.1 | 114.7 | 31.3 | 4.9 | 1660 | Au-dessus 5°C |
| Below 0 °C | 237.9 | 214.8 | 106.2 | 8.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 23.1 | 156.8 | 748 | Au-dessous 0°C |
| Precipitation | | | | | | | | | | | | | | Précipitations |
| Rainfall (mm) | 44.2 | 32.6 | 39.8 | 60.3 | 87.4 | 85.2 | 97.8 | 88.1 | 84.2 | 105.6 | 90.1 | 71.9 | 887.2 | Chutes de pluie (mm) |
| Snowfall (cm) | 62.7 | 59.0 | 50.7 | 26.3 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0T | 2.4 | 15.7 | 54.2 | 274.0 | Chutes de neige (cm) |
| Precipitation (mm) | 104.5 | 87.4 | 93.4 | 88.3 | 90.8 | 85.2 | 97.8 | 88.1 | 84.2 | 108.2 | 105.8 | 124.0 | 1157.8 | Précipitations (mm) |
| Extreme Daily Rainfall (mm) | 100.2 | 83.8 | 51.8 | 106.7 | 45.3 | 99.1 | 104.0 | 83.1 | 153.7 | 93.5 | 72.1 | 90.0 | | Extrême quot. de pluie (mm) |
| Date | 979/08 | 953/08 | 913/27 | 962/01 | 990/30 | 968/13 | 983/22 | 948/13 | 942/22 | 917/22 | 919/06 | 990/08 | | Date |
| Extreme Daily Snowfall (cm) | 55.9 | 43.0 | 47.0 | 40.6 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22.9 | 39.2 | 43.2 | | Extrême quot. de neige (cm) |
| Date | 961/04 | 987/01 | 962/23 | 963/08 | 985/03 | 990/30+ | 990/31+ | 990/31+ | 990/30+ | 972/13 | 980/18 | 970/24 | | Date |
| Extreme Daily Pcpn. (mm) | 100.2 | 83.8 | 57.7 | 106.7 | 45.3 | 99.1 | 104.0 | 83.1 | 153.7 | 93.5 | 72.1 | 105.0 | | Extrême quot. de préc. (mm) |
| Date | 979/08 | 953/08 | 972/03 | 962/01 | 990/30 | 968/13 | 983/22 | 948/13 | 942/22 | 917/22 | 919/06 | 990/08 | | Date |
| Month-end Snow Cover (cm) | 18 | 22 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15 | | Couver. de neige, fin de mois (cm) |
| Days With | | | | | | | | | | | | | | Journées avec |
| Maximum Temperature >0°C | 10 | 9 | 20 | 29 | 31 | 30 | 31 | 31 | 30 | 31 | 27 | 15 | 293 | Température maximale >0°C |
| Measurable Rainfall | 5 | 4 | 6 | 10 | 14 | 12 | 11 | 12 | 11 | 12 | 12 | 7 | 116 | Hauteur de pluie mesurable |
| Measurable Snowfall | 10 | 8 | 8 | 4 | • | 0 | 0 | 0 | 0 | • | 3 | 9 | 42 | Hauteur de neige mesurable |
| Measurable Precipitation | 13 | 11 | 12 | 12 | 14 | 12 | 11 | 12 | 11 | 13 | 13 | 14 | 148 | Hauteur de préc. mesurable |
| Sunshine (hrs) | 95.9 | 111.6 | 137.4 | 146.5 | 192.5 | 214.9 | 229.1 | 216.2 | 164.5 | 129.7 | 83.6 | 77.4 | 1799.3 | Insolation (h) |

predominantly slough grass (Spartina pectinata), blue-joint (Calamagrostis canadensis) with scattered meadowsweet (Spirea latifolia). On poorly drained sections of the marsh the dominant species was sedge (Carex paleacea), sphagnum (sp.) and cattail (Typa sp.). Larch (Larix laricina), alder (Alnus sp.) and typical ericaceous shrubs invaded the higher bog areas.

Smith (1967) gives the most complete record of vegetation associations after impoundment and water control structures were established at the Missaquash Marsh Unit. The following associations were established by A. Smith and are included here in detail because they are *the most complete observations available,* and therefore serve as a reference point for other areas at present, and in the future:

Aquatic vegetation: A total of 45 species of aquatic plants were identified from the study area. Patten Lake, the most productive lake on the system, had the greatest variety of aquatic plant species. Tingley, Jones and Dwyers Lakes, the most unproductive aquatic areas, contained very few species.

Of the three species of Lemnaceae, greater duckweed (Spirodela polyrhiza) was the most widely distributed, occurring in 50% of the localities. Star duckweed (Lemna trisulca) and lesser duckweed (Lemna minor) have a far more restricted distribution and occur in dense mats along the main canal, flooded areas and to a lesser extent, in Patten and Hackmatack Lakes. Abundant quantities of all three species of duckweed were found growing together in wind protected areas along the main canal.

Seven species of the pondweed family occurred on the study area. floating-leaf pondweed (Potamogeton natans) was found scattered throughout, while white stem pondweed (Potamogeton praelongus) was found only in Patten Lake. Potamogeton epihydrus and Potamogeton obstusifolius were found infrequently in small patches along the canal and in a few upper lakes. flat-stemmed pondweed (Potamogeton zosterformis) and Potamogeton pusillus were abundant along the main canal and common throughout Patten and Hackmatack Lakes. Large-leaf pondweed (Potamogeton amplifolius) occurred in large patches in Portage, Front, Gunners, and Patten Lakes. P. Epihydrus and P. pusillus were the only two pondweed species that have thus far advanced into the impoundment area. (i.e. as of 1967, ed. note). four species of Sparganiaceae occurred on the study area. Giant bur-reed (Sparganium eurycarpum) and Sparganium chlorocarpum were abundant and widely distributed, whereas, Sparganium angustifolium and S. fluctuans were more local.

Spike rush (Eloecharis palustris), bulrush (Scirpus validus), water arum (Calla palustris), water parsnip (Sium sauve) and arrowhead (Sagittaria latifolia) were scattered in small plots in a variety of locations.

Wild rice (Zizania aquatica) occurred in scattered clumps throughout the shallow upper ponds and lakes. The largest patch of wild rice was found in

Patten Lake, where another member of the Graminaceae, Glyceria borealis was growing about the center of the lake.

Sweet flag (Acorus calamus), bayonet rush (Juncus militaris), smartweed (Polygonum amphibium) and mare's tail (Hippuris vulgaris) occurred in very small patches within the impoundment and canal areas of the lower marsh region.

The three species of yellow water lilies (Nuphar) grew in many of the upper lakes and ponds. Nuphar variegatum is the most abundant and occurred in all the upper sterile, deep water lakes. Water shield (Brasenia Schreberi), the fourth species of Nuphaeaceae on the study area had a very restricted distribution. Water shield was only found in the western ends of Patten and Rush Lakes, Pauly Pond and potholes six and seven.

Myriophyllum exalbescens had the widest occurence of the three species of water milfoil. M. Farwelli and M. verticillatum were both found in Patten Lake.

The bladderwors were represented by three species, the most common Utricularia vulgaris. U. geminiscapap and U. intermedia were not widely distributed, however, the latter was becoming extremely abundant on the impoundment area (i.e., in 1967, ed.note.)

Water starwort (Callitriche palustris) and water plaintain (Alisma trivale) were invading the impoundment area, especially in regions of exposed alluvial deposit.

Waterweed (Elodea canadensis) and water marigold (Megalodonta Beckii) occured in Patten, Front and Portage Lakes. Waterweed was established in large patches in all three lakes, whereas water marigold had only a scattered occurence.

Coontail (Ceratophyllum demersum) formed dense floating mats in the upper end of the canal and was also scattered in smaller quantities throughout the lower marsh region.

Common cat-tail (Typha latifolia) was not abundant on the marsh, but occurred in scattered clumps. Typha glauca the most abundant species formed dense mats around many of the lakes. T. angustifolia was also common and usually found in association with T. glauca.

Whitman (1974) reports on the vegetation within impoundments of varying ages and compares the species to natural marsh vegetation.

Terrestrial Vegetation: Canal banks:

The dry, elevated canal banks provide important areas of nesting cover within the impoundment. Vegetative cover consisted mainly of blue-joint and timothy (Phleum pratense) with the exception of the first one-half mile where cover consisted of meadowsweet, fire weed (Epilobium angustifolium), rough goldenrod (Solidago rugosa) and sow-thistle (Sonchus arvensis). Several mature white spruce (Picea glauca) occured along this lower section of canal bank. scattered along the entire length of the canal banks were wild lettuce (Lactuca

biennis), yarrow (Achillaea millifolim), scotch thistle (Cirsium vulgare) and meadow rue (Thalictrum pelygamum).

Terrestrial Vegetation: **Bog Associations**

The transition marsh to bog communities were characterized by a mixture of species. Generally, Calamagrostis canadensis, Spirea latifolia, Carex sp. association with alder (Alnus rugosa) interspersed, dominated the zone. Potentilla palustris, sweet gale (Myrica Gale) and large cranberry (Vaccinium macro carpum occurred infrequently throughout the zone.

The floating or "quaking" bog community was composed of sedges and sphagnum moss. Carex lasiocarpa, Eriophorum virginicum and Sphagnum sp. formed the bulk of the floating mat. Crowberry (Empetrum nigrum), Labrador tea (Ledum groenlandicum), small cranberry (Vaccinium oxycoccos) and bog fern (Dryopteris simulata) were scattered throughout. The pitcher plant (Sarracenia purpurea) and sundew (Drosera rotundifolia) were abundant. Buckbean (Menyanthes trifoliata) and Potentilla palustris usually occurred about the small bog potholes. Equisetum fluviatile and two species of bog orchids, Habenaria dilata and Pogonia ophioglossoides were scattered throughout the bog. Leather leaf (Chamaedaphne calyculata) was usually common along water ways and about lake margins.

Terrestrial vegetation: **Wooded Upland**

Dispersed within the bog are numerous small wooded "islands" of upland soil Vegetative cover was mainly red spruce (Picea rubens), yellow birch (Betula lutea), white birch (B. papyrifera) and scattered balsam fir (Abies balsamea). About the periphery of the islands black spruce (P. marina) and larch (Larix laricina) advanced over the surface of the bog. Generally wherever the bog meets the upland, black spruce and larch advance over it.

## 2.9 Fauna

Invertebrates Aquatic invertebrates play such an important role in waterfowl production that they have been recognized as a limiting factor. Whitman (1974) provides a detailed account of the species and density patterns within constructed wetlands. Invertebrate abundance showed a relationship to the density of emergent vegetation. Zones of submerged and floating-leaf aquatic plants contained the lowest densities of invertebrates, while dense emergent vegetation supported the highest numbers of invertebrates. Fresh water cord grass, spirea, sedge, and blue-joint associations contained significantly more invertebrate fauna

than any other plant species sampled, while bogbean showed the lowest numbers. (Whitman, 1974). The numbers and kinds of invertebrate production is dependent on soil and water chemistry and capability, age of impoundments, and localized temperature regimes. Whitman concluded that the optimum production of invertebrates and plants for waterfowl occured within the first four years of impoundment construction. Impoundments at 7 years show a sharp decline in available plant and invertebrate production. A. Hansens report (pending) may provide information for future water level regimes.

Vertebrates The most striking vertebrate species within the management area are the waterfowl, particularly the large flocks that stop on the fall migration. Figure 4 indicates some of the increased producitivity of waterfowl within a regional context. This data was obtained from Black Duck surveys and does not represent true numbers of waterfowl using the area.

Fig. 4

**Total breeding pairs of five major waterfowl species observed in the New Brunswick – Nova Scotia border region, 1954–60 and 1978–84**

| Species | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 7-yr. ave. | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 7-yr. ave. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Black Duck | 41 | 31 | 19 | 110 | 18 | 20 | 8 | 35 | 83 | 55 | 31 | 36 | 32 | 47 | 51 | 48 |
| Green-winged Teal | 1 | 1 | 8 | 7 | 0 | 2 | 0 | 3 | 18 | 11 | 6 | 5 | 3 | 1 | 15 | 8 |
| Blue-winged Teal | 0 | 0 | 7 | 2 | 4 | 3 | 5 | 3 | 16 | 14 | 4 | 11 | 5 | 5 | 12 | 10 |
| Ring-necked Duck | 2 | 4 | 6 | 1 | 3 | 5 | 0 | 3 | 26 | 17 | 11 | 17 | 27 | 17 | 19 | 19 |
| Northern Pintail | 3 | 7 | 10 | 12 | 2 | 4 | 1 | 5 | 9 | 14 | 8 | 6 | 0 | 5 | 4 | 7 |
| Total | 47 | 43 | 50 | 132 | 27 | 39 | 14 | 50 | 152 | 111 | 60 | 75 | 67 | 75 | 101 | 92 |

Source: Whitman (1984)

Melanson (1986) reports that prior to development work at the east Amherst sites, the annual production of duck broods was 15-20. By 1985, ten species of waterfowl were breeding on the marsh, including Blue-winged Teal, Green-winged Teal, Black Duck, American Widgeon, Ring-necked Duck, Mallard, Wood Duck, Hooded Merganser and Northern Shoveler. Smith (1967) reports on increased production at the Missaquash Marsh unit: "The 1966 production figure of 33 broods of dabblers on the impoundment and main canal is a substatial increase over the near zero figures from years before flooding".

In addition to waterfowl, the management area has provided habitat for several osprey nest sites (pers comm. R. Hall), a highly visible resident (and migratory) population of northern harriers, and nesting tree swallows. The management area has also provided for the establishment of the only breeding colony of Black Terns in the province. This colony, initially formed in the Missaquash area, has now spread to the Amherst Marsh Unit as well. When water levels are low, some species of migrating shorebirds rest and feed within the impoundments. See Appendix 4 for the most current check list of birds within the management area.

Appendix 5 lists the reptiles and amphibians associated with the management area.
Appendix 6 lists fish species.

From a management perspective, the most important mammals within the management unit are beaver and muskrat. These two species can become "nuisance" species due to their activities. Beaver can significantly alter optimum water levels for waterfowl; muskrat may cause eat outs in dense marsh vegetation allowing for a high percentage of open water; muskrat also burrow into dykes, causing washouts and dyke failure.
Appendix 7 lists the mammals associated with the management area.

Note: Baseline data on species and status is needed for reptiles, amphibians, fish and mammals.

## 3. Potential Management Conflicts:

Although lands within the management area are wholly owned by the Province of Nova Scotia, they are adjacent to:rural areas where agriculture is an important economic factor: an intensively used highway corridor: urban development areas, particularly at Amherst. Traditionally, permanent camp/cottage use has occurred on the Upper LaPlanche drainage system. (See Appendix 9). Anderson and Broughm (1988) identified large tracts of peatlands within the management area (the Upper Missaquash, specifically) which may be economically viable for mining.

Conflicts with agriculture: There has been a traditional conflict between agricultural communities and wildlife interests regarding the best possible management of the rich dykeland soils. Some agriculturalists have, in the past, tended to maintain ownership of even abandoned dykeland areas. Their view has been, and continues to be, that at some time in the future these lands can be managed for intensive cropping, if the demand for such crops makes it feasible to improve pasture land, abandoned or "run down" land. Future land acquisitions for wildlife conservation may be difficult or impossible.

Due to a great deal of effort on the part of modern agriculturalists, farming practises on adjacent lands need not impact the management area. Monitoring of run-off from agricultural lands is required (i.e. herbicides, pesticides, lime, manure, etc.)

It should be noted that agriculture often benefits many kinds of wildlife, particularly waterfowl. Liaison with agricultural groups can result in a harmonization of management efforts.

Highway Corridor: Apart from disturbing natural patterns of wetlands, the biggest threats from the highway corridor are accidents involving trucks containing toxic materials. Contingency plans for such an event are in place through various federal agencies.

Urban Development: Apart from "urban sprawl" and the resultant hectares of pavement, houses, and lawns, urban areas may be a source of pollutants from airborne chemicals and influences on quantity and quality of ground water and run off. At present, use by various groups has not been intense enough to negatively impact vegetation or wildlife.

Camp/cottage Development: At present, two camps are located on crown lands within the Amherst Marsh unit. Leases for these camps will be renewed on the basis of traditional use. However, no new sites will be approved.

While the lakes and waterways are owned by the province of Nova Scotia, the extent of water controls (flooding or draw down) are limited due to their impact on camps and cottages on adjacent private lands.

Peat Mining: Aesthetic and philosophical values aside, the peatlands provide an important filtration system for any number of airborne pollutants (sulphates in particular) and for toxic metals such as aluminium. Disturbance of deep peatlands can cause downstream loading of sediments and high values of released toxins, in addition to atmospheric carbon dioxide (Gorham, Bayley & Schindler, 1984). Research in the field of peatlands and their role in global environmental checks and balances is a relatively new area of research, and one which grows more complex as the research continues (Kerekes, pers. comm.) In their 1988 report on peatland resources, Anderson and Broughm correctly identified *some* of the environmental impacts of peat mining, but suggested that done correctly, mining of these resources need not be detrimental, at least on a small scale.

Peat extraction within the management area will not be permitted.

## 4. Management Policies

### 4.1 Objectives and Goals:

The Missaquash East Amherst Wildlife Management Area will be managed primarily for the protection and enhancement of wetland habitat. Management practises will strive to provide optimum habitat conditions for a wide range of wildlife species, as well as recreational and educational opportunities for people.

Management Goals

A. To maintain and enhance quality habitat for the perpetuation of waterfowl and an abundance and diversity of wetlands related wildlife.

B. To implement biological studies and monitoring programs which will provide a solid data base for management efforts.

C. To encourage public education and use (consumptive and non-consumptive) that will be compatible with habitat and wildlife resources.

D. Management practises shall include physical techniques including water level manipulation and vegetation enhancement, as well as legislated and regulated human activities.

### 4.2 Resource Units: Description and History of Development

The Missaquash East Amherst Wildlife Management Area consists of approximately 4184 hectares (10328.7 acres). The Province of Nova Scotia is the major landowner, however Ducks Unlimited Canada holds titles to the Fort Lawrence and Eddy Road Cove units. These lands will be transferred to the Province of Nova Scotia. Most of these lands are flooded to some degree, and are managed primarily for waterfowl and other wetland fauna and flora through habitat securement and enhancement.

Securements of the area began in the early 1960's and habitat enhancement followed as resource units were assembled. The enhancement techniques initially employed were water level management through control structures and dykes, followed by vegetation removal by mechanical means (cookie cutter). When conditions permitted, level ditches were dug to allow for water circulation between isolated ponds. These ditches are also used by waterfowl during pairing behaviour, provide travel corridors for duck broods, and access for people.

These techniques are employed as required to optimize the productivity of the various units.

Intensive trapping for furbearers takes place throughout the management area.

The Missaquash/East Amherst Wildlife Management Area consists of four physiographic units, situated in relatively close proximity, and separated either by a natural landform (i.e. Fort Cumberland Ridge) or a man made highway. The four units are: The Amherst Marsh Unit, Eddy Road Cove Unit, Fort Lawrence Marsh Unit. and the Missiquash Marsh Unit. Within broad categories of soils, flora and fauna, there are similarities between the units. For example, the upper portions of the Missaquash and Amherst Marsh units are characterized by peatlands and shallow fresh water lakes. On previously dyked and drained tidal soils, such as the lower portion of the Amherst Marsh, Eddy Road Cove, and the Fort Lawrence units, many similar species are encountered.

However,within similar units minor and localized substrates (marine or till) and past land use can create very different management requirements. For each unit then, it is important that soil and land use practises be carefully reviewed.

Amherst Marsh Unit.

This unit is located approximately 3 kilometres (1.8 miles) north of the town of Amherst. The primary water supply is the LaPlanche River watershed. The marsh system encompasses approximately 1530 ha (3780.6 acres). The lower 680 ha (1680.2 acres) were once tidal flats which were reclaimed by the Acadians prior to 1755 and used for hay and pasture crops for two hundred years. Tidal flooding breached the old dykes in 1951 and again in 1956. Under the Maritime Marshland Reclamation Act, the task of rebuilding dykes and sluiceways began in the early 60's, and tidal influences were again excluded from these dykelands. Except for occasional hay cropping, the marsh was abandoned for agricultural purposes.

The upper 850 ha (2100.3 acres) consists of 10 small lakes interspersed in a heath-bog community. Several of the lakes contain submergent vegetation and provide low density brood habitat for blacks and ringnecks, as well as pair territories and nesting sites.

Throughout the unit, the diverse aquatic communities provide habitat for a wide variety of wildlife. Before enhancement, the marsh flooded in the spring freshet and gradually drained with the exception of major ditches, deep channels and isolated potholes.

It required several years to assemble the lands for the Amherst Marsh Unit, as ownerships and boundary lines were difficult to determine. Land consolidation was completed in 1981 with most properties acquired, and easements signed for some parcels.

In 1982. DUC began work to enhance the marsh by developing three compartments consisting of dykes and variable water level control structures. These structures were built in order to manage water levels in each compartment independently to optimize waterfowl habitat. Work was completed in 1983. Compartment #1 consists of 43.3 ha (107 acres) and 3.4 km (2 miles) of shoreline. Compartment #2 is approximately 124.3 ha (307.1 acres), with 7.4 km (4.4 miles) of shoreline. Compartment #3 is 1362.7 ha (3367.2 acres) and 19.4 km (11.6 miles) of shoreline.
A denil fishway was incorporated in compartment #3 to facilitate anandromous fish migration up the LaPlanche River (target species being brook trout, gaspereau. and eel).Vegetation overgrowth and removal has been accomplished by using the cookie cutter in 1988,1991, and 1993.

The Amherst Marsh has a long tradition of use by trappers, hunters and fishermen and many camps have been built on the upland edges of the marshes (Appendix 8).

The 4.6 ha (11.3 acres) Sunrise Marsh was constructed in 1992 and while it provides biological benefits it was established to provide for accessible education, awareness. and interpretation. The access road and parking facilities are used by trappers, hunters, people who fish, camp owners, and people who come to walk or watch birds. At present, the parking area,boat storage, and launching facilities are inadequate.

Eddy Road Cove Unit:

This unit is located 3.2 km (1.9 miles) west of the town of Amherst on the Eddy Road. north-west side. The marsh was originally part of the tidal flats of the LaPlanche River. It was drained for agriculture and used for hay crops until the dykes collapsed in the late 1940's. The dykes were re-built in 1959, but agricultural practises did not resume and the lands were abandoned. The area was dry, with the exception of one small pothole. The land was purchased by private individuals from the former owner for a wild rice production project. Rice was sown, but never harvested.

In 1984 Ducks Unlimited Canada completed construction of two compartments by dyking and construction of variable outlet water level control structures. The compartments are dyked on four sides, and therefore depend on precipitation for water supply. Eddy Cove #1 is 28 ha (69 acres), Eddy Cove #2 is approximately 21 ha (51.8 acres) The project provides brood rearing habitat surrounded by approximately 1619 ha (3998.9 acres) of unimproved hay and pasture land which provides nesting cover.

Both compartments of the Eddy Road Cove Unit have full drawdown capability and are ideal for studies to determine the benefits of this management practise. An extensive research project (A. Hansen, CWS) has been carried out between 1989 and 1994 to determine the effects of draw down on productivity of the wetlands. The final report will be available in March of 1995.

Fort Lawrence Marsh Unit:

This unit is located 1.6 km (1 mile) west of the town of Amherst between the Eddy Cove Road and the Trans Canada Highway. This marsh unit has similar soils and history to that of the Eddy Cove Road unit, having been built on a relatively flat reclaimed dykeland. The land was purchased by a private individual for commercial wildrice production.

In 1973, DUC developed two shallow water compartments (F1 is 40 ha {98.8 acres}, F2 is 30 ha {74.1 acres}) which provide brood rearing areas for the adjacent 1620 ha (4003 acres) of unimproved hay and pasture land. In 1978 a dry portion of compartment #1 was level ditched to create open water. Compartment #2 was further subdivided into two cells (20 and 10 ha {49.4 and 24.7 acres respectively}) in 1981 in order to establish a better interspersion of aquatics and enhancing habitat for all wildlife. In the early 1980's some cookie cutter work was carried out to control the cattail mat.

Initially, water transfers were conducted each year in mid-August in order to facilitate harvesting of wild rice (this practise had no affect on waterfowl production). However, wild rice harvests were limited due to falling rice prices in the mid 1980's and the area was purchased by North American Waterfowl Management Plan funds in 1992.

This area was the control for a drawdown study from 1989 to 1994 which was initiated and managed through the Eastern Habitat Joint Venture and the Canadian Wildlife Service.

Missaquash Marsh Unit:

This unit is located west of Amherst on an access road running north from the Fort Lawrence road and is approximately 2430 ha (6004.5 acres) in size. The lower 485.8 ha (1200.4 acres) are on fertile marine soils and have rooted emergent vegetation associations, including wild rice. The upper, or northerly section of 1943.3 ha (4801.8 acres) are composed of a floating bog complex, with 35 shallow lakes and ponds. The main lakes in the upper region (Patten, Hackmatack, Dwyers, Gunners, Front, Portage, Big Duck and Goose) are within the Missaquash River drainage system, while the largest and deepest, Round Lake, is drained by the LaPlanche River.

Land assembly for this project began in 1961, with the Province of Nova Scotia's purchase of 2429 ha (6002 acres) from the Missaquash Marsh Company. Approximately 372 ha (919.2 acres) of this land, (primarily upland) are located in New Brunswick.

There is no public access road from New Brunswick to the marshlands but there is an access road with a boat launch from the Nova Scotia side that is in need of improvements. This road allows walking access to the dykes of M2,3,4, and the major water control structure and fishway for this unit.

From 1961 to 1964, the Province of Nova Scotia gathered biological data on marsh vegetation, water quality and levels, soils and waterfowl production. Some experimental pothole blasting was conducted.

In 1965 DUC constructed a variable water level control structure in the bed of a large drainage canal that runs 9.6 km (5.7 miles) through the Missaquash Marsh (approximately 5 km {3 miles} of this canal is within the management unit). The control structure and large dyke on the outlet controls water levels up to and including Patton Lake. In 1968 a denil fishway was constructed at this control structure to allow the passage of fish migrating up the Missaquash River.

In 1967 blasting activities created a channel between Patton and Hackmatack Lakes, and smaller passages were created from the main channel through the spoil banks in several places. The object of this was to provide water flow through Hackmatack Lake, and to increase water flow throughout the lower shallow water segments. Further pot hole blasting was done in 1969.

In 1971 land was assembled below the control structure for impoundment M1. Consequently, construction was begun on impoundments M2 (65 ha {160.6 acres}), M3 (28 ha {69.1 acres}), and M4 (8 ha {19.7 acres}). This work was completed in 1973. A new water control and fishway were constructed at this location, replacing the original structures. Impoundments M1 and M2 are operated at the same water level, while M3 is operated independently. M4 is operated by a screw gate and is subject to water level fluctuations according to precipitation amounts. The installation of a small variable control structure would provide the opportunity for water level management.

Two winter draw downs (1972/73 and 1992/93) were initiated to revitalize productivity.

The most intensive management to date has occurred in impoundment #1 on the upper 1943 ha (4801.1 acres) of floating Typha mat. From 1975 to the early 1990's channels were cut and re-cut by the cookie cutter providing open water. This technique then changed to clear cutting areas of thin mat and complete removal. These areas provide excellent fall staging habitat and wildrice has been well established.

In 1967, 29 Canada Geese goslings were introduced to the marsh from the Nasha Game farm in Ontario. This attempt to establish a resident breeding flock ended in failure, due largely to the fact that the birds were too domesticated and suffered heavy mortality during the first fall.

In 1968, 50 wood duck boxes were erected and 48 hand reared wood ducks were released. From 1976 to 1987, 745 wood ducks were "gentle" released and while some birds nested in the boxes on the marsh, it appears that most have utilized small beaver ponds within a 30 km (18 mile) radius from the release site. The Missaquash Marsh is an important staging and mating area for wood ducks from as far away as the Saint John River area.

### 4.3 Resource Management Policies for the Missaquash/East Amherst Wildlife Management Area:

These policies shall apply to all four units within the management area, notwithstanding the special priorities and policies for each unit.

#### 4.3.1 Biological Studies Required:

This area has had an extensive history of management, and many changes in habitat have occurred. There is a need to begin baseline inventories (base year 1995), and update these at regular, established intervals.

❑ Baseline data inventory of vascular and non-vascular rare and/or significant plant species.

❑ Vegetation monitoring for obvious changes in vegetation associations to be done by annual air photo transects. Increase in cattail mats or sphagnum

communities may require adjustments to management techniques and timing. for optimum habitat.

❒ Establish vegetation transects to document changes in intensively managed impoundments and canals. Invertebrate species associated with certain plant communities are important limiting factors for brood production.

❒ Establish indicator species which can be used to estimate nutrient availability, sedimentation, changes in pH, and other factors.

❒ Establish appropriate methodology to document presence and status of reptile and amphibian species.

❒ Establish appropriate methodology to document presence and status of small mammals in particular, and other mammalian species in general.

❑ Monitoring of water quality for localized pollution sources and effects of long range transportation of airborne pollutants (with Atmospheric Environment Service).

❑ Monitoring and assessment of management practises, with a system for ongoing documentation of successes or failures.

❑ Fish studies to determine species present, status of resident and anandromous species, socio-economic importance of sport fishery, and management policies to maintain and/or improve capability.

❑ Quantify the value of impoundments to staging/moulting waterfowl as well as to other aquatic birds, especially black terns, tree swallows, grebes, rails etc.

### 4.3.2 Wildlife Enhancements:

Where required;

a.) nesting structures for wood ducks, loons, osprey, tree swallows, purple martin, etc. (* Those structures requiring maintenance must be placed in areas which are easily accessible, and may be part of community involvement programs).

b.) grit stations

c.) selected feeding sites to enhance opportunities for wildlife viewing (e.g. Sunrise Marsh).

d.) planting power line corridors with low growing shrubs useful for wildlife cover and food.
e.) when nutrients or pH become limiting factors (as evidenced by above noted studies) both lime and fertilizer can be applied. Commercial fertilizer is readily available, but green manure may be a more suitable option (although more difficult to apply).

## 4.4 Public Use Policies for the Missaquash/East Amherst Wildlife Management Area:

The Missaquash/East Amherst Wildlife Management Area is accessible for public use. Many of the activities take place on waterways where there is little or no impact on the physical environment. Dykes are used by hikers, birders and hunters but at present levels of use, there appears to be little damage from these activities. These activities are encouraged (except for hunting from the dykes themselves) particularly on the Amherst, Eddy Road Cove and Fort Lawrence units. All terrain vehicle use is restricted from the dykes. Snowmobiles are not restricted as little damage is caused on snow covered vegetation. Should damage occur, regulations may be required. The northern bog complexes on the Amherst and Missaquash marshes are fragile and concentrated use by snowmobiles, A.T.V's, hikers and canoe portaging can cause extensive damage. Surveys and floral inventories will be required before corridors are designated and use encouraged within these areas.

Natural islands will remain wooded to provide nesting cover and shelter for a variety of wildlife.

Human activity that causes disruption of floral and faunal communities may be restricted (e.g. hiking through areas where ducks are nesting).

Hunting: Waterfowl hunting efforts are concentrated in the first two weeks of the season. Waterfowl hunting will be permitted only if the hunter has a means of retrieving downed birds. No hunting will be allowed from the dykes. Blind sites are selected by hunters and must be identified with the hunters name and address; however, this does not provide proprietal rights. The province reserves the right to remove a blind at any time, if deemed necessary. Blinds must be constructed of native materials and spaced no closer than one hundred and fifty meters. Big game hunting (primarily deer) takes place on wooded islands and upper reaches of the marsh.

There is a limited harvest of bullfrogs.

All provincial and federal seasons and bag limits apply in the wildlife management area.

Hunting will not be permitted within one hundred and fifty meters of the

Sunrise Marsh.

Fishing Sport fishing for brook trout takes place in the spring of the year before water temperatures in the marsh elevate. Yellow perch, white perch and brown bullheads are abundant, but there is little angler interest in them. Blueback herring and gaspereau runs are common on both the LaPlanche and Missaquash Rivers. Eels are taken commercially on the Amherst and Missaquash Marsh, with harvesting restricted to eel pots.

All provincial fishing regulations apply in the management area.

Trapping: The principal furbearer taken is muskrat, however small numbers of mink, beaver, raccoon, fox and otter are also trapped.

All provincial trapping regulations apply in the wildlife management area.

**NOTE:** Managers of the Missaquash unit have voiced concerns regarding hunting, trapping, and fishing laws that are different for Nova Scotia and New Brunswick. This causes confusion for both the user and those responsible for enforcement. Efforts at harmonizing licenses,bag limits, seasons, etc. need to be made, and the resultant decisions made clear to the various user groups.

Canoeing and Hiking The waterways and dykes offer opportunities for canoe routes and hiking trails. Camping and open fires are permitted, but sites and times need to be designated (e.g. no camping or fires during nesting season).

Ecotourism. If present trends continue, there may be an increased demand from this market for opportunities to view wildlife and use trails and possibly canoe or boating routes. While this is a unique opportunity for public awareness and education, the level of use (i.e. how many people) must be studied in order that the natural systems are not negatively impacted. Planning must identify which sites are best suited to this type of use, and how many people during each season will be permitted to use the area without detriment to wildlife, vegetation, and infrastructure. Further developments such as washrooms, interpretive materials, and other public use structures and programs will have to be identified in conjunction with tour operators and the Nova Scotia Tourism departments (locally and provincially).

### 4.4.1 Public Use Enhancements

Amherst (and Sunrise) Marsh Unit

1. Parking for a minimum of 15 cars and boat trailers will be provided and clearly delineated.
2. The 2 existing launch sites will be upgraded, with adjacent wharves. Existing

private wharfs will be dismantled and disallowed.
3. A loop, surfaced walking trail will be constructed starting at the parking lot, and proceeding around A #1 impoundment. This may require lease or acquisition agreements with private landowners at the upper reaches of the loop.
4. Directional and mapping signage will be erected for walking trail and boating routes.
5. Designate areas where boats can be stored without damaging dykes or preventing access.
6. Washroom facilities will be constructed in the parking area.
7. Picnic facilities may be provided near the parking area, to the west of the present control structure.
8. A viewing mound for bird and wildlife viewing should be constructed at the Sunrise Marsh.
9. The Sunrise Marsh should be developed for interpretive purposes.

Eddy Road Cove Unit:
1. County access road needs improvement.
2. Provision of a viewing mound for naturalists/birders and other user groups.
3. Access to this viewing mound must be a clearly defined pathway.
4. Provide access and signage to Chignecto Ship Railway bed from C #1, as an historic and cultural experience.

Fort Lawrence Unit:
1. Improve access road to prevent deterioration of surrounding area.

Missaquash Marsh Unit:
1. Improve access, parking, and boat launch area at lower end of Missaquash (at M #2). for a maximum of ten cars and boat trailers.
2. Provide canoe access to the area from the New Brunswick side at Portage Lake[1] (this will require acquisition of lands, or agreements with landowners). Parking for a maximum of ten vehicles should be provided.
3. A "wilderness "canoe route can be established from the upper part of the Amherst Marsh, through the lakes and into Round Lake. Before this is established, surveys must be made especially of sensitive and fragile areas of the bogs. Boardwalks must be erected over fragile sites, and forested islands must be acquired and/ or have lease arrangements for public use on private lands. One campsite will be designated with minimum facilities i.e. constructed tent pad and outhouse. Pack-in, pack-out will be enforced. Garbage containers must be provided at the beginning and end of the route, and all facilities must be maintained regularly.

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[1] Note that this area has possible significance as an archaeological site .See section 2.5.1

## 5. Education and Interpretation: Management Options

Ducks Unlimited has produced some very effective advertisements for television, stressing the importance of wetlands in the large scale health of the environment, "...not just for ducks". Within the head of the Bay of Fundy region, the various conservation sites have dramatically benefited waterfowl, shorebirds, and other wildlife. A united effort among all of these agencies to increase public awareness of the benefits accrued from management and/or protection would be a very cost- effective and productive exercise.

Within the Missaqaush/East Amherst Wildlife Management Area, target audiences and requirements for education, awareness and interpretation are outlined.

Tourism: The highway corridor at Aulac is one of the most intensively used roads in the Atlantic Provinces, as it provides the access or exit route for the majority of visitors. This site is an ideal location for increasing awareness about the successes of reclamation and management.

a. ) In co-operation with the provincial departments of highways, establish pull-off areas along the Aulac-Tormentine highway, and/or the road along the Amherst Ridge. Both of these areas provide a view of the dykelands and marshlands. Signs with graphics and text could pin-point areas of productivity for waterfowl, or other wildlife species, dykes and impoundments. and historic landmarks such as the remains of the Ship Railway Bed.

b.) Tourist bureaus at Aulac and at the Amherst border should be supplied with static displays of the marshlands, and brochures outlining the activities of the cooperating agencies in the management units. Staff at these sites should be well informed as to access to specific areas of interest.

c.) Travel information produced by Nova Scotia and New Brunswick should include write ups of the management area, highlighting access points and activities such as bird watching and wildlife viewing.

d.) Brochures and other information should be made available at all overnight accommodations sites within the Chignecto Region.

e.). Highway signage must clearly indicate the various access and or viewing sites within the management area.

Convention/Conference Visitors. Moncton, Amherst, and to some extent Sackville are all important areas for this segment of visitors. These visitors often have spare time, and organizers often are looking for interest and activity sites for their groups. Conservation messages targeted toward this group would be very effective in increasing awareness of the importance of wetlands, and soliciting

support dollars for conservation. In some cases, this may be the only time when groups could be exposed to conservation efforts, wetland values and benefits. In some ways, while they are staying in the area they become a "captive" audience which would otherwise require enormous inputs of man power and media to reach.

a.) All accommodation in Moncton, Amherst, and Sackville should have printed materials (maps and brochures) available for visitors. Staff should be made aware of access routes and points of interest (printed materials must clearly state personal liability and possible risk factors).

b.) At sites such as the Wandlyn (Amherst) the view of the marshlands could be augmented with interpretive signs in the parking lot, explaining what visitors can see from that vantage point.

c.) Efforts should be made to liaise with convention/conference organizers, encouraging visitation to accessible areas such as the Sunrise Marsh and walking trail, and where possible, provide "guided tours" by staff from DUC, CWS, or Natural Resources. At first glance, this may appear to be putting too heavy a demand on man-power available at these agencies. However, this group in particular may be very fertile ground for expansion of awareness, and support. A knowledgeable person acting as a guide can often leave lasting impressions on people who have never considered wetlands as valuable habitat for wildlife.

Local Residents: The objectives for this group are to promote awareness of the rich wetland community that has been created, and to encourage use of the Amherst Marsh walking trails (A#1 and Sunrise Marsh).

a.) Through interpretive presentations to schools, business clubs, natural and cultural history groups, to increase awareness and appreciation of the management area as a beneficial wetland for a healthy environment, and for a diversity of wildlife.

b.) Encourage various user groups to take part in bird census, nest box construction and maintenance, trail and facility monitoring and clean up.

c.) At the Sunrise Marsh walking trail, provide self-guided interpretive signs along the trail.

d.) Develop working relationships with landowners, particularly farmers, adjacent to the management area. Ensure that real and perceived wildlife related problems are dealt with, and produce information for farmers and the public about the benefits of agriculture to wildlife.

e.) With Mount Allison University (biology department) develop an interest in and use of the area for field trips. Familiarity with the area and with management requirements will allow for well-trained students who in turn may be utilized in monitoring and research projects and/or thesis studies.

## 6. Enforcement.

Enforcement of game laws and regulations will be the responsibility of the appropriate provincial and federal departments. Compliance with wildlife management area regulations will be the responsibility of the Province.

## 7. Maintenance and Administration:

The maintenance and administration of the wildlife management area will be the responsibility of the Nova Scotia Department of Natural Resources. It will require the cooperative input of the North-Central Subdivision, Parks and Recreation Division, Wildlife Division, and Ducks Unlimited Canada.

North-Central Subdivision Responsibilities:
1. Construction and maintenance of parking lots, access and boundary lines, boat launches,, hiking and canoe routes.
2. Law Enforcement
3. Maintenance of interpretive facilities and distribution of materials
4. Biologist assisting in interpretive activities and biological studies/programs.

Parks and Recreation Division Responsibilities:
1. Assist (with funds and staffing) in development of interpretive program.
2. Design day use programs
3. Provide information on trail construction, washroom facilities, and other infrastructures for public use.

Wildlife Division Responsibilities:
1. Chair the wildlife management area steering committee consisting of representatives from NSDNR, NBDNR, CWS, and DUC.
2. The above committee will be responsible for designing, implementing and approving biological and research studies.
3. Habitat management

Ducks Unlimited Canada Responsibilities.
1. Maintain water control structures, dykes, fish ladders, and channels.
2. Vegetation control
3. Monitor and manage water levels
4. Input in management and research

Priorities for the Missaquash/East Amherst Wildlife Management Area:
1. Complete land surveys of crown owned properties in order to declare this location as a wildlife management area.
2. Acquire and develop access as needed.
3. Develop regulations for the wildlife management area.
4. Improve parking and boat launch facilities
5. Provide highway signage to access areas.
6. Develop and implement interpretive materials and supporting infrastructures.

**8. Information Sources:**

Managers may need to consult with or refer to the following agencies or reports for in depth information.

Atmospheric Environment Services, Environment Canada, Ottawa
Agriculture Canada, Experimental Farm, Nappan, N.S. (polder soil information)
Canadian Parks Service, Historic Sites Division, and Interpretive Services Division, Regional Office, Halifax, N.S.
Evaluation of Peatland Resources (Anderson & Broughm, 1988) vegetation maps (possibly of use to indentify location of selected vegetation to start the baseline inventory of flora as per recommendations Section 4.3.1)

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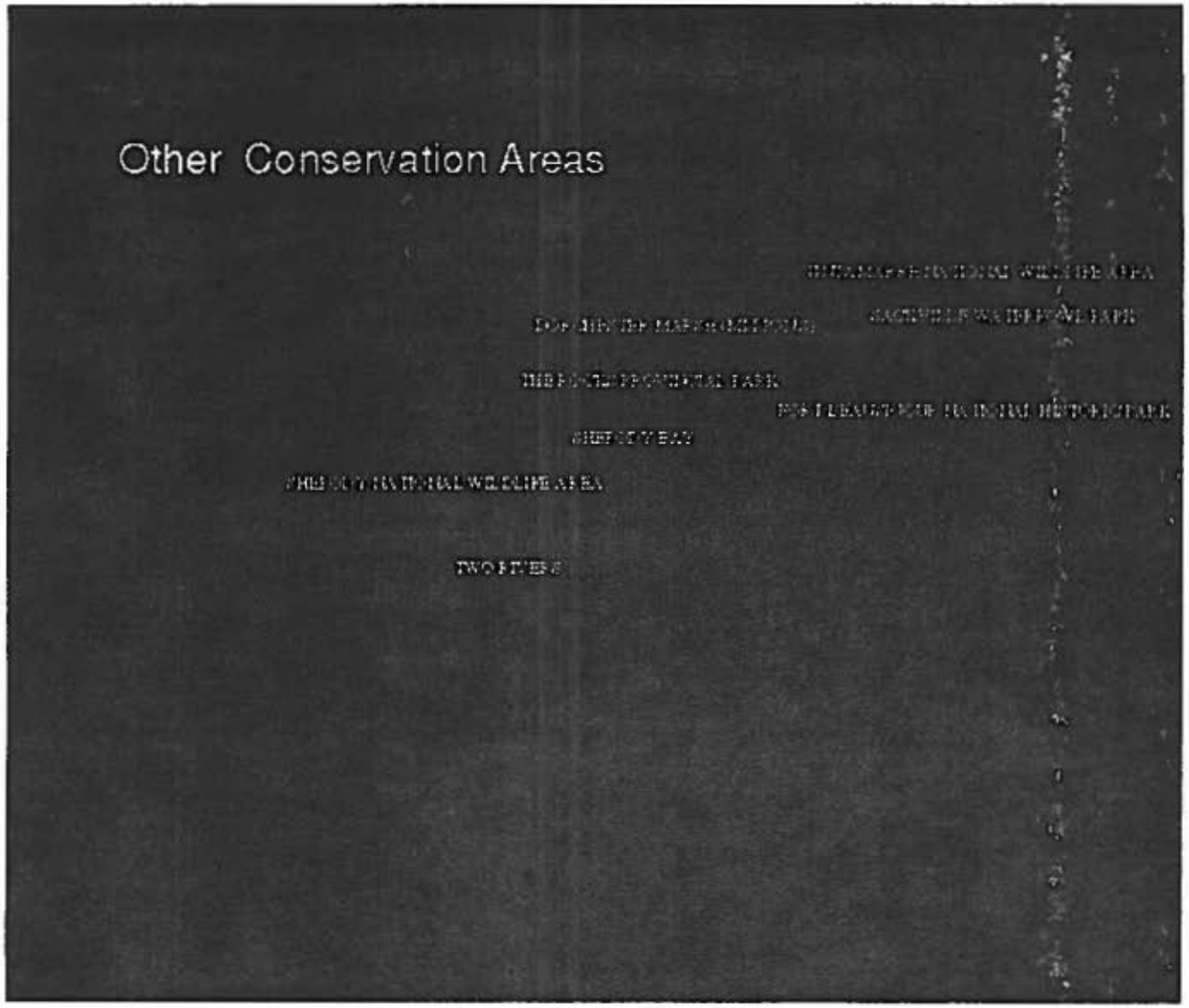
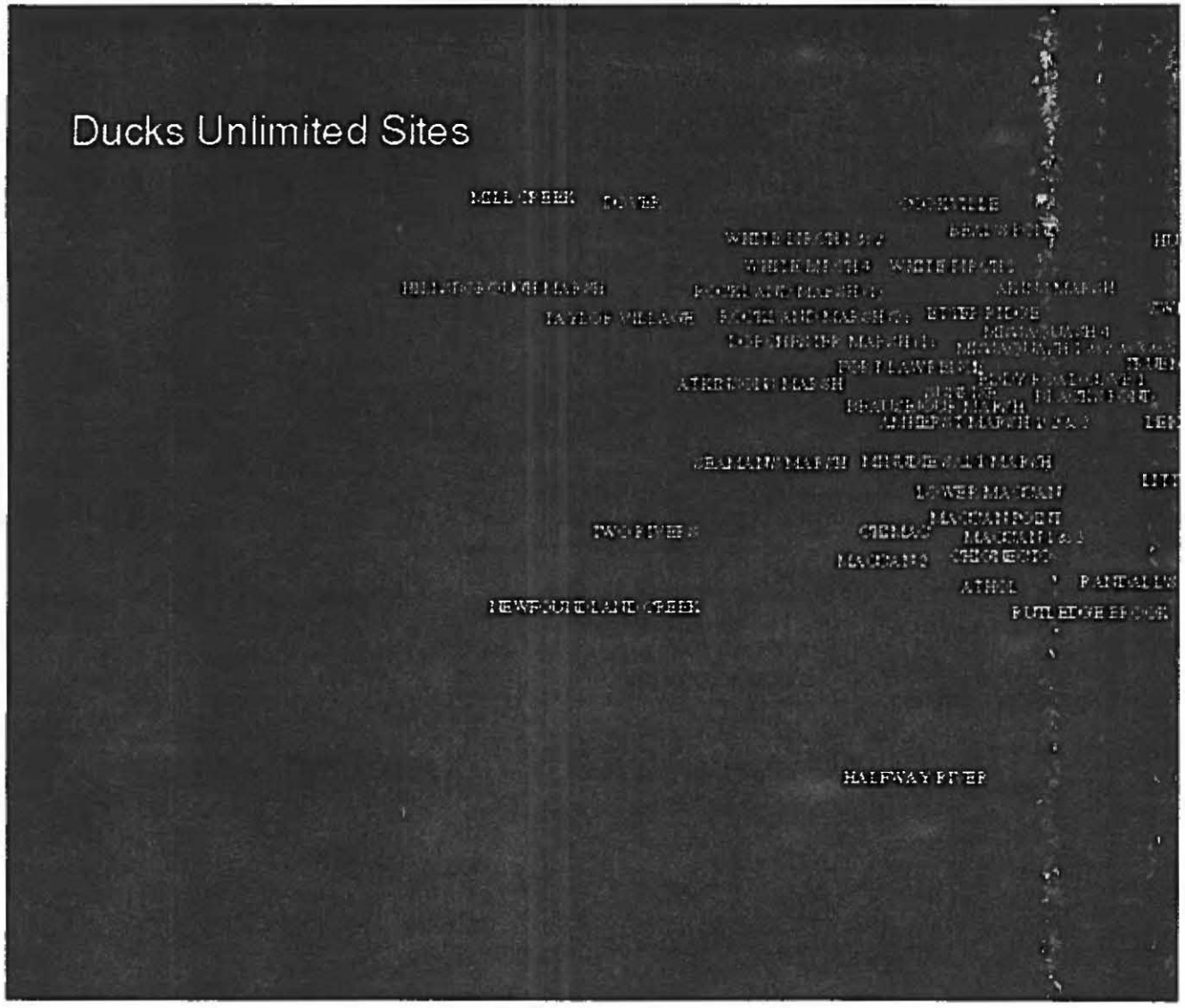
# Appendix 1 Conservation Sites within the Upper Bay of Fundy Region

| Prov | Name | Lat | | Long | | Levl | Hect | Year |
|---|---|---|---|---|---|---|---|---|
| NB | SACKVILLE WATERFOWL PARK | 45 | 54 | 64 | 22 | CMP | 22 | 1987 |
| NB | ATKINSONS MARSH | 45 | 51 | 64 | 22 | DUN | 13 | 1986 |
| NB | BEAL'S POND | 45 | 59 | 64 | 16 | DUN | 3 | 1988 |
| NB | BEAUSEJOUR MARSH | 45 | 51 | 64 | 16 | DUN | 20 | 1987 |
| NB | COOKVILLE | 46 | 0 | 64 | 19 | DUN | 0 | 1991 |
| NB | DORCHESTER MARSH (1) | 45 | 53 | 64 | 32 | DUN | 28 | 1991 |
| NB | DOVER | 45 | 59 | 64 | 40 | DUN | 26 | 1983 |
| NB | ETTER RIDGE | 45 | 54 | 64 | 15 | DUN | 7 | 1984 |
| NB | HILLSBOROUGH MARSH | 45 | 55 | 64 | 39 | DUN | 20 | 1984 |
| NB | MILL CREEK | 45 | 59 | 64 | 48 | DUN | 30 | 1981 |
| NB | NEWFOUNDLAND CREEK | 45 | 38 | 64 | 48 | DUN | 81 | 1982 |
| NB | ROCKLAND MARSH (1) | 45 | 54 | 64 | 33 | DUN | 29 | 1985 |
| NB | ROCKLAND MARSH (2) | 45 | 53 | 64 | 33 | DUN | 23 | 1985 |
| NB | TAYLOR VILLAGE | 45 | 54 | 64 | 33 | DUN | 9 | 1983 |
| NB | TWO RIVERS | 45 | 42 | 64 | 41 | DUN | 37 | 1991 |
| NB | WHITE BIRCH 1 & 2 | 45 | 58 | 64 | 21 | DUN | 73 | 1973 |
| NB | WHITE BIRCH 3 | 45 | 58 | 64 | 20 | DUN | 103 | 1981 |
| NB | WHITE BIRCH 4 | 45 | 58 | 64 | 19 | DUN | 15 | 1984 |
| NB | DORCHESTER MARSH (MITTON'S) | 45 | 53 | 64 | 32 | EHJ | 41 | 1992 |
| NB | TWO RIVERS | 45 | 40 | 64 | 42 | EHJ | 43 | 1992 |
| NB | FORT BEAUSEJOUR NATIONAL HISTORIC | 45 | 51 | 64 | 17 | NHP | 120 | 1977 |
| NB | SHEPODY NATIONAL WILDLIFE AREA | 45 | 44 | 64 | 45 | NWA | 979 | 1980 |
| NB | TINTAMARRE NATIONAL WILDLIFE AREA | 45 | 58 | 64 | 16 | NWA | 1990 | 1978 |
| NB | THE ROCKS PROVINCIAL PARK | 45 | 50 | 64 | 34 | PVR | 72 | 1958 |
| NB | SHEPODY BAY | 45 | 47 | 64 | 35 | RAM | 12200 | 1987 |
| NS | AKINS MARSH | 45 | 56 | 64 | 12 | DUN | 60 | 1987 |
| NS | AMHERST MARSH 1, 2 & 3 | 45 | 51 | 64 | 11 | DUN | 45 | 1983 |
| NS | ATHOL | 45 | 40 | 64 | 13 | DUN | 17 | 1972 |
| NS | BLACKS POND | 45 | 51 | 64 | 10 | DUN | 2 | 1983 |
| NS | CHIGNECTO | 45 | 43 | 64 | 14 | DUN | 77 | 1971 |
| NS | CHIMAC | 45 | 43 | 64 | 15 | DUN | 14 | 1971 |
| NS | EDDY ROAD COVE 1 | 45 | 51 | 64 | 13 | DUN | 29 | 1984 |
| NS | EDDY ROAD COVE 2 | 45 | 51 | 64 | 14 | DUN | 21 | 1984 |
| NS | FORT LAWRENCE | 45 | 51 | 64 | 15 | DUN | 42 | 1973 |
| NS | HALFWAY RIVER | 45 | 30 | 64 | 21 | DUN | 60 | 1991 |
| NS | HUNTERS POND | 45 | 59 | 64 | 0 | DUN | 3 | 1991 |
| NS | LEICESTER MARSH | 45 | 49 | 64 | 0 | DUN | 8 | 1980 |
| NS | LITTLE RIVER | 45 | 46 | 64 | 0 | DUN | 8 | 1982 |
| NS | LOWER MACCAN | 45 | 45 | 64 | 17 | DUN | 10 | 1985 |
| NS | MACCAN 1 & 3 | 45 | 43 | 64 | 15 | DUN | 24 | 1969 |
| NS | MACCAN 2 | 45 | 42 | 64 | 15 | DUN | 8 | 1969 |
| NS | MACCAN POINT | 45 | 44 | 64 | 15 | DUN | 7 | 1989 |
| NS | MINUDIE SALT MARSH | 45 | 48 | 64 | 21 | DUN | 167 | 1975 |
| NS | MISSAQUASH 1 & 2 & 3 & 5 | 45 | 54 | 64 | 13 | DUN | 2596 | 1965 |
| NS | MISSAQUASH 4 | 45 | 54 | 64 | 14 | DUN | 8 | 1972 |
| NS | RANDALL'S LAKE | 45 | 41 | 64 | 4 | DUN | 3 | 1988 |
| NS | RUTLEDGE BROOK | 45 | 41 | 64 | 3 | DUN | 5 | 1981 |
| NS | SEAMAN'S MARSH | 45 | 46 | 64 | 22 | DUN | 14 | 1989 |
| NS | SUNRISE | 45 | 51 | 64 | 11 | DUN | 4 | 1992 |
| NS | TRUEMAN'S POND | 45 | 52 | 64 | 2 | DUN | 13 | 1981 |
| NS | ZWICKERS | 45 | 55 | 64 | 0 | DUN | 4 | 1991 |

CMP-Community Park
DUN-Ducks Unlimited Site
EHJ-Eastern Habitat Joint Venture
NHP-National Historic Park
NWA-National Wildlife Area
PVR-Provincial Park (recreational)
RAM-Ramsar Wetland Site


Other Conservation Areas


Ducks Unlimited Sites
HALFWAY RIVER

# Appendix 2
# Diagrams of Dyking Techniques*

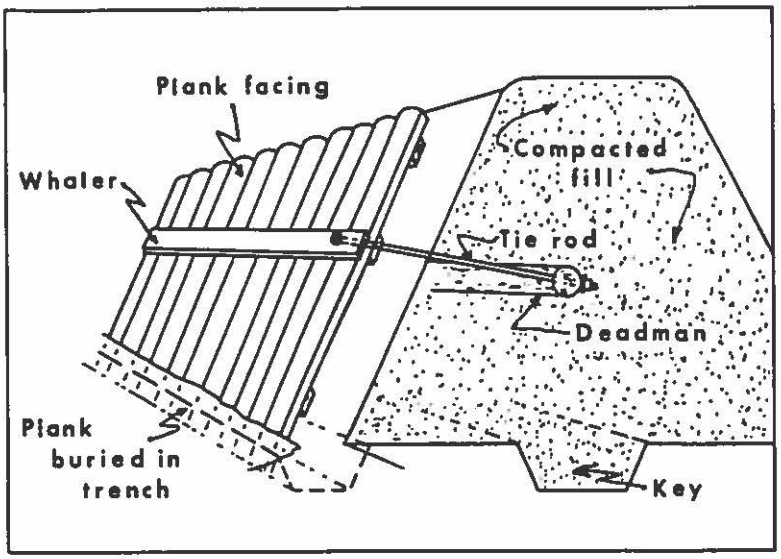



*Figure 11 A typical method of installing plank facing to dykes to protect them from erosion due to wave and tidal current action.* (Drawn by MRMS)

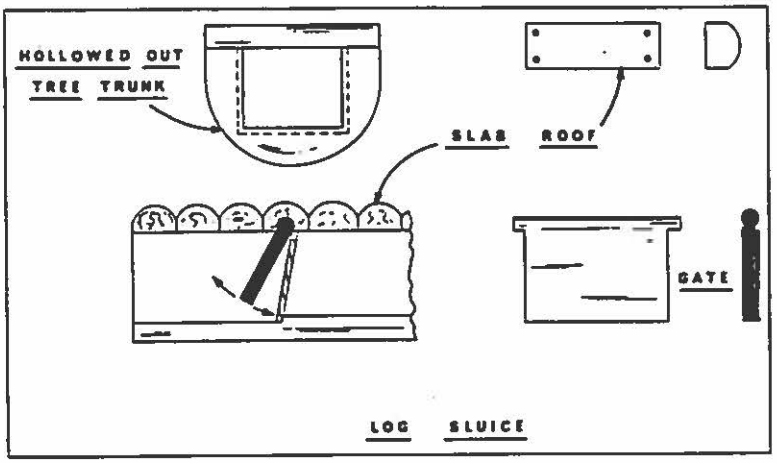



*Figure 12 Sketches showing a method to build an early Acadian aboiteau from a hollowed log.*

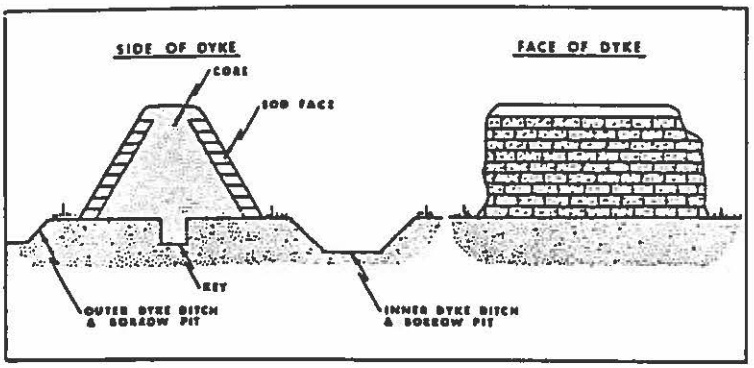



*Figure 8 This drawing shows a typical hand-built dyke as used by the Acadians. The top width would be from 30-60 cm wide with 1:1 side slopes. The sods or permangues were cut from saltmarsh sods using the very sharp dyking spade.*

*Maritime Dykelands. The 350 Year Struggle. 1987

# Appendix 3

## Vascular Plant List, Chignecto Area

## H. Harries, 1973

# Index for Check List of Chignecto Area Vascular Plants - 1973.

# CHECK LIST OF WILD AND CULTIVATED VASCULAR PLANTS IN THE CHIGNECTO AREA OF NEW BRUNSWICK AND NOVA SCOTIA

Compiled by H. Harries on the basis of own notes and specimens in the Mount Allison University herbarium.

Sackville, N. B. - June 1, 1973.

Note: The abbreviation 'intr.' denotes plants which have been intentionally or accidentally introduced into the area. The asterisk (*) marks rare plants for which reports of localities are desired. The abbreviations N.B. or N.S. indicate plants which so far are known in the Chignecto area only from the New Brunswick or Nova Scotia side of the border. The abbreviations spec. and spp. refer to respectively one or several unidentified species.

## PTERIDOPHYTES (SPORE-PRODUCING VASCULAR PLANTS)

Equisetaceae - Horsetail Family

- Equisetum - horsetails
  - E. arvense L. - field horsetail
  - E. sylvaticum L. - wood horsetail
  - E. fluviatile L. - water horsetail
  - E. hyemale L. var. affine (Engelm.) A.A.Eat. * N.S. - scouring rush

Lycopodiaceae - Clubmoss Family

- Lycopodium - clubmosses
  - L. lucidulum Michx. - shining clubmoss
  - L. inundatum L. var. inundatum - bog clubmoss
  - L. annotinum L. var. annotinum - bristly clubmoss
    - var. acrifolium Fern. * N.B.
    - var. pungens (LaPylaie) Desv. * N.B.
  - L. clavatum L. var. clavatum
  - L. obscurum L.
  - L. sabinaefolium Willd. var. sitchense (Rupr.) Fern.: *N.B.
  - L. flabelliforme (Fern.) Blanchard
  - L. tristachyum Pursh *

  (the last five: ground pine)

Isoetaceae - Quillwort Family

- Isoetes - quillworts
  - I. muricata Dur.: * N.B.

Ophioglossaceae - Adder's-tongue Family

- Botrychium - grape-ferns
  - B. matricariaefolium A.Br.: * N.B.
- Ophioglossum
  - O. vulgatum L. var. Pseudopodum (Blake) Farw. * N.S. - adder's-tongue

Osmundaceae - (ferns)

- Osmunda
  - O. regalis L. var. spectabilis (Willd.) Gray - royal fern
  - O. claytoniana L. - interrupted fern
  - O. cinnamomea L. - cinnamon fern

Polypodiaceae - (ferns)

- Cystopteris
  - C. bulbifera (L.) Bernh.* N.S. - bulblet fern
- Pteretis
  - P. pensylvanica (Willd.) Fern. - ostrich fern
- Onoclea
  - O. sensibilis L. - sensitive fern
- Dryopteris
  - D. thelypteris (L.) Gray var. pubescens (Lawson) Nakai - marsh fern
  - D. noveboracensis (L.) Gray - New York fern
  - D. disjuncta (Ledeb.) C.V. Mort. - oak fern
  - D. phegopteris (L.) Christens. - beech fern
  - D. spinulosa (O.F. Muell.) Watt. - wood fern
    - var. intermedia (Muhl.) Undew.
    - var. americana (Fisch.) Fern.: * N.B.
  - D. cristata (L.) Gray - crested wood fern
  - D. marginalis (L.) Gray * N.S. - marginal fern
- Polystichum
  - P. acrostichoides (Michx.) Schott - Christmas fern
- Dennstaedia
  - D. punctilobula (Michx.) Moore - hay-scented fern
- Athyrium
  - A. filix-femina (L.) Roth var. michauxii (Spreng.) Farw. - lady fern
- Pteridium
  - P. aquilinum (L.) Kuhn var. latiusculum (Desv.) Underw. - bracken
- Polypodium
  - P. virginianum L. * N.S. - rock polypody

## GYMNOSPERMS (CONIFERS AND RELATED PLANTS)

Taxaceae - Yew Family

- Taxus - yew
  - intr. T. cuspidata Sieb. & Zncc. - Japanese yew
  - T. canadensis Marsh - Canada yew

Pinaceae - Pine Family

- Abies - fir
  - A. balsamea (L.) Mill. - balsam fir
- Tsuga - hemlock
  - T. canadensis (L.) Carr.
- Picea - spruce
  - intr. P. abies (L.) Karst. - Norway spruce
  - P. glauca (Moench) Voss - white spruce
  - P. rubens Sarg. - red spruce
  - P. mariana (Mill.) BSP. - black spruce
- Larix - larch
  - L. laricina (Duroi) K.Koch - tamarack
- Pinus - pine
  - subgen. Haploxylon - soft pines
    - intr. P. cembra L. - Swiss stone pine
    - P. strobus L. - white pine
  - subgen. Diploxylon - hard pines
    - P. resinosa Ait. - red pine
    - intr. P. sylvestris L. - Scotch pine
    - intr. P. mugo Turra - mountain pine
    - intr. P. nigra Arnold - Austrian pine
    - P. banksiana Lamb. - jack pine

Cupressaceae - Cypress Family
- Juniperus - juniper
  - J. communis L. var. depressa Pursh * - common juniper
  - intr. J. chinensis L. - Chinese juniper
- Chamaecyparis - cypress
  - intr. C. obtusa Endl. - Hinoki cypress
- Thuja - arbor vitae
  - intr. Thuja occidentalis L. - northern white cedar

ANGIOSPERMS (FLOWERING PLANTS)

Typhaceae - Cat-tail Family
- Typha - cat-tails
  - T. latifolia L.
  - T. angustifolia L.
  - T. glauca Godr.

Aparganiaceae - Bur-reed Family
- Sparganium - bur-reeds
  - S. eurycarpum Englem.
  - S. chlorocarpum Rydb.
  - S. angustifolium Michx.
  - S. fluctuans (Morong) Robins.
  - S. minimum (Hartm.) Fries.

Zosteraceae - Pondweed Family
- Zostera - eel-grasses
  - Z. marina L. var. stenophylla Aschers. & Graebn.
- Potamogeton - pondweeds
  - P. pectinatus L. *
  - P. zosteriformis Fern. *
  - P. pusillus L. (incl. P. berchtoldi Fieber)
  - P. obtusifolius Mert. & Koch
  - P. spirillus Tuckerm.
  - P. epihydrus Raf. var. nuttallii (C. & S.) Fern.
  - P. alpinus Balbis var. tenuifolous (Raf) Ogden *
  - P. amplifolius Tuckerm.
  - P. natans L.
  - P. praelongus Wulfen
  - P. perfoliatus L. var. bupleuroides (Fern.) Farw.
- Ruppia - widgeon grasses
  - R. maritima L. var. obliqua (Schur.) Aschers & Graebn.
- Zanichellia - horned pondweeds
  - Z. palustris L. var. major (Boem.) Koch *

Najadaceae - Naiad Family
- Najas - naiads
  - N. flexilis (Willd.) Rostk. & Schmidt: * N.B.

Juncaginaceae - Arrow-grass Family
- Triglochin - arrow-grasses
  - T. elata Nutt.
- Scheuchzeria
  - S. palustris L. var. americana Fern. * N.B.

Alismataceae - Water-plantain Family
- Alisma - water-plantains
  - A. trivale Pursh
- Sagittaria - arrow-heads
  - S. latifolia Willd. var. latifolia
  - S. cuneata Sheldon

Hydrocharitaceae - Frog's-bit Family
- Elodea
  - E. canadensis Michx. *
- Vallisneria
  - V. americana Michx. * N.B. - water-celery

Gramineae - Grass Family
- Bromus - brome grasses
  - B. ciliatus L. * N.B.
  - intr. B. inermis Leyss.
- Festuca - fescues
  - intr. F. capillata Lam. * N.B. - hair fescue
  - F. rubra L. - red fescue
  - intr. F. elatior L. - meadow fescue
- Puccinellia - alkali grasses
  - P. americana Sorensen
- Glyceria - manna grasses
  - G. borealis (Nash) Batchelder
  - G. melicaria (Michx.) F.T. Hubbard
  - G. canadensis (Michx.) Trin.
    - var. canadensis
    - var. laxa (Scribn.) Hitchc.
  - G. striata (Lam.) Hitchc.
  - G. grandis S. Wats.
  - G. fernaldii (Hitchc.) St. John
- Poa - meadow-grasses
  - intr. P. annua L.
  - intr.? P. pratensis L. - Kentucky bluegrass
  - P. palustris L. - fowl-meadow grass
- Dactylis
  - intr. D. glomerata L. - orchard-grass
- Phragmites
  - P. communis Trin. var. berlandieri (Fourn.) Fern. - reed
- Agropyron
  - intr.? A. repens (L.) Beauv. - couch-grass
  - intr. A. cristatum (L.) Beauv. * N.B.
- Triticum - wheats
  - intr. T. aestivum L. - bread-wheat
- Hordeum - barleys
  - H. jubatum L. - fox-tail barley
  - intr. H. distichon L. - two-rowed barley
- Elymus
  - E. mollis Trin. - dune grass
- Avena - oats
  - intr. A. sativa L. - oat
- Deschampsia
  - D. flexuosa (L.) Trin. - hair-grass

Danthonia
D. spicata (L.) Beauv. - wire-grass
Calamagrostis
C. canadensis (Michx.) Nutt. var. canadensis - blue-joint
C. neglecta (Ehrh.) Gaertn. * N.B.
Ammophila - marram grasses
A. breviligulata Fern.
Agrostis - bents
intr.? A. stolonifera L. (incl. A. alba L. - red-top, and A. palustris Huds. - creeping bent-grass)
intr.? A. tenuis Sibth. - brown-top
A. scabra Willd. - tickle grass
Cinna
C. latifolia (Trev.) Griseb.: * N.S. - wood-reed
Phleum
intr. P. pratense L. - timothy
Alopecurus - fox tails
intr. A. pratensis L. - meadow fox-tail
A. geniculatus L. * N.B. - water fox-tail
Muhlenbergia
M. glomerata (Willd.) Trin. var. cinnoides (Link) F.J. Herm. * N.B.
Brachyelythrum
B. erectum (Schreb.) Beauv. var. glabratum (Vasey) Kiyamak & Kawano * N.B.
Spartina - cord-grasses
S. pectinata Link. - broad-leaf
S. alterniflora Loisel. - cord-grass
S. patens (Ait.) Muhl.
Anthoxanthum
intr. A. odoratum L. - sweet vernal grass
Hierochloe
H. odorata (L.) Beauv. - sweet grass
Leersia
L. oryzoides (L.) Sw. - rice cut-grass
Zizania
Z. aquatica L. var. angustifolia Hitchc. - wild rice
Echinochloa
intr. E. crusgalli (L.) Beauv. - barnyard grass
Zea
intr. Z. mays L. - corn

Cyperaceae - Sedge Family
Dulichium
D. arundinaceum (L.) Britt.
Eleocharis - spike-rushes
? E. parvula (Lightf.) Link ( in area?)
E. acicularis (L.) R. & S.
E. obtusa (Willd.) Schultes
E. palustris (L.) R. & S. S. Lat.

Scirpus - (rushes)
S. cespitosus L. var. callosus Bigel.
S. hudsonianus (Michx.) Fern. * N.B.
S. subterminalis Torr. - swaying rush
S. americanus Pers. * N.B. - three-square

S. validus Vahl - soft-stem bulrush
S. maritimus L. s. lat. - salt-marsh bulrush
S. rubrotinctus Fern.
S. cyperinus (L.) Kunth var. pelius Fern. ) - woolgrass
S. atrocinctus Fern. )

Eriophorum - cotton-grasses
E. chamissonis C. A. Mey
E. spissum Fern.
E. gracile W. D. J. Koch
E. tenellum Nutt.
E. angustifolium Honckeny
E. viridi - carinatum (Engelm) Fern.
E. virginicum L.

Rhynchospora - beak-rushes
R. alba (L.) Vahl.

Carex - sedges
Sect. Chordorrhizae
C. chordorrhiza L. f.
Sect. Paniculatae
C. diandra Schrank
Sect. Vulpinae
C. stipata Muhl.
Sect. Heleonastes
C. disperma Dew.
C. trisperma Dew.
C. canescens L. var. disjuncta Fern.
C. brunnescens (Pers.) Poir. var. sphaerostachya (Tuckerm.) Kukenth.
Sect. Stellulatae
C. interior Bailey
Sect. Ovales
C. scoparia Schkuhr
C. projecta Mackenz.
C. hormathodes Fern.
Sect. Bicolores
C. aurea Nutt.
Sect. Cryptocarpae
C. paleacea Wahlenb.
C. crinita Lam. var. gynandra (Schwein.) Schwein. & Torr.
Sect. Acutae
C. nigra (L.) Reichard
C. lenticularis Michx.
C. torta Boott * N.S.
Sect. Limosae
C. limosa L.
C. paupercula Michx.
Sect. Anomalae
C. scabrata Schwein.
Sect. Hirtae
C. lasiocarpa Ehrh. var. americana Fern.
Sect. Virescentes
C. pallescens L. var. neogaea Fern.
Sect. Sylvaticae
C. arctata Boott.
C. debilis Michx. var. rudgei Bailey

Sect. Extensae
*C. flava* L. var. *fertilis* Peck
*C. viridula* Michx.
Sect. Pseudo-Cypereae
*C. pseudo-cyperus* L.
*C. lurida* Wahlenb.
Sect. Lupulinae
*C. intumescens* Rudge
Sect. Vesicariae
*C. rostrata* Stokes var. *utriculata* (Boott) Bailey

Araceae - Arum Family
*Arisaema*
*A. stewardsonii* Britt. - Jack-in-the-pulpit
*Calla*
*C. palustris* L. - wild calla
*Symplocarpus*
*S. foetidus* (L.) Nutt. * N.S. - skunk cabbage
*Acorus*
*A. calamus* L. - sweet flag

Lemnaceae - Duckweed Family
*Spirodela*
*S. polyrhiza* (L.) Schleid.
*Lemna*
*L. trisulca* L.
*L. minor* L.

Xyridaceae - Yellow-eyed grass Family
*Xyris* - yellow-eyed grasses
*X. montana* Ries * N.B.

Eriocaulaceae - Pipewort Family
*Eriocaulon* - pipeworts
*E. septangulare* With.

Pontederiaceae - Pickerelweed Family
*Pontederia* - pickerelweeds
*P. cordata* L. *

Juncaceae - Rush Family
*Juncus* - bog-rush
*J. bufonius* L. var. *bufonius*
*J. gerardi* Loisel.
*J. tenuis* Willd.
*J. filiformis* L.
*J. effusus* L.
*J. balticus* Willd. var. *littoralis* Engelm.
*J. canadensis* J. Gray var. *canadensis*
*J. brevicaudatus* (Engelm.) Fern.
*J. militaris* Bigel.
*J. articulatus* L.
*J. pelocarpus* Mey.

*Luzula* - wood-rush
*L. multiflora* (Retz.) Lejeune

Liliaceae - Lily Family
- Uvularia - bellworts
  - U. sessilifolia L. * N.S.
- Hemerocallis - day-lilies
  - intr.: H. fulva
- Allium
  - intr.: A. schoenoprasum L. - shives
  - intr.: A. cepa - onion
- Lilium - ("true") lilies
  - intr.: L. bulbiferum L. - orange lily
  - intr.: L. tigrinum L. - tiger lily
- Tulipa - tulip
  - intr.: T. gesneriana L. - garden (Dutch) tulip
- Erythronium
  - E. americanum Ker - trout lily
- Scilla - scillas
  - intr. S. sibirica Andr.
- Ornithogalum
  - intr. O. umbellatum L. - star-of-Bethlehem, nap-at-noon
- Muscari - grape-hyacinths
  - intr. M. botryoides (L.) Mill.
- Asparagus
  - intr. A. officinalis L. - asparagus
- Clintonia
  - C. borealis (Ait.) Raf. - bluebead lily
- Smilacina
  - S. racemosa (L.) Desf. - false spikenard, Solomon's zigzag
  - S. stellata (L.) Desf. * N.B.
  - S. trifolia (L.) Desf.
- Maianthemum
  - M. canadense Desf. - wild lily-of-the-valley
- Streptopus
  - S. amplexifolius (L.) DC. var. americanus Schultes - white mandarin
  - S. roseus Michx. var. perspectus Fassett - rose mandarin
- Polygonatum - Solomon's seals
  - P. pubescens (Willd.) Pursh
- Convallaria - Lilies-of-the-valley
  - intr. C. majalis L.
- Medeola
  - M. virginiana L. - Indian cucumber-root
- Trillium - trilliums
  - T. cernuum L. * N.S. - nodding trillium
  - T. erectum L. * N.B. - stinking Benjamin, purple trillium
  - T. undulatum Willd. - painted trillium

Amaryllidaceae - Amaryllis Family
- Galanthus
  - intr. G. nivalis L. - snowdrop
- Narcissus
  - intr. N. pseudonarcissus L. - daffodil

Iridaceae - Iris Family
- Sisyrinchium - blue-eyed grasses
  - S. montanum Greene var. crebrum Fern.

Iris
intr.: I. germanica L.
intr. I. variegata L.
intr. I. pseudacorus - yellow iris
I. versicolor L. - blue flag
Crocus
intr. C. neapolitanus (Ker-gawl.) Mord.
Gladiolus
intr. G. spp. (mainly including G. cardinalis Curt. and/or G. psittacinus Hook. as parent species)

Orchidaceae - Orchis Family
Cypripedium - lady's-slippers
C. acaule Ait. - mocassin-flower
Habenaria
H. blephariglottis (Willd.) Hook
H. lacera (Michx.) Lodd
H. psycodes (L.) Spreng.
Pogonia
P. ophioglossoides (L.) Ker - snake-mouth
Calopogon
C. pulchellus (Salisb.) R. Br. - grass pink
Arethusa
A. bulbosa L. - dragon's mouth
Spiranthes - ladies' tresses
S. lacera Raf. * N.B.
S. romanzoffiana Cham. * N.B.
Corallorhiza - coral-roots
C. trifida Chatelain var. verna (Nutt.) Fern * N.S.
Malaxis
M. unifolia Michx.

Salicaceae - Willow Family
Salix - willows
intr. S. pentandra L. - bay-leafed willow
intr. S. alba L. - "French willow"
S. lucida Muhl. var. lucida - shiny willow
S. pyrifolia Anderss. - balsam willow
S. bebbiana Sarg. - beaked willow
S. pedicellaris Pursh var. hypoglauca Fern. * N.S. - bog willow
S. discolor Muhl. - pussy-willow
intr. S. purpurea L. * N.B. - purple osier

Populus - poplars
P. tremuloides Michx. - tremling aspen
P. grandidentata Michx. - large-toothed aspen
intr. P. alba L. - silver poplar
intr. P. balsamifera L. - balsam poplar

Myricanceae - Bayberry Family
Myrica
M. gale L. var. subglabra (Chev.) Fern. - sweet gale
M. pensylvanica Loisel. - bayberry
Conptonia
C. peregrina (L.) Coult. - sweet fern

Betulaceae - Birch Family
- Corylus - hazels
  - C. cornuta Marsh - beaked hazel
- Ostrya - hop-bornbeams
  - O. virginiana (Mill.) K. Koch *
- Betula - birches
  - B. lutea Michx. f. - yellow birch
  - B. populifolia Marsh. - gray birch
  - B. papyrifera Marsh. s. lat. - paper birch
  - B. caerulea-grandis Blanch. - blue birch
- Alnus - alders
  - A. crispa (Ait.) Pursh - mountain alder
  - A. rugosa (DuRoi) Spreng. - speckled alder

Fagaceae - Beech Family
- Fagus - beeches
  - F. grandifolia Ehrh.
- Quercus - oaks
  - intr. Q. robur L. * N.B. - English oak
  - Q. borealis Michx. f. var. borealis - red oak

Ulmaceae - Elm Family
- Ulmus - elms
  - U. americana L. - American elm
  - intr. U. glabra Huds. - scotch elm

Moraceae - Mulberry Family
- Humulus - hops
  - intr. H. lupulus L.

Urticaceae - Nettle Family
- Urtica - nettles
  - U. spec. *

Santalaceae - Sandal-wood Family
- Geocaulon
  - G. lividum (Richards) Fern. * N.B.

Polygonaceae - Smartweed Family
- Rumex - sorrels and docks
  - R. orbiculatus Gray )
  - intr. R. crispus L. ) docks
  - R. maritimus L. var. fueginus (Phil) Dusen * N.S.
  - intr. R. acetosella L. - sheep sorrel
  - intr. R. acetosa L. * N.B. - garden sorrel, sourdock
- Rheum
  - intr. R. rhaponticum L. - rhubarb
- Polygonum - knotweeds and smartweeds
  - P. aviculare L.
  - P. natans Eaton * - water smartweed
  - P. pensylvanicum L. var. laevigatum Fern.
  - intr. P. hydropiper L. - water-pepper
  - intr. P. persicaria L. - lady's-thumb
  - P. sagittatum L. - tear-thumb

P. arifolium L. var. pubescens (Keller) Fern. *
P. cilinode Michx. - bindweed
intr. P. convolvulus L. - wild buckwheat
intr. P. cuspidatum Sieb. & Zucc. - Japanese knot-weed
Fagopyrum
intr. F. esculentum Moench. - buckwheat

Chenopodiaceae - Saltwort (Goosefoot) Family
Beta
intr. B. vulgaris L. - mangel, swiss chard
Chenopodium - pigweeds
intr. C. album L. - lamb's-quarters
Spinacia
intr. S. oleracea L. - spinach
Atriplex - orachs
A. patula L. s. lat.
intr. A. sabulosa Rouy * N.B.
Salicornia - glassworts
S. europaea L. - "samphire"
Suaeda - sea-blites
S. maritima (L.) Dumort.
Salsola - saltworts
S. kali L. var. kali * N.B.

Amaranthaceae - Amaranth Family
Amaranthus
intr. A. retroflexus L. - red-root pigweed

Portulacaceae - Purslane Family
Claytonia
C. caroliniana Michx. * N.B. - spring beauty

Caryophyllaceae - Pink Family
Spergularia - sand-spurreys
intr. S. rubra (L.) J. & C. Presl.
S. marina (L.) Griseb.
Spergula - spurreys
intr. S. arvensis L.
Sagina
intr. S. procumbens L. - pearlwort
Arenaria
A. lateriflora L.
A. peploides L. var. robusta Fern. * N.B. - sea purslane
Stellaria
intr. S. media (L.) Cyrillo - common chickweed
intr. S. graminea L. - stichwort
S. calycantha (Ledeb.) Bong. * N.S. - northern starwort
Cerastium
intr.? C. vulgatum L. var. hirsutum Fries - mouse-ear chickweed
intr. C. arvense L. - common chickweed
Lychnis
intr. L. calcedonica - Maltese cross
Silene
intr. S. cucubalus Wibel * N.S. - bladder champion

Saponaria
intr. S. officinalis L. - soapwort
Dianthus - pinks, carnations
intr. D. spp.

Ceratophyllaceae - Hornwort Family
Ceratophyllum - hornworts
C. demersum L.

Nymphaeaceae - Water-Lily Family
Nuphar - pond-lilies
N. microphyllum (Pers.) Fern.
N. rubrodiscum Morong
N. variegatum Englem.
Brasenia
B. schreberi Gmel.* - water-shield

Paeoniaceae - Peony Family
Paeonia - peonies
intr. P. officinalis L.

Ranunculaceae - Buttercup Family
Ranunculus - buttercups or crowfoots
R. trichophyllus Chaix - white water-crowfoot
R. cymbalaria Pursh - seaside crowfoot
R. gmelini DC. var. hookeri (D. Don) Benson - small yellow water-crowfoot
R. abortivus L. var. acrolasius Fern.* N.B. - kidney-leaf buttercup
intr. R. repens L. - creeping buttercup
intr. R. acris L. - common buttercup
Thalictrum - meadow-rues
T. polygamum Fern. - king-of-the-meadow
Clematis
C. virginiana L. - devil's-darning-needle
Coptis
C. trifolia (L.) Salisb. - goldthread
Aquilegia - columbines
intr. A. vulgaris L. - European columbine
Delphinium
intr. D. spec. L. - larkspur
intr. D. elatum L. - "delphinium"
Aconitum - monkshoods
intr. A. napellus L.
intr. A. variegatum L.
Actaea - baneberries
A. rubra (Ait.) Willd. - red baneberry
A. pachypoda Ell. - white baneberry, doll's eyes

Berberidaceae - Barberry Family
Berberis - barberries
intr. B. vulgaris L. - European barberry
intr. B. thunbergii DC. - Japanese barberry

Papaveraceae - Poppy Family
- Papaver - poppies
  - intr. P. orientale - oriental poppy
  - intr. P. nudicaule - Icelandic poppy
  - intr. P. somniferum L. - opium poppy
- Dicentra - bleeding hearts
  - intr. D. spectabilis (L.) Lem.
  - intr. D. spec. (D. eximia and/or D. formosa)
- Fumaria - fumitory, earth-smoke
  - intr. F. occicinalis L.*

Cruciferae - Mustard Family
- Alyssum
  - intr. A. saxatile L. - golden-tuft
- Iberis
  - intr. I. amara L. - candytuft
- Lepidium - pepper-grasses
  - intr. L. densiflorum Schrad.
- Capsella
  - intr. C. bursa-pastoris (L.) Medic - Shepherd's purse
- Cakile
  - C. edentula (Bigel.) Hook. - sea rocket
- Raphanus - radishes
  - intr. R. raphanistrum L. - wild radish
  - intr. R. sativus L. - radish
- Brassica - mustards
  - intr. B. oleracea L. - cabbage
  - intr. B. campestris L. - field mustard
  - intr. B. rapa L. - turnip
  - intr. B. napobrassica Mill. - rutabaga, swede
- Sisymbrium
  - intr. S. officinale (L.) Scop. - hedge-mustard
- Hesperis
  - intr. H. matronalis L. - mother-of-the-evening, dame's violet
- Erysimum
  - intr. E. cheiranthoides L. - wormseed-mustard
- Rorippa
  - R. islandica (Oed.) Borb. - marsh cress
- Nasturtium
  - intr. N. officinale R. Br. - watercress
- Armoracid
  - intr. A. rusticana (Lam.) G.M. & S. - horseradish
- Barbaraea
  - intr. B. vulgaris R. Br. - yellow rochet
- Matthiola
  - intr. M. incana (L.) R.Br. - stock or gilliflower
- Dentaria - toothwort
  - D. diphylla Michx.* N.S.
- Cardamine
  - C. pensylvanica Muhl.

Sarraceniaceae - Pitcher-plant Family
- Sarracenia - pitcher plant
  - S. purpurea L.

Droseraceae - Sundew Family
- Drosera - sundew
  - D. intermedia Hayne * N.B.
  - D. rotundifolia L.

Crassulaceae - Orpine Family
- Sedum
  - intr. S. telephium L. - live-forever

Saxifragaceae - Saxifrage Family
- Astilbe
  - intr. A. japonica (Morren and Dene.) Gray
- Mitella - miterwort
  - M. nuda L.
- Chrysosplenium - golden saxifrage
  - C. americanum Schwein.
- Philadelphus - mock-orange
  - intr. P. coronarius L.
- Hydrangea
  - intr. H. paniculata Sieb.
- Ribes - gooseberries and currants
  - (R. hirtellum Michx.* in area? - wild gooseberry)
  - intr. R. grossularia L. - garden gooseberry
  - R. lacustre (Pers.) Poir. - bristly black currant
  - R. glandulosum Grauer - skunk currant
  - intr. R. sativum Syme - garden red currant
  - intr. R. nigrum L. - garden black currant

Hamamelidaceae - Witch-hazel Family
- Hamamelis - witch-hazel
  - H. virginiana L.*

Rosaceae
- Spiraea
  - S. latifolia (Ait.) Borkh. - meadow-sweet
  - S. tomentosa L. - steeple-bush
  - intr. S. spp.
- Pyrus - pears
  - intr. P. communis L.
- Malus - apples
  - intr. M. silvestris (L.) Mill.
  - intr. M. spp. - crab-apples
- Aronia - chokeberries
  - Aronia prunifolia (Marsh.) Rehd.
- Sorbus - mountain ashes
  - S. americana Marsh
  - intr. S. aucuparia L.
  - intr. S. hybrida L. s. lat.
- Amelanchier - shadbush, wild pear
  - In North America with partially apomictic reproduction, therefore not well-differentiated into distinct species.

Crataegus - hawthorns
The native North American forms with partially apomictic reproduction and therefore not well-differentiated into distinct species. Also an introduced species from Europe.
intr. C. monogyna Jacq. - English hawthorn
Fragaria - strawberries
F. virginiana Duchesne
var. virginiana
var. terrae-novae (Rydb.) Fern.
intr. F. ananassa Duch. - cultivated strawberry
Potentilla - cinquefoil
P. tridentata Ait.
P. palustris (L.) Scop.
intr.? P. norvegica L.
P. simplex Michx. var. calvescens Fern.
P. anserina L. s.lat.
Filipendula
intr. F. ulmaria (L.) Maxim. - queen-of-the-meadow
Geum - avens
G. canadense Jacq. var. camporum (Rydb.) Fern & Weath.* N.S.
G. aleppicum Jacq. var. strictum (Ait.) Fern. * N.S.
G. macrophyllum Willd.
Rubus
R. chamaemorus L. - bakeapple, cloud-berry
R. pubescens Raf. - dewberry
R. idaeus L. - raspberry
intr. var. idaeus - European or garden raspberry
var. strigosus (Michx.) Maxim. - North American raspberry
Subgen. Eubatus - blackberries
With partially apomictic reproduction, therefore not well-differentiated into distinct species.
Dalibarda
D. repens L. * N.B. - robin-run-away
Agrimonia
A. striata Michx. *
Rosa - roses
R. nitida Willd. * N.B.
R. virginiana Mill.
intr. R. spp. - cultivated roses
Prunus - cherries and plums
P. pensylvanica L.f. - bird - or pin-cherry
P. virginiana L. - choke-cherry
intr. P. spp. - cultivated plums and cherries

Leguminosae - Legume Family
Lupinus - lupines
intr. L. polyphyllus Lindl.
Trifolium - clovers
intr. T. arvense L. - rabbit-foot clover
intr. T. pratense L. - red clover
intr. T. repens L. - white clover
intr. T. hybridum L. - Alsihe clover
intr. T. agrarium L.* N.S.) hop-clovers
intr. T. procumbens L. )

Melilotus - sweet-clover
intr. M. officinalis (L.) Lam. - yellow sweet-clover
intr. M. alba Desr. - white sweet-clover
Medicago - medick
intr. M. sativa L. - alfalfa
intr. M. lupulina L. - black medick
Lotus
intr. L. corniculatus L. - birdsfoot-trefoil
Caragana - pea-tree
intr. C. arborescens Lam.
Vicia - vetch
intr. V. angustifolia Reichard
intr. V. sepium L.
intr. V. faba L. - broad bean
intr. V. tetrasperma (L.) Moench.
intr. V. cracca L. - tufted vetch
Lathyrus - pea
L. japonicus Willd. var. glaber (Ser.) Fern. - beach pea
L. palustris L. var. pilosus (Cham.) Leleb. - swamp pea
intr. L. odoratus L. - sweet pea
Pisum - pea
intr. P. sativum L. - garden pea
Phaseolus - bean
intr. P. vulgaris L. - kidney bean
intr. P. coccineus L. - scarlet runner bean

Linaceae - Flax Family
intr. L. usitatissimum - flax

Tropaeolaceae
Tropaeolum
intr. T. majus L. - garden "nasturtium"

Oxalidaceae - Wood-sorrel Family
Oxalis
O. montana Raf. - wood sorrel
intr. O. strica L.

Geraniaceae - Geranium Family
Geranium
intr. G. pratense L. *

Euphorbiaceae - Spurge Family
Euphorbia - spurges
intr. E. cyparissias L. * - cypress spurge
E. polygonifolia L. (in area?) *

Callitrichaceae - Water-starwort Family
Callitriche - water-starworts
C. verna L.

Anacardiaceae - Cashew Family
Cotinus - smoke tree
intr. C. coggygria Scop.

Rhus - sumac
R. typhina L. N.B. * - staghorn sumac
R. radicans L. var. rydbergii (Small) Rehd. N.B.* - poison ivy

Aquifoliaceae - Holly Family
Ilex - hollies
I. verticillata (L.) Gray - black alder, winterberry
Nemopanthus
N. mucronata (L.) Trel. - mountain holly

Aceraceae - Maple Family
Acer - maples
A. spicatum Lam. - mountain maple
A. pensylvanicum L. - striped maple
intr. A. platanoides L. - Norway maple
A. saccharum Marsh. - sugar maple
A. rubrum L. - red maple
intr. A. saccharinum L. - silver maple
intr. A. negundo L. - box elder

Hippocastanaceae - Buckeye Family
Aesculus
intr. A. hippocastaneum L. - horse-chestnut

Balsaminaceae - Touch-me-not Family
Impatiens
I. capensis Meerb. - jewelweed

Rhamnaceae - Buckthorn Family
Rhamnus - buckthorns
R. alnifolia L'Her N.B.*
intr. R. frangula L. N.S.*

Vitaceae - Vine Family
Parthenocissus
intr. P. quinquefolia (L.) Planch. ) Virginia creeper
intr. P. inserta (Kerner) K. Fritsch)
intr. P. tricuspidata (Sieb. & Zucc.) Planch. - Boston ivy

Tiliaceae - Linden Family
Tilia - linden, basswoods
intr. Tilia spec.

Malvaceae - Mallow Family
Malva
intr. M. moschata L. - musk-mallow

Hypericaceae - St. John's-wort Family
Hypericum - St. John's wort
intr. H. perforatum L.
H. ellipticum Hook.
H. boreale (Britt.) Bickn.
H. canadense L.
H. virginicum L. var. fraseri (Spach) Fern.

Violaceae - Violet Family
- Viola - violets
  - V. cucullata Ait.
  - V. septentrionalis Greene
  - V. pallens (Banks.) Brainerd.
  - V. incognita Brainerd.
  - V. conspersa Reichenb.*
  - intr. V. tricolor L. - pansy, Johnny-jump-up

Thymelaeaceae - Mezereum Family
- Daphne
  - intr. D. mezereum L. - mezereum

Eleagnaceae - Oleaster Family
- Shepherdia
  - S. canadensis (L.) Nutt. * N.S. - soapberry

Lythraceae - Loosestrife Family
- Lythrum
  - intr. L. salicaria L. - purple loosestrife

Onagraceae - Evening-primrose Family
- Epilobium - willow-herbs
  - E. angustifolium L. - fireweed
  - E. palustre L. s.lat.
  - E. adenocaulon Haussk.
- Oenothera
  - O. parviflora L. - evening primrose
  - O. perennis L. * N.B. - sundrops
- Circaea - enchanter's nightshade
  - C. alpina L.

Haloragaceae - Water-milfoil Family
- Myriophyllum - water-milfoils
  - M. alterniflorum DC.
  - M. exalbescens Fern.
  - M. verticillatum L. var pectinatum Wallr.

Hippuridaceae - Mare's-tail Family
- Hippuris - mare's tail
  - H. vulgaris L.

Araliaceae - Ginseng Family
- Aralia
  - A. racemosa L.* N.S. - spikenard
  - A. hispida Vent. - bristly sarsaparilla
  - A. nudicaulis L. - wild sarsaparilla

Umbelliferae - Parsley Family
- Hydrocotyle - water-pennyworts
  - H. americana L.* N.B.
- Osmorhiza - sweet cicely
  - O. claytoni (Michx.) Clarke * N.S.
- Petroselinum
  - intr. P. crispum (Mill.) Mansf. - parsley

Cicuta - water-hemlock
C. bulbifera L.
C. maculata L. - spotted cowbane
Carum
intr. C. carvi L. - caraway
Sium
S. suave Walt. - water-parsnip
Ligusticum
L. scothicum L. - Scotch lovage
Coelopleurum
C. lucidum (L.) Fern.
Pastinaca
intr. P. sativa - parsnip
Daucus
intr. D. carota L. - queen Anne's-lace, carrot

Cornaceae - Dogwood Family
Cornus - dogwoods
C. canadensis L. - bunchberry
C. stolonifera Michx. - red osier
C. rugosa Lam.* N.S. - round-leaved dogwood
C. alterifolia L. f. - pagoda dogwood

Pyrolaceae - Wintergreen Family
Chimaphila - wintergreen, pipissewa
C. umbellata (L.) Bartr. var cisatlantica Blake
Moneses - wintergreen
M. uniflora (L.) Gray
Pyrola - wintergreen
P. secunda L.
P. elliptica Nutt.
P. rotundifolia L.
Monotropa
M. uniflora L. - Indian pipe

Ericaceae - Heath Family
Ledum
L. groenlandicum Oeder - Labrador tea
Rhododendron
R. canadense (L.) Torr. - rhodora
intr. R. spp. - cult. azaleas
Kalmia
K. angustifolia L. - sheep-laurel
K. polifolia Wang. - bog-laurel
Andromeda
A. glaucophylla Link - bog-rosemary
Chamaedaphne
C. calyculata (L.) Moench var. angustifolia (Ait.) Rehd. - leather-leaf
Epigaea
E. repens L. var. glabrifolia Fern. - mayflower, trailing arbutus
Gaultheria
G. procumbens L. - teaberry
G. hispidula (L.) Muhl. - creeping snowberry
Gaylussacia - huckleberries
G. dumosa (Andr.) T. & G. var. bigeloviana Fern.
G. baccata (Wang.) K. Koch

Vaccinium
V. myrtilloides Michx. )
V. angustifolium Ait. ) - low-bush blueberries
V. vitis idaea L. var. minus Lodd. - foxberry, mountain cranberry
V. oxycoccos L. - small cranberry
V. macrocarpon Ait. - large cranberry

Empetraceae - Crowberry Family
Empetrum - crowberries
E. nigrum L.

Primulaceae - Primrose Family
Primula
intr. P. veris L. and hybrids - cowslip
Lysimachia - loosestrife
intr. L. punctata L.
L. terrestris (L.) BSP.
intr. L. nummularia L. - moneywort
L. thyrsiflora L.
Trientalis
T. borealis Raf. - star-flower
Glaux
G. maritima L. var. obtusifolia Fern. - sea-milkwort

Plumbaginaceae - Leadwort Family
Limonium
L. nashii Small - sea-lavender

Oleaceae - Olive Family
Fraxinus - ash
F. americana L. - white ash
F. nigra Marsh. - black ash
Syringa - lilac
intr. S. vulgaris L.
Forsythia
intr. F. spp.

Gentianaceae - Gentian Family
Menyanthes
M. trifoliata L. var minor Raf. - buckbean

Apocynaceae - Dogbane Family
Vinca - periwinkle
intr. V. minor L.
Apocynum - dogbane, Indian hemp
A. androsaemifolium L.

Convolvulaceae - Bindweed Family
Convolvulus
C. sepium L. - bindweed, wild morning-glory

Polemoniaceae - Phlox Family
Phlox
intr. P. subulata L. - ground pink, moss-pink
intr. P. paniculata L. - garden phlox
intr. P. drummondii Hook. - annual phlox

Boraginaceae - Borage Family
- Lycopsis
  - intr. L. arvensis L. - small bugloss
- Myosotis - forget-me-not
  - M. laxa Lehm. - small forget-me-not
  - intr. M. sylvatica Hoffm. - garden forget-me-not
- Pulmonaria
  - intr. P. officinalis - spotted-dog

Verbenaceae - Vervain Family
- Verbena - vervain
  - intr. V. hortensis

Labiatae - Mint Family
- Scutellaria - skullcap
  - S. lateriflora L.
  - S. galericulata L.
- Glechoma
  - intr. G. hederacea L. - ground-ivy
- Prunella
  - P. vulgaris L. var. lanceolata (Bart.) Fern. - heal-all, self-heal
- Leonurus
  - intr. L. cardiaca L. - motherwort
- Galeopsis
  - intr. G. tetralhit L. var. bifida (Boenn.) Lej. & Court.- hemp-nett
- Lamium - dead-nettle
  - intr. L. spec.
- Stachys
  - intr. S. palustris L. - woundwort
- Salvia - sage
  - intr. S. splendens
- Monarda
  - intr. M. didyma L. - oswego-tea, bee-balm
- Satureja
  - intr. S. hortensis L. - summer-savory
- Thymus - thyme
  - intr. T. serpyllum L.
- Lycopus - water-horehound
  - L. uniflorus Michx.
  - L. americanus Muhl.
- Mentha - mint
  - M. arvensis L.

Solanaceae - Nightshade Family
- Physalis - ground-cherry
  - intr. P. alkekengi L. - Chinese-lantern-plant
- Capsicum
  - intr. C. annum L. - peppers
- Solanum
  - intr. S. dulcamara L. - bittersweet nightshade
  - intr. S. tuberosum L. - potato
  - intr. S. lycopersicum L. - tomato
- Nicotiana - tobacco
  - intr. N. spp.
- Petunia
  - intr. P. atkinsiana D. Don

Scrophulariaceae - Figwort Family
- Verbascum - mullein
  - intr. V. thapsus L.* N.S.
- Nemesia
  - intr. N. strumosa
- Antirrhinum
  - intr. A. majus L. - snapdragon
- Linaria
  - intr. L. vulgaris Mill. - butter-and-eggs, toadflax
- Chelone
  - C. glabra L. var. dilatata Fern. & Wieg. - turtlehead
- Mimulus
  - M. ringens L. - monkey-flower
- Lindneria
  - L. dubia (L.) Pennell * N.B. - false pimpernel
- Veronica - speedwell
  - intr. V. longifolia L. - garden-speedwell
  - intr. V. serpyllifolia L. - thyme-leaved speedwell
  - intr. V. officinalis L. - common speedwell
  - intr. V. chamaedrys L. * N.B. - bird's eye
  - V. scutellata L. - marsh-speedwell
  - V. americana (Raf.) Schwein. - brooklime
- Melampyrum - cow-wheat
  - M. lineare Desr. var. americanum (Michx.) Beauverd
- Euphrasia - eyebright
  - intr.? E. americana Wettst.
- Odontites
  - intr. O. serotina (Lam.) Dum. * N.B. - red eyebright
- Rhinanthus - yellow rattle
  - intr.? R. crista-galli L. (=R. minor L.)

Orobanchaceae - Broom-rape Family
- Epifagus
  - E. virginiana (L.) Bart. * N.S. - beech-drops

Lentibulariaceae - Bladderwort Family
- Utricularia - bladderwort
  - U. geminiscapa Benj.
  - U. vulgaris L.
  - U. intermedia Hayne
  - U. cornuta Michx.

Plantaginaceae - Plantain Family
- Plantago - plantain
  - intr. P. major L. - broad-leaved plantain, white-man's foot
  - P. maritima L. - sea-side plantain, "goose tongue"

Rubiaceae - Madder Family
- Galium - bedstraw
  - G. triflorum Michx. * N.S. - sweet-scented bedstraw
  - intr. G. mollugo L. * N.B. - cleavers
  - G. palustre L.
  - G. trifidum L.
  - G. asprellum Michx. - rough bedstraw

Mitchella
M. repens L. - patridge berry
Houstonia
H. caerulea L. * N.S. - bluets

Caprifoliaceae - Honeysuckle Family
Sambucus - elder
S. canadensis L. * N.S. - black elder
S. pubens Michx. - red elder
Viburnum
V. alnifolium Marsh - hobblebush
V. cassinoides L. - witherod, wild-raisin
V. trilobum Marsh. * N.B. - highbush-cranberry, pimbina
intr. V. opulus L. - guelder-rose
Symphoricarpos
intr. S. albus (L.) Blake - snowberry
Linnaea
L. borealis L. var. americana (Forbes) Rehd. - twinflower
Kolkwitzia
intr. K. amabilis Graebn. - beauty-bush
Diervilla
D. lonicera Mill. - bush-honeysuckle
Weigelia
intr. W. florida (Bunge) DC.
Lonicera - honeysuckle
intr. L. tatarica L.
L. villosa (Michx.) R. & S. *
L. canadensis Bartr.

Valerianaceae - Valerian Family
Valeriana - valerian
intr. V. officinalis L.

Cucurbitaceae - Gourd Family
Cucumis
intr. C. sativus L. - cucumber
Cucurbita
intr. C. maxima L. )
intr. C. moschata ) squash and pumpkin
intr. C. pepo L. )
Echinocystis
intr. E. lobata (Michx.) T. & G. - wild or prickly cucumber

Campanulaceae - Bluebell Family
Campanula - bluebells
intr. C. medium L. - Canterbury bell
intr. C. glomerata L.
intr. C. rapunculoides L.
intr. C. persicifolia L.
C. aparinoides Pursh * N.B.
Lobelia
L. inflata L. * N.B. - Indian tobacco
intr. L. erinus L.

Compositae - Composite Family

Eupatorium
- E. maculatum L. - joe-pye-weed
- E. perfoliatum L. - boneset

Ageratum
- intr. A. mexicanicum Sims

Solidago - goldenrod
- S. flexicaulis L.*
- S. bicolor L.* N.S.
- S. puberula Nutt.
- S. sempervirens L.
- S. uliginosa Nutt.
- S. rugosa Ait.
- S. canadensis L.
- S. graminifolia (L.) Salisb.

Aster - aster
- A. macrophyllus L.
- A. cordifolius L.
- A. undulatus L.* N.B.
- A. puniceus L.
- A. radula Ait.* N.B.
- A. lateriflorus (L.) Britt.
- A. novi-belgii L.
- A. nemoralis Ait.
- A. acuminatus Michx.
- A. umbellatus Mill.

Erigeron - fleabane
- E. annuus (L.) Pers.* N.S.
- E. strigosus Muhl.

Antennaria
- A. neglecta Greene s.lat. * N.S. - pussy's-toes, everlasting

Anaphalis
- A. margaritacea (L.) C.B. Clarke - pearly everlasting

Gnaphalium - cudweed
- intr.? G. uliginosum L.
- intr.? G. sylvaticum L. * N.S.

Ambrosia - ragweed
- A. artemisiifolia L.*

Xanthium - cocklebur
- X. strumarium L. s.lat.*

Zinnia
- intr. Z. elegans Jacq.

Rudbeckia
- intr. R. serotina Nutt.* N.B. - black-eyed susan

Helianthus
- intr. H. annus L. - sunflower

Bidens - beggar-ticks, bur-marigold
- B. cernua L.
- B. frondosa L.

Megalodontia
- M. beckii (Torr.) Greene - water-marigold

Cosmos
- intr. C. bipinnatus Cav.

Dahlia

intr. D. pinnata Cav. )
intr. D. coccinea Cav.) and hybrids

Tagetes
intr. T. erectus L. - marigold

Achillea - yarrow
intr. A. ptarmica L. - sneezeweed
A. lanulosa Nutt. )
intr. A. millefolium L.) - common yarrow, milfoil

Matricaria - wild chamomile
intr. M. maritima L.
intr. M. matricarioides (Less) Porter - pineapple-weed

Chrysanthemum
intr. C. indicum L. - "chrysanthemum"
intr. C. leucanthemum L. - ox-eye daisy
intr. C. parthenium (L.) Bernh. - fever-few
intr. C. vulgare (L.) Bernh. (= Tanacetum vulgare L.) - tansy

Cotula
intr. C. coronopifolia L. * N.B.

Artemisia - wormwood
intr. A. vulgaris L.

Tussilago
intr. T. farfara L. (in area?)* - colts foot

Petasites - sweet coltsfoot
P. palmatus (Ait) Gray

Doronicum - leopard's bane
intr. D. spec.

Senecio - groundsel
intr. S. vulgaris L.
intr. S. jacobaea L. (in area?) * - ragwort, stinking-willie

Arctium - burdock
intr. A. minus (Hill.) Bernh.

Cirsium - thistle
intr. C. vulgare (Savi) Tenore - bull thistle
intr. C. arvense (L.) Scop. - Canada thistle

Centaurea - knapweed
intr. C. cyanus L. - bachelor's button, cornflower
intr. C. nigra L. * N.B.

Lapsana
intr. L. communis L. - nipplewort

Cichorium
intr. C. intybus L. - chicory, blue sailors

Leonfodon
intr. L. autumnalis L. - fall-dandelion
var. autumnalis (L.)
var. pratensis (Link) Koch

Tragopogon
intr. T. pratensis L. - goats-beard

Taraxacum
intr. T. officinale Weber - dandelion

Sonchus - sow-thistle
intr. S. arvensis L.
intr. S. oleraceus L.
intr. S. asper (L.) Hill.

Lactuca - lettuce
L. biennis (Moench) Fern. - blue wild lettuce
intr. L. sativa L. - garden lettuce

Prenanthes
P. trifoliata (Cass.) Fern. - lion's-paw
P. altissima

Hieracium - hawkweeds
intr. H. pilosella - mouse-ear hawkweed
intr. H. aurantiacum L. - orange hawkweed, devil's paintbrush
intr. H. caespitosum Dumort
intr. H. floribundum Wimm. & Grab. - king-devil
intr. H. lachenalii C.C. Gmel.
intr. H. scabrum Michx.

## Appendix 4 Checklist of Birds, Missaquash/East Amherst Wildlife Management Area



Birds of the Nova Scotia-New Brunswick Border Region. Species compiled from Boyer, G.F. (first addition 1966, addendum 1971 and 1981). Breeding information and latin nomenclature from Erskine and Tufts.

**S-spring Su-summer F-fall W-winter**
**B-confirmed breeder b-suspected breeder**
**PR-permanent resident R-rare (at least 1 record) E-exotic**

| | | |
|---|---|---|
| **Loons** | | |
| Common | Gavia immer | S,Su,F,B |
| Red-throated | Gavia stellata (R) | F |
| **Grebes** | | |
| Horned | Podiceps auritus (R) | F |
| Pied-billed | Podilymbus podiceps | S,Su,F.B |
| Red-necked | Podiceps grisegena (R) | F |
| **Cormorants** | | |
| Double-crested | Phalacrocorax auritus | S,Su,F |
| **Herons** | | |
| Great blue | Ardea herodias | S,Su,F |
| Black-crowned night | Nycticorax nycticorax (R) | F |
| Little blue | Egretta caerulea (R) | Su |
| Green backed | Butorides striatus (R) | S |
| **Bitterns** | | |
| American | Botaurus lentiginosus | S,Su,F,B |
| Least | Ixobrychus exilis (R) | Su |
| **Egrets** | | |
| Great | Casmerodius albus (R) | S |
| Snowy | Egretta thula (R) | S,Su |
| White Ibis | Endocimus albus (R) | S |
| Cattle | Bubulcus ibis (R) | |
| Glossy Ibis | Plegadis falcinellus (R) | S,Su |

| | | |
|---|---|---|
| **Geese** | | |
| Canada | Branta canadensis | S,Su,F,B |
| Brant | Branta bernicla | S |
| Snow | Chen caerulescens (R) | S |
| **Ducks** | | |
| Mallard | Anas platyrhynchos | S,Su,F,B |
| Black | Anas rubripes | S,Su,F,B |
| Gadwall | Anas strepera | S,Su,F,b |
| Northern Pintail | Anas acuta | S,Su,F,B |
| Green-wing Teal | Anas crecca carolinenss | S,Su,F,B |
| Eurasian Green-wing Teal | Anas crecca crecca (R) | S |
| Blue-wing Teal | Anas discors | S,Su,F,B |
| American Wigeon | Anas americana | S,Su,F,B |
| Eurasian Wigeon | Anas penelope (R) | S,Su |
| Northern Shoveler | Anas clypeata | S,Su,F,B |
| Wood | Aix sponsa | S,Su,F.B |
| Ring-necked | Aythya collaris | S,Su,F,B |
| Greater Scaup | Aythya marila | S,F |
| Lesser Scaup | Aythya affinis (R) | S |
| Common Goldeneye | Bucephala clangula | S,F,W |
| Barrow's Goldeneye | Bucephala islandica (R) | Su |
| Redhead | Aythya americana (R) | Su |
| Canvasback | Aythya valisineria (R) | F |
| Bufflehead | Bucephala albeola | S,F |
| Oldsquaw | Clangula hyemalis | S,F |
| White-winged Scoter | Melanitta fusca | S |
| Surf Scoter | Melanitta perspicillata | S |
| Black Scoter | Melanitta nigra | S,F |
| Ruddy | Oxyura jamaicensis | F |
| Hooded Merganser | Lophodytes cucullatus | S,Su,F,b |
| Common Merganser | Mergus merganser | S,F,W |
| Red-breasted Merganser | Mergus serrator | S,F |

| | | |
|---|---|---|
| **Hawks and Falcons** | | |
| Osprey | Pandion haliaetus | S,Su,F,B |
| Bald Eagle | Haliaeetus leucocephalus | S,W |
| Northern Harrier | Circus cyaneus | S,Su,F,B |
| Gyrfalcon | Falco rusticolus (R) | F,W |
| Northern Goshawk | Accipiter gentilis | S,Su,F,W |
| Sharp-shinned | Accipiter striatus | S,Su,F,W,B |
| Red-tailed | Buteo jamaicensis | S,Su,F,W,b |
| Broad-winged | Buteo platypterus | S,Su,F,b |
| Rough-legged | Buteo lagopus | W |
| Coopers | Accipiter cooperii (R) | F |
| Merlin | Falco columbarius | S,Su,F,b |
| American Kestrel | Falco sparverius | S,Su,F,B |
| Peregrine | Falco peregrinus (R) | S,W |
| **Grouse** | | |
| Spruce | Dendragapus canadensis | PR |
| Ruffed | Bonasa umbellus | PR |
| Ring-necked Pheasant | Phasianus colchicus | PR |
| Gray Partridge | Perdix perdix | PR |
| **Rails** | | |
| Virginia | Rallus limicola | S,Su,F,B |
| Sora | Porzana carolina | S,Su,F,B |
| Yellow | Coturnicops noveboracenis | Su |
| American Coot | Fulica americana | S,Su,F,B |
| Purple Gallinule | Porphyrula martinica (R) | F |
| Common Moorhen | Gallinula chloropus (R) | S,B |
| **Plovers, Sandpipers, Woodcock, Snipe.** | | |
| Semipalmated Sandpiper | Calidris pusilla | Su,F |
| Killdeer | Charadrius vociferus | S,Su,F,B |
| Lesser Golden Plover | Pluvialis dominica | Su,F |
| Black bellied Plover | Pluvialis squatarola | Su,F |
| Semipalmated Plover | Charadrius semipalmatus | Su,F |
| Whimbrel | Numenius phaeopus | Su,F |
| Willet | Catoptrophorus semipalmatus | S,Su,F |
| Spotted | Actitis macularia | S,Su,F,B |

| | | |
|---|---|---|
| Solitary | Tringa solitaria (R) | Su,F |
| Greater Yellowlegs | Tringa melancoleuca | S,Su,F |
| Lesser Yellowlegs | Tringa flavipes | Su,F |
| Pectoral Sandpiper | Calidris melanotos | Su,F |
| White -rumped Sandpiper | Calidris fuscicollis (R) | F |
| Least Sandpiper | Calidris minutilla | S,Su,F |
| Dunlin | Calidris alpina | F |
| Short-billed Dowitcher | Limnodromus griseus | Su,F |
| Long-billed Dowitcher | Limnodromus scolopaceus (R) | F |
| Hudsonian Godwit | Limosa haemastica (R) | Su,F |
| Purple Sandpiper | Calidris maritima (R) | Su |
| Western Sandpiper | Calidris mauri (R) | Su |
| Red Knot | Calidris canutus (R) | F |
| Ruddy Turnstone | Arenaria interpres (R) | |
| Sanderling | Calidris alba (R) | |
| Stilt Sandpiper | Calidris himantopus (R) | F |
| Buff-breasted Sandpiper | Tryngites subruficollis (R) | F |
| Ruff | Philomachus pugnax (R) | S |
| Red Phalarope | Phalaropus fulicaria (R) | F |
| Wilson's Phalarope | Phalaropus tricolor (R) | S,F, b |
| Red-necked Phalarope | Phalaropus lobatus (R) | F |
| American Woodcock | Scolopax minor | S,Su,F, B |
| Common Snipe | Gallinago gallinago | S,Su,F,B |
| American Avocet | Recurvirostra americana (R) | F |

**Gulls**

| | | |
|---|---|---|
| Great Black-backed | Larus marinus | PR |
| Herring | Larus argentatus | PR |
| Ring-billed | Larus delawarensis | F |
| Bonaparte's | Larus philadelphia (R) | S,Su |
| Glaucous | Larus hyperboreus (R) | W |
| Iceland | Larus glaucoides (R) | W |

**Terns**

| | | |
|---|---|---|
| Caspian | Sterna caspia (R) | S |
| Black | Chlidonias niger | S,Su,F,B |
| Common | Sterna hirundo | S.Su,F |

| | | |
|---|---|---|
| **Murres, Dovekie, Puffin** | | |
| Dovekie | Alle alle (R) | F |
| Thick-billed Murre | Uria lomvia (R) | W |
| Atlantic Puffin | Fratercula arctica (R) | F |
| **Doves** | | |
| Rock | Columba livia | PR |
| Mourning | Zenaida macroura | S,Su,F,W,b |
| **Cuckoos** | | |
| Black-billed | Coccyzus erythropthalmus | Su |
| **Owls** | | |
| Great Horned | Bubo virginianus | PR |
| Short-eared | Asio flammeus | S,Su,F |
| Snowy | Nyctea scandiaca | W |
| Barred | Strix varia | PR |
| Burrowing | Athene cunicular (R) | S |
| Boreal | Aegolius funereus (R) | W |
| Common Barn | Tyto alba (R) | S |
| Long-eared | Asio otus (R) | S,Su,F,b |
| Northern Saw-whet | Aegolius acadicus | S,Su,F |
| **Goat Suckers** | | |
| Whip-poor-will | Caprimulgus vociferus (R) | S |
| Common Nighthawk | Chordeiles minor | S,SU,F,b |
| **Swifts** | | |
| Chimney | Chaetura pelagica | S,Su b |
| Hummingbird, Ruby- throated | Archilochus colubris | S,Su B |
| **Kingfisher** | | |
| Belted | Cervle alcyon | S,Su,F,B |

| | | |
|---|---|---|
| **Woodpeckers** | | |
| Northern Flicker | Colaptes auratus | S,Su,F,b |
| Hairy | Picoides villosus | PR |
| Downy | Picoides pubescens | PR |
| Black-backed | Picoides arcticus (R) | S,Su,F,W |
| Three-toed | Picoides tridactylus (R) | W |
| Pileated | Dryocopus pileatus | PR |
| Yellow-bellied Sapsucker | Sphyrapicus varius | S,Su,F,b |
| Red-headed | Melanerpes erythrocephalus (R) | W |
| **Flycatchers** | | |
| Olive- sided | Contopus borealis | S,Su |
| Eastern Wood-Pewee | Contopus virens | S,Su |
| Alder | Empidonax alnorum | S,Su |
| Eastern Kingbird | Tyrannus tyrannus | S,Su,B |
| Western Kingbird | Tyrannus verticalis (R) | F |
| Yellow-bellied | Empidonax flaviventris | S |
| Willow | Empidonax traillii | S |
| Least | Empidonax minimus | S,Su |
| Eastern Phoebe | Sayornis phoebe | S |
| Great Crested | Myiarchus crinitus (R) | S |
| **Larks** | | |
| Horned | Eremophila alpestris | PR |
| **Swallows** | | |
| Purple Martin | Progne subis | S,Su,B |
| Tree | Tachycineta bicolor | S,Su,B |
| Bank | Riparia riparia | S,Su,B |
| Cliff | Hirundo pyrrhonota | S,Su,B |
| Barn | Hirundo rustica | S,Su,B |
| **Jays, Ravens, Crows** | | |
| Gray Jay | Perisoreus canadensis | PR |
| Blue Jay | Cyanocitta cristata | PR |
| American Crow | Corvus brachyrhynchos | PR |
| Common Raven | Corvus corax | PR |

| | | |
|---|---|---|
| **Chickadeees** | | |
| Black-capped | Parus atricapillus | PR |
| Boreal | Parus hudsonicus | PR |
| **Nuthatches** | | |
| Red-breasted | Sitta canadensis | PR |
| White-breasted | Sitta carolinensis | S,F,W |
| **Creepers** | | |
| Brown | Certhia americana | PR |
| **Wrens** | | |
| Winter | Troglodytes troglodytes | S,Su,F |
| Marsh | Cistothorus palustris | S,Su |
| House | Troglodytes aedon (R) | Su |
| Sedge | Cistothorus platensis | Su |
| **Kinglets, Thrushes, and Gnatcatchers** | | |
| Golden-crowned | Regulus satrapa | PR |
| Ruby-crowned | Regulus calendula | S,Su,F,b |
| American Robin | Turdus migratorius | PR |
| Hermit | Catharus guttatus | S,Su,F,b |
| Gray-cheeked | Catharus minimus | S,Su |
| Swainson's | Catharus ustulatus | S,Su,F,b |
| Bichnells | Hylocichla minima (R) | |
| Eastern Bluebird | Sialia sialis (R) | S |
| Blue-gray Gnatcatcher | Polioptila caerulea (R) | S |
| Veery | Catharus fuscescens | S,Su |
| Brown Thrasher | Toxostoma rufum (R) | S |
| **Pipits** | | |
| Water | Anthus spinoletta (R) | F |
| **Mockingbirds** | | |
| Northern | Mimus polyglottus (R) | W |
| Gray Catbird | Dumetella carolinensis | S,Su,b |

| | | |
|---|---|---|
| **Waxwings** | | |
| Bohemian | Bombycilla garrulus (R) | W |
| Cedar | Bombycilla cedrorum | S,Su,F,W,B |
| **Shrikes** | | |
| Northern | Lanius excubitor | S,F,W |
| Loggerhead | Lanius ludovicianus (R) | S |
| **Starling** | | |
| European | Sturnus vulgaris | PR |
| **Vireos** | | |
| Solitary | Vireo solitarius | S,Su |
| Red-eyed | Vireo olivaceus | S,Su,F,b |
| Warbling | Vireo gilvus (R) | S |
| Philadelphia | Vireo philadelphicus (R) | S |
| **Warblers** | | |
| Black-and-White | Mniotilta varia | S,Su,b |
| Tennessee | Vermivora peregrina | S,Su,b |
| Nashville | Vermivora ruficapilla | S,Su,b |
| Northern Parula | Parula americana | S,Su,b |
| Yellow | Dendroica petechia | S,Su,B |
| Magnolia | Dendroica magnolia | S,Su,B |
| Cape May | Dendroica tigrina | S,Su,b |
| Black-throated Blue | Dendroica caerulescens | S,Su |
| Yellow-rumped | Dendroica coronata | S,Su,b |
| Black-throated Green | Dendroica virens | S,Su,b |
| Blackburnian | Dendroica fusca | S,Su,b |
| Chestnut-sided | Dendroica pensylvanica | S,Su,b |
| Bay-breasted | Dendroica castanea | S,Su |
| Blackpoll | Dendroica striata | S |
| Palm | Dendroica palmarum | S,Su,F |
| Ovenbird | Seiurus aurocapillus | S,Su,B |
| Northern Waterthrush | Seiurus noveboracensis | S,Su |
| Common Yellowthroat | Geothlypis trichas | S,Su,F,B |
| Wilson's | Wilsonia pusilla | S,Su |

| | | |
|---|---|---|
| Canada | Wilsonia canadensis | S,Su |
| American Redstart | Setophaga ruticilla | S,Su.B |
| Pine | Dendroica pinus (R) | F |
| Mourning | Oporornis philadelphia (R) | Su |
| Yellow-breasted Chat | Icteria virens (R) | |

**Weaver Finches**

| | | |
|---|---|---|
| House Sparrow | Passer domesticus | PR |

**Meadowlarks, Blackbirds, Orioles**

| | | |
|---|---|---|
| Bobolink | Dolichonyx oryzivorus | S,Su.B |
| Eastern Meadowlark | Sturnella magna (R) | F |
| Red-winged Blackbird | Agelaius phoenicens | S,Su.F,B |
| Northern Oriole | Icterus galbula (R) | F |
| Rusty Blackbird | Euphagus carolinus | S,Su.F |
| Common Grackle | Quiscalus quiscula | PR |
| Brown-headed Cowbird | Molothrus ater | PR |
| Orchard Oriole | Icterus spurius (R) | |

**Grosbeaks, Finches, Sparrows, Buntings.**

| | | |
|---|---|---|
| Rose-breasted Grosbeak | Pheucticus ludovicianus | S,Su.B |
| Evening | Coccothraustres vespertinus | PR |
| Pine | Pinicola anucleator | F,W |
| Purple Finch | Carpodacus purpureus | PR |
| Common Redpoll | Carduelis flammea | S,F,W |
| Pine Siskin | Carduelis pinus | PR |
| American Goldfinch | Carduelis tristis | PR |
| White winged Crossbill | Loxia leucoptera | PR |
| Northern Cardinal | Cardinalis cardinalis (R) | W |
| Indigo Bunting | Passerina cyanea (R) | S |
| Dickcissel | Spiza americana (R) | W |
| Savannah Sparrow | Passerculus sandwichensis | S,Su.F,B |
| Sharp-tailed sparrow | Ammodramus candacutus | S,Su,F,b |
| Vesper | Pooecetes gramineus | S,Su,F |
| Dark-eyed Junco | Junco hyemalis | PR |
| American Tree Sparrow | Spizella arborea | S,F,W |
| Chipping | Spizella passerina | S,Su.F,B |
| White-throat | Zonotrichia albicollis | S,Su,F,B |
| Fox | Passerella iliaca | S,F |

| | | |
|---|---|---|
| Swamp | Melospiza georgiana | S,Su.F,B |
| Lapland Longspur | Calcarius lapponicus | S,F,W |
| Snow Bunting | Plectrophenax nivalis | S,F,W |
| Song Sparrow | Melospiza melodia | S,Su,F,B |
| Grasshopper Sparrow | Ammodramus savannarum (R) | |
| Seaside Sparrow | Ammodramus maritimus (R) | |
| Field Sparrow | Spizella pusilla (R) | |
| Lincoln's Sparrow | Melospiza lincolnii | S,Su |

# Appendix 5

## Reptiles and Amphibians
## Missaquash -East Amherst Wildlife Management Area[1]

(* documented)[2]

**Reptiles:**

| | |
|---|---|
| Brown and Redbelly snakes | |
| Northern Redbelly | Storeria occipitomaculata occipitomaculata |
| Garter and Ribbon Snakes | |
| Maritime Garter | Thamnophis sirtalis pallidula |
| Green Snakes | |
| Eastern Smooth Green | Opheodrys vernalis vernalis |

**Amphibians:**

| | |
|---|---|
| Mole Salamanders | |
| Blue-spotted | Ambystoma laterale |
| Yellow-spotted | Ambystoma maculatum |
| Newts | |
| Red-spotted | Notophthalmus viridescens viridescens* |
| Lungless Salamanders | |
| Eastern Redback | Plethodon cinereus |
| Toads | |
| Eastern American | Bufo americanus americanus* |
| Treefrogs | |
| Northern Spring Peeper | Hyla crucifer crucifer* |
| Typical Frogs | |
| Bullfrog | Rana catesbeiana* |
| Green Frog | Rana clamitans melanota* |
| Mink Frog | Rana septentrionalis |
| Wood Frog | Rana sylvatica |
| Northern Leopard Frog | Rana pipiens* |
| Pickerel frog | Rana palustris* |
| Turtles | |
| Common Snapping Turtle | Chelydra serpentina |

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1 Melanson, R. 1986 Fort Lawrence Marsh Management Plan

2 Further studies required to ascertain species and status

# Appendix 6[1]

## Fish Associated with the Missaquash-East Amherst Wildlife Managment Area[2] (*documented)

| | |
|---|---|
| **Lamprey Family** | |
| Sea Lamprey | Petromyzon marinus |
| **Eel Family** | |
| American Eel | Anquila rostrata* |
| Herring Family | |
| Gaspereau | Alosa pseudoharengus* |
| Blueback Herring | Alosa aestivalis* |
| American Shad | Alosa sapidissima |
| **Trout Family** | |
| Brook Trout | Salvelinus fontinalis* |
| **Smelt Family** | |
| Rainbow Smelt | Osmerus mordax* |
| **Minnow and Carp Family** | |
| Northern Redbelly Dace | Chrosomus eos |
| Lake Chub | Couesius plumbeus |
| Golden Shiner | Notemigonus crysoleucas* |
| Common Shiner | Notropis cornutus |
| Balcknose Shiner | Notrophis heterolepis |
| Blacknose Dace | Rhinichtys atratulus |
| Creek Chub | Semotilus atromaculatus |
| Pearl Dace | Semotilus margarita |
| **Sucker Family** | |
| White Sucker | Catostomus commersoni* |
| **Catfish Family** | |
| Brown Bullhead | Ictalurus nebulosus* |
| **Killifish Family** | |
| Banded Killifish | Fundulus diaphanus* |
| **Stickleback Family** | |
| Threespine Stickleback | Gasterosteus aculeatus |
| Ninespine Stickleback | Pungitius pungitius |
| **Temperate Bass Family** | |
| White Perch | Morone americana* |
| **Perch Family** | |
| Yellow Perch | Perca flavescens* |

[1] Further studies required to ascertain species and status

[2] Melanson, R. 1986. Fort Lawrence Marsh Wildlife Management Plan

# Appendix 7[1]

## Mammals associated with The Missaquash-East Amherst Wildlife Management Area[2]

| | |
|---|---|
| **Insectivores** | |
| Shrews | |
| Arctic Shrew | Sorex arcticus |
| Masked Shrew | Sorex cinereus |
| Water Shrew | Sorex palustris |
| Short-tailed Shrew | Blarina brevicauda |
| **Bats** | |
| Little Brown Bat | Myotis lucifugus |
| Keen's Long-eared Bat | Myotis keenii |
| Red Bat | Laiurus borealis |
| **Lagomorphs** | |
| Hares | |
| Snowshoe Hare | Lepus americanus |
| **Rodents** | |
| Squirrels | |
| Eastern Chipmunk | Tamias striatus |
| Red Squirrel | Tamiasciurus hudsonicus |
| Beavers | |
| Beaver | Castor canadensis |
| **Rats and Mice** | |
| Red-backed Mouse | Clethrionomys gapperi |
| Meadow Vole | Microtus pennsylvanicus |
| Muskrat | Ondatra zibethicus |
| Meadow Jumping Mouse | Zapus hudsonius |
| Woodland Jumping Mouse | Napaeozapus insignis |
| Porcupine | Erethizon dorsatum |
| **Carnivores** | |
| Foxes and Wolves | |
| Red Fox | Vulpes vulpes |
| Coyote | Canis latrans |
| Bears | |
| Black Bear | Ursus americanus |
| Raccoons | |
| Raccoon | Procyon lotor |
| Weasels | |
| Short-tailed Weasel | Mustela erminea |
| Mink | Mustela vison |
| Otter | Lontra canadensis |
| Skunk | Mephitis mephitis |

[1] Further studies required to ascertain species and status

[2] Melanson, R. 1986 Fort Lawrence Marsh Management Plan

Appendix 7, mammals cont.

| | | |
|---|---|---|
| | Cats | |
| | Bobcat | Lynx rufus |
| **Deer** | | |
| | White-tailed Deer | Odocoileus virginianus |
| | Moose | Alces alces |

# Appendix 8 Camp/Cottage Ownership & Use

## Missaquash/East Amherst Wildlife Management Area
(1986 Data)

| Camp No. | and Owner | Hunting | Fishing | Trapping | Snowmobiling | Escape | Social Activity | Permanent Residence |
|---|---|---|---|---|---|---|---|---|
| 1 | Lewis Farrow, Sr., 34 Pleasant St., Amherst | x | x | x | x | x | - | - |
| 2 | John G. McKay, P.O. Box 675, Amherst | - | - | - | - | - | - | x |
| 3 | Robert G. Corbett, 20 Dale St., Amherst | x | - | - | x | x | - | - |
| 4 | K. Lawrence Carter, 83 Spring St., Amherst | x | - | - | - | - | x | - |
| 5 | Burton S. Vergie, R.R. #6, Amherst | x | x | - | x | - | x | - |
| 6 | Roy Smith, 256 Victoria St., Amherst | x | - | - | x | - | x | - |
| 7 | Lionel Robichaud, 44 LaPlanche St., Amherst | x | - | - | x | - | x | - |
| 8 | Robert Scott Rayworth, Dorsay Rd., Amherst | x | - | - | x | x | x | - |
| 9 | Meddie Landry, 13 Foundry St., Amherst | ? | ? | ? | ? | ? | ? | ? |
| 10 | Aurele Landry, 12 Rambler St., Amherst | x | x | - | - | x | x | - |
| 11 | Rod MacDougall, 206 Victoria St., Amherst | x | x | - | - | x | x | - |
| 12 | Robert Hawkes, East Amherst | ? | ? | ? | ? | ? | ? | ? |
| 13 | Douglas Farrow, 2 Ralston Place, Amherst | ? | ? | ? | ? | ? | ? | ? |
| 14 | Dean Allen & Robert Scott Rayworth (joint ownership) | ? | ? | ? | ? | ? | ? | ? |
| 15 | Sid Fisher, 26 Lawrence St., Amherst | ? | ? | ? | ? | ? | ? | ? |
| 16 | Cletus DeLong, 20 Eddy St., Amherst | x | x | - | - | - | x | - |
| 17 | Jack Wood, 3 Summit Ave., Amherst | ? | ? | ? | ? | ? | ? | ? |
| 18 | David Christie, 23 LaPlanche St., Amherst | ? | ? | ? | ? | ? | ? | ? |
| 19 | Gary Goodine, R.R. #6, Amherst | ? | ? | ? | ? | ? | ? | ? |