

**Penjawoc Marsh Conservation Plan**

**Prepared for the Bangor Land Trust**

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## **Introduction**

Penjajawoc Marsh, 300 acres of diverse wetland habitat, sits as a jewel in the center of the rapidly growing city of Bangor. The following report was prepared by Maine Audubon at the request of the Bangor Land Trust to help guide the land trust's conservation priorities for protecting and preserving the wildlife habitat inherent in the marsh. The plan is based on the current knowledge of the area and includes the following:

1. Summary of wildlife values
2. Known threats to the functions and values of the marsh
3. Management recommendations (based on the best available science), for maintaining the integrity of the Marsh as it functions today
4. Summary of the regulations that would come into play for proposed developments adjacent to the marsh, and
5. Summary of conservation strategies that may be relevant for achieving the conservation goals.

The conservation plan that was developed reflects an exhaustive search of the current published literature on the threats and habitat needs of species living in and around wetlands similar to the Penjajawoc Marsh. By following a rigorous science-based approach, we were able to develop specific recommendations, which are the minimum requirements for protecting the marsh and the wildlife that use it. It is hoped that this document will be a valuable tool to help the Bangor Land Trust develop a comprehensive approach to conservation of this valuable resource and to take advantage of all opportunities as they arise.

## **Summary of Wildlife Values**

Penjajawoc Marsh is among the largest wetland complexes in Bangor and has been rated as one of the most valuable freshwater marshes in Maine by the State (DIFW report, 2001). This wetland complex is further distinguished by its adjacency to undeveloped terrestrial habitat (including grasslands and a wildlife travel corridor along the railroad bed to Orono) and to a suite of isolated wetlands in a forested matrix to the east.

The Marsh includes 300 acres of open water, aquatic beds (lily pads and other floating plants), persistent (cattails and sedges; important nesting area for least bitterns and wrens) and non-persistent (pickerelweed and arrowhead; important nesting material for American coot; food for black ducks and others) emergent marshes, wet meadow, scrub-shrub wetland, and forested wetland. A diverse wetland complex, Penjajawoc has a high degree of mixing of plant communities which creates productive edges and diverse habitats to meet the foraging, cover, nesting, and resting needs of wetland fauna. The complex plant community structures also support a rich invertebrate community. The function of this wetland complex is further enhanced by the presence of extensive adjacent grasslands. Grasslands are a declining habitat in the northeastern U.S. and the

contiguity of this habitat to the marsh provides an unusual system that attracts a diverse avifauna including both wetland and land-based species.

Species richness around the Penjajawoc Marsh is supported by a number of isolated wetlands to the east which are identified by the National Wetlands Inventory. The value of large marshes is often enhanced by close proximity to smaller, isolated wetlands which support species traveling among wetlands. Scientists are now recognizing that wetland number and spatial distribution in a given area may be more important ecologically to wetland-dependent species than wetland area alone (Semlitsch and Bodie 1998; Gibbs 2000; Snodgrass et al. 2000). Loss of these isolated wetlands, many of them forested and with the potential to support vernal pools, could result in loss of local amphibian and reptile populations (Semlitsch and Bodie 1998). The average interwetland distance between the eastern edge of the Marsh and these wetlands is 1362 feet. This distance is at the upper limit of what amphibians use for traveling among wetlands; any loss of these stepping stones could potentially sever connectivity to important summering or breeding habitats.

In addition, the Penjajawoc Marsh has been identified by Maine's *Beginning with Habitat* program (see Appendix 1: map and accompanying text) as part of a Focus Area of Statewide Ecological Significance. The focus area is known as the Caribou Bog and covers nearly 6000 acres. The values of the Penjajawoc Marsh are significantly greater due to its proximity to other high value areas within the Caribou Bog Focus Area. Connectivity for wildlife movement between the Penjajawoc Marsh and other features of the Caribou Bog Focus Area are critical to maintaining the ecological value within the Penjajawoc area. Connectivity can be compromised by roads and development separating high value areas (Trombulak & Frissell, 2000), particularly along riparian habitat areas (rivers, lakes, streams, ponds, wetlands) which serve as wildlife travel corridors for many species (Beginning with Habitat 2003).

Forested wetlands are also a part of the Penjajawoc wetland complex but these have not been surveyed and are not specifically addressed in this document. However, the presence of forested wetlands creates additional complexity and adds value to the marsh functions and values.

### Beaver

Trapping in the early 1900's pushed Maine's beaver population to the brink of extinction. Many historic beaver flowages reverted to forest land. Their return is marked by an increase in wetland diversity in forested landscapes through beaver creation, maintenance, and abandonment of flowages. The value of their comeback is showcased in Penjajawoc marsh; indeed, the outstanding wildlife habitat function of the Penjajawoc marsh is driven by beaver activity. The Penjajawoc complex has a high degree of wetland interspersions, from open-water areas to wet meadows and scrub-shrub swamps. The mixing of wetland classes (marsh, open water, shrub swamp) supports a diversity of wildlife species that would otherwise not be successful in a forested, unflooded landscape. The diversity of breeding birds, including endangered and threatened species

that have been observed in the marsh (see section of Avifauna below) is a good example of this principle.

In undisturbed landscapes with large basins such as the Penjajawoc Marsh, beaver were, most likely, an integral part of the ecosystem. Beaver select locations where their activities (e.g. dam building) will result in larger wetlands with ample aquatic food with a high perimeter to dam ratio. The underlying landform at the Penjajawoc Marsh is such a location, which will likely be able to support beaver indefinitely if left undisturbed.

The dynamic water regimes resulting from beaver activity may favor different suites of animals at different times, but, in general, the cycle supports a diverse suite in the long-term. The outstanding amphibian, reptile, small mammal, and bird habitat reported for Penjajawoc hinges on the persistence of this native mammal that serves as a water control engineer ensuring fluctuations in hydrology needed to conserve the vegetation communities that serve as the foundation for wildlife species of concern.

### Avifauna

Penjajawoc Marsh was ranked 4<sup>th</sup> among Maine's top emergent marshes (based on species richness; Gibbs and Melvin 1990) and rated 6<sup>th</sup> of 60 for supporting target nongame waterbirds. Data from 1997 suggests the marsh may be the single-most significant emergent marsh for waterbirds in Maine (out of 106 marshes surveyed). The Maine Department of Inland Fisheries and Wildlife (MDIFW) subsequently rated Penjajawoc as a high value waterfowl and wading bird habitat and candidate for Significant Wildlife Habitat designation. Nowhere in Maine is there such a spectacular assemblage of rare, uncommon, and common birds, all easily observed. This is owing to the combination of extensive areas of water, aquatic and emergent plants, cattail marsh interspersed with water channels, wet fields, shrub swamps, forested wetlands, all surrounded with dry fields and forest. The nesting, resting, and feeding needs of nearly every inland Maine species are met here. Because of its size, it provides habitat for species with large home ranges.

Over 185 bird species (including 97 species of song birds) have been recorded utilizing the marsh or adjacent uplands (see Appendix 2). Nineteen species are listed as State-endangered or threatened, or on regional and national watch lists (see Table 1).

### *Endangered Species*

The black tern and sedge wren, both of which have been documented in Penjajawoc, are state-endangered species (McCollough 1998). Sedge wrens nest in wet sedge meadows with interspersed low shrubs. These wrens have successfully nested in the marsh, a

**Table 1: Rare Avifauna occurring in Penjajawoc Marsh**

Species	Status
Sedge Wren	Maine Endangered Species
Black Tern	Maine Endangered Species
Upland Sandpiper	Maine Threatened Species
Bald Eagle	Maine Threatened Species, PIF Priority Species
Pied-billed Grebe	Northeast Regional Concern
Least Bittern	Maine Special Concern
American Bittern	Northeast Regional Concern
American Coot	Maine Special Concern
American Black Duck	PIF Priority Species
Common Moorhen	Maine Special Concern
American Woodcock	PIF Priority Species
Northern Harrier	Northeast Regional Concern, PIF Priority Species
Northern Goshawk	Maine Special Concern
Belted Kingfisher	PIF Priority Species
Bobolink	PIF Priority Species
Eastern Meadowlark	Maine Special Concern
Black-crowned Night Heron	Maine Special Concern
Osprey	PIF Priority Species
Red-shouldered Hawk	Northeast Regional Concern

significant finding given that only 3-6 sedge wrens are recorded each year in Maine (MDIFW personal communication).

Black terns have also bred in the marsh. They feed on large aquatic invertebrates (e.g., dragonflies) flying over open areas. The adjacent fields or wet sedge meadows may be foraging habitat as well. Shallow, exposed marsh islands provide nesting habitat.

*Northeast Regional Concern Species and Maine Special Concern*

Fourteen Species of Concern have been identified in the Penjajawoc Marsh including pied-billed grebe, American bittern, least bittern, common moorhen, American coot, American black duck, American woodcock, black-crowned night heron, northern harrier, northern goshawk, and belted kingfisher. These birds use deep and shallow marshes with emergent and aquatic vegetation and open landscapes (fields, wet meadow) for foraging, resting, cover, and breeding. The Penjajawoc provides this full array of habitat requirements.

### *Priority Upland Species*

Upland sandpiper (Maine Threatened), bobolink, and northern harrier are three grassland bird species that have either nested, or have been sighted, during the breeding season in the adjacent hay fields and interface between the marsh and fields. The shrub-scrub wetlands at the edge of the marsh provides potential breeding habitat for harriers.

The grasslands adjacent to Penjajawoc Marsh are particularly important due to their size (approximately 224 acres) and adjacency to the marsh. Upland sandpipers require a minimum of 150 acres of grasslands (Jones & Vickery 1997). According to Vickery et al 1997, “conservation efforts seeking to protect rare grassland birds need to consider sites of at least 50-100 ha (124 – 247 acres)” which are rare in Maine.

For a complete list of birds documented in the Marsh, see Appendix 2. For a more complete description of individual bird habitat needs, see pre-filed testimony of Judy Kellogg Markowsky (Appendix 3).

### Amphibians and reptiles (herptiles)

Because of the marsh’s proximity to wet meadow, fields, and isolated wetlands, the marsh supports at least 7 of our 9 singing amphibians (American toads and mink frogs may be present but no formal survey has been conducted). This assemblage of amphibians, all with diverse breeding and non-breeding habitat requirements, is a testimony to the complexity of the marsh and its environs.

*Documented:* Spring peeper, grey treefrog, wood frog, green frog, bullfrog, leopard frog, pickerel frog, snapping turtle.

*Expected:* American toad, painted turtle, garter snake, spotted salamanders, eastern newt.

### Future Work

All the wildlife functions provided by the Marsh have not been enumerated here owing to lack of a complete scientific inventory. The marsh is most likely diverse in mammal, reptile, and invertebrate species as well. In fact, the rich avifauna attest to this as the understudied components of this system provides food for the documented avifauna.

Also lacking are aquatic plant inventories. The Penjajawoc Marsh wetland and the adjacent fields, forests and isolated wetlands, should be the focus of a “bioblitz,” or intense inventory of plants and animals. More biological gems would likely be uncovered given this attention.

## **Overview of Threats to the Long-Term Ecological Values of the Marsh**

The primary threats to the wildlife values of the Penjajawoc Marsh are roads and associated development. Roads and other types of development (e.g. buildings and parking lots) cause habitat fragmentation and habitat loss. When habitats become fragmented, animals are not able to move successfully on the landscape to find food, shelter and mates. For some more sensitive species, the habitat (both forested and grasslands) adjacent to developed areas is either avoided or becomes a population sink for breeding individuals (i.e. breeding is often unsuccessful often due to increased levels of predators). In a study by Knutson et al (1999), the abundance of all anurans (frogs and toads) was significantly negatively affected by the presence of urban land. According to Findlay and Houlihan (1997), "land use practices around the wetland may be as important as the size of the wetland itself." They found that removal of 20% of the forest cover on lands within 1000m (3280 feet) of a wetland had approximately the same impact on amphibians, reptiles and mammals species richness as would the loss of 50% of the wetland proper.

The reduction and loss of species near roads is due to the effects of noise, road mortality and creation of a barrier preventing species from moving among key habitats. Many studies address the impacts of roads and development on wildlife. In a study by Ashley and Robinson (1996), road mortality along a causeway, in terms of numbers of individuals, numbers of species and populations resulted in extreme reductions with over 90% amphibian mortality. In comparison to other studies that assessed road mortality along mixed hardwood forest, road mortality was very high, indicating that roads near wetlands may pose a greater threat to wildlife compared to roads adjacent to other habitat types (Oxley et al. 1974 *In* Ashley and Robinson 1996).

The species of direct concern and most negatively impacted by the effects of roads at the Penjajawoc Marsh include birds, particularly grassland birds, such as bobolink and eastern meadowlark, waders, such as American and least bitterns, and amphibians and reptiles. Numerous studies have investigated road impacts with the species affected and at the distance of those impacts from roads at different traffic volumes (see Table 2).

Higher traffic volumes significantly reduce the presence and breeding of birds near roads, probably due to traffic noise (Reijnen, Foppen & Veenbaas 1997; Forman 2002). Amphibians and reptiles are most at risk from road mortality. Studies are finding significant reduction in populations near roads. According to Fahrig et al (1995), "traffic mortality has a significant negative effect on the local density of anurans (frogs and toads). Results of their study suggest that recent increases in traffic volumes worldwide are probably contributing to declines in amphibian populations, particularly in populated areas."

To our knowledge, the presence and location of vernal pools within the uplands surrounding the Penjajawoc Marsh has not yet been determined. However, we do know that roads and development also pose a threat to vernal pools and the terrestrial habitat

connecting them. Though we have not made any specific recommendations for conservation of vernal pools within the Penjajawoc Marsh wetland complex, we recommend using the publication "Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States" to guide vernal pool conservation in the area. Vernal pools contribute a significant amount of food to the surrounding habitats. (See Calhoun and Klemens 2002) To ensure successful breeding, vernal pool depressions must be left intact and undisturbed. Excluding development and minimizing disturbances to the area immediately surrounding the vernal pool (i.e., the pool's envelope) will provide breeding amphibians with a staging ground and will also help to maintain pool water quality. Additional upland habitats are required during the nonbreeding season; such "critical terrestrial habitats" can be maintained by limiting development.

Finally, there are numerous examples of what appear to be productive wetlands that are adjacent to roads. These wetlands are typically inhabited by more common species that are more tolerant of human intrusion or they may be used only temporarily during migration. Adding more roads in close proximity to the Penjajawoc Marsh complex would impact the more sensitive species that currently occur there such as amphibians, several grassland species and waterbirds (Table 2).

Wetlands adjacent to roads and development can also act as a "populations sink" meaning certain animals may eventually be extirpated from the area or if they continue they are unable to breed successfully. Mortality from roads alone may be enough to wipe out an entire local population over time. In Connecticut, there are no wood turtle populations found within a mile of paved roads (Line 1998).

Table 2: Impacts of Roads on Wildlife

SPECIES GROUP AFFECTED	IMPACTS OF ROADS ON WILDLIFE	TRAFFIC VOLUME	SUPPORTING LITERATURE	SPECIES IN PENJAJAWOC MARSH <sup>1</sup>
Birds	500-1000 meters (1640 – 3280 feet)		Findlay, C. Scott and Jeff Houlahan, Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands, Conservation Biology, Volume 11, No. 4, August 1997, pp. 1000-1009.	Rated as single most significant emergent marsh by DIFW (2001)
Grassland Birds	400 meters (1300 feet)	8000-15,000 vehicles/day (through street)	Forman, Richard T.T., Bjorn Reineking, Anna M. Hersperger, <i>Road Traffic and Nearby Grassland Bird Patterns in a Suburbanizing Landscape, Environmental Management</i> Vol. 29, No. 6, pp. 782-800.	Bobolink Eastern Meadowlark Upland Sandpiper
	700 meters (2300 feet)	15,000-30,000 vehicles/day (two-lane highway)		
	1200 meters (4000 feet)	>30,000 vehicles/day (Multilane highway)		
Open Grassland Habitat – all bird species combined	190 meters (625 feet)	10,000 vehicles/day	Reijnen, Rien, Ruud Foppen and Geesje Veenbaas (1997) Disturbance by traffic of breeding birds: evaluation of the effect and considerations in planning and managing road corridors, Biodiversity and Conservation 6, 567-581.	Bobolink Eastern Meadowlark Upland Sandpiper Northern Harrier
	560 meters (1840 feet)	50,000 vehicles/day		
Waders	200 meters (650 feet) most significant	15,000-20,000 vehicles/day (two lane highway)	Hirvonen, Heikki, <i>Impacts of Highway Construction and Traffic on a Wetland Bird Community</i> , International Conference On Ecology and Transportation 2001 Proceedings, pp. 369-372.	American Bittern Least Bittern
	800 meters (2600 feet) clear disturbance effects	15,000-20,000 vehicles/day (two lane highway)		
Waders (in open field habitat)	625 meters (2050 feet)	secondary road	Van der Zande, A.N., ter Keurs, W.J. and Van der Weijden, W.J. (1980) The impact of roads on the densities of four bird species in an open field habitat – evidence of a long distance effect. Biol. Conserv. 18, 299-321 <i>IN</i> Reijnen, Rien, Ruud Foppen and Geesje Veenbaas (1997) Disturbance by traffic of breeding birds: evaluation of the effect and considerations in planning and managing road corridors, Biodiversity and Conservation 6, 567-581.	
	2000 meters (6560 feet)	busy highway		

<sup>1</sup> Species currently occurring in or adjacent to the Penjajawoc Marsh that are relevant to the supporting literature

Table 2: Impacts of Roads on Wildlife

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SPECIES GROUP AFFECTED	IMPACTS OF ROADS ON WILDLIFE	TRAFFIC VOLUME	SUPPORTING LITERATURE	SPECIES IN PENJAJAWOC MARSH <sup>1</sup>
<b>Herptiles</b>	<b>2000 meters</b> (6560 feet)		Findlay, C. Scott and Jeff Houlahan, Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands, Conservation Biology, Volume 11, No. 4, August 1997, pp. 1000-1009.	Snapping turtle Spring peeper Grey treefrog Wood frog Green frog Bullfrog Leopard frog Pickeral frog
<b>Amphibians</b>	<b>1500 meters</b> (4900 feet)		Carr, Laurie W. & Lenore Fahrig, Effect of Road Traffic on Two Amphibian Species of Differing Vagility, Conservation Biology, Vo. 15, No. 4, August 2001, pp. 1071-1078.	Spring peeper Grey treefrog Wood frog Green frog Bullfrog Leopard frog Pickeral frog
<b>Mammals</b>	<b>2000 meters</b> (6560 feet)		Findlay, C. Scott and Jeff Houlahan, Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands, Conservation Biology, Volume 11, No. 4, August 1997, pp. 1000-1009.	Bear Moose Deer Otter Muskrat Beaver
<b>Plants</b>	<b>1000-2000 meters</b> (3280-6560 feet)		Findlay, C. Scott and Jeff Houlahan, Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands, Conservation Biology, Volume 11, No. 4, August 1997, pp. 1000-1009.	

<sup>1</sup> Species currently occurring in or adjacent to the Penjajawoc Marsh that are relevant to the supporting literature

## **Recommendations for Conserving the Ecological Functions of the Marsh**

### Identification of Management Zones

The research in the section on overview of threats (page 6), outlined how roads and associated development intrude into wetland resources including species specific to the Penjajawoc Marsh ecosystem. Using this information, we have developed two "management zones" around the perimeter of the marsh in which we describe the values and offer guidelines for management. A third management "area" is also identified beyond the perimeter. These areas are all depicted on the map on page 11.

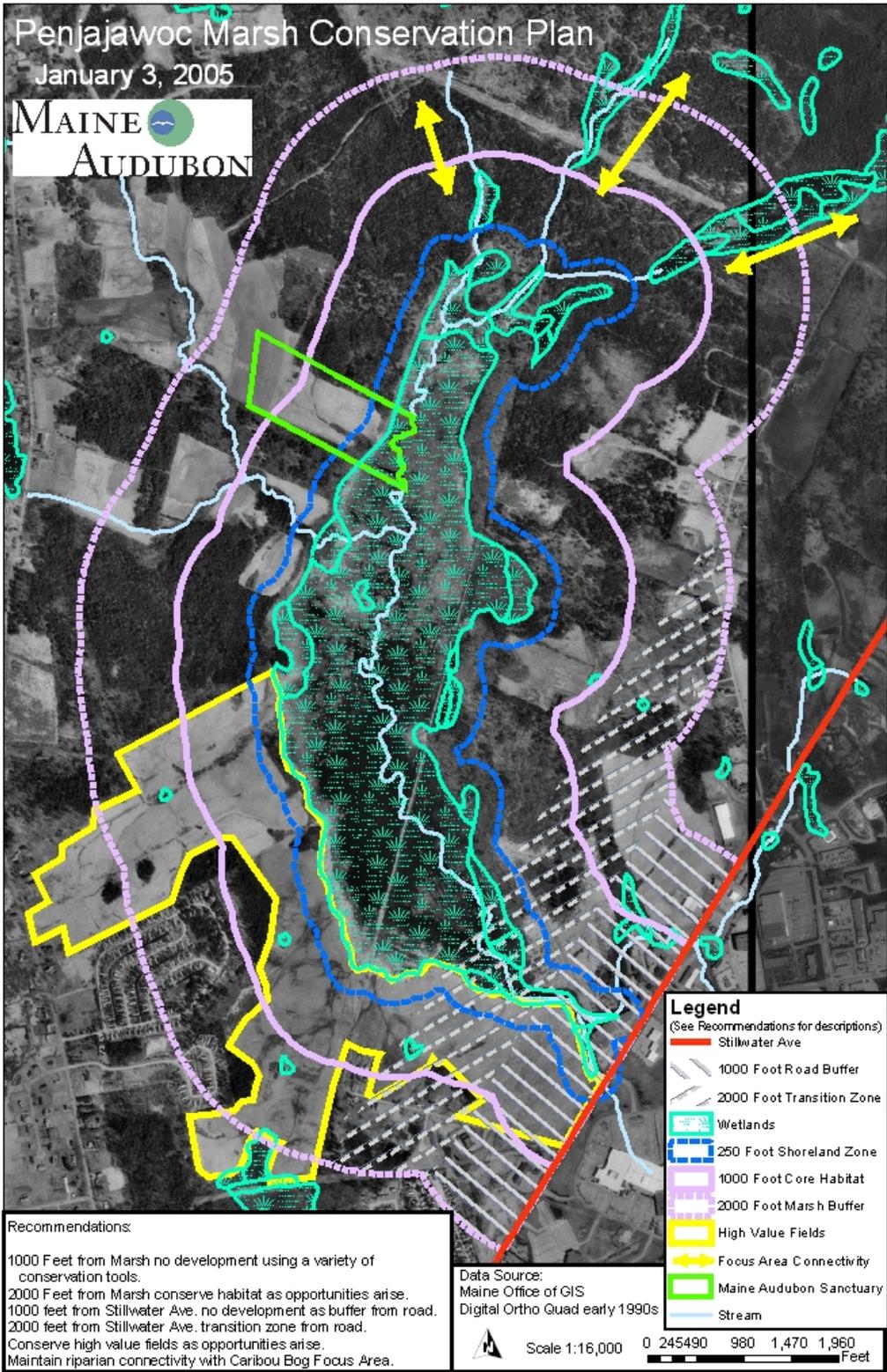
The first zone, which extends 1000 feet from the marsh perimeter, is the **Core Habitat**. The Core Habitat, approximately 590 acres, includes critical areas of field and forest that provide key elements to support the life history needs (nesting, foraging, cover, migration) of the current diverse fauna associated with the marsh. The second zone, which extends 2000 ft, is the **Marsh Buffer**. This area, approximately 610 acres, is needed to provide a buffer, or ameliorate impacts from human intrusion into the core habitat and functions as additional habitat for wildlife in general. Ideally, both zones should be free of development with the Core Habitat closest to the marsh being the first priority for conservation.

The **Caribou Bog Connectivity Area** provides a wildlife travel corridor between the Penjajawoc Marsh and other parts of the Caribou Bog Focus Area. Conservation of this area enhances the value of the Penjajawoc Marsh by allowing wildlife to move freely and helps prevent the marsh from becoming a population sink. Excluding development and roads around riparian habitats between the northern part of the Caribou Bog Focus Area and Penjajawoc Marsh area may be necessary to maintain the value of the Penjajawoc Marsh. However, specific recommendations for the conservation of this area of connectivity were beyond the scope of this plan and are not included below. There are also a large number of isolated wetlands between the Penjajawoc Marsh and the rest of the Caribou Bog Focus area. The presence of these wetlands further enhances the habitat value beyond the important function of a wildlife travel corridor. The next step would be to identify a conservation zone extending north to Caribou Bog so that the connectivity/riparian corridor functions are protected.

It is important to note that these recommendations are biologically based management zones for wildlife and are supported in the literature we have cited (see Tables 2 and 3). Indeed, there is significant overlap in the functions and values of both the Core Habitat and the Marsh Buffer. We have chosen to distinguish these two areas as separate conservation priorities by assessing risk to the marsh. We also recognize the constraints of current land-use patterns at any given site and that the Marsh Buffer, although seemingly extensive, is still a compromise for some species. For example, the literature indicates that amphibians and reptiles use up to 2000 feet from a wetland as core habitat (see Table 3) and this plan would not offer much if any buffer for them. Our Penjajawoc

# Penjajawoc Marsh Conservation Plan

January 3, 2005



**Legend**  
(See Recommendations for descriptions)

- Stillwater Ave
- 1000 Foot Road Buffer
- 2000 Foot Transition Zone
- Wetlands
- 250 Foot Shoreland Zone
- 1000 Foot Core Habitat
- 2000 Foot Marsh Buffer
- High Value Fields
- Focus Area Connectivity
- Maine Audubon Sanctuary
- Stream

**Recommendations:**

- 1000 Feet from Marsh no development using a variety of conservation tools.
- 2000 Feet from Marsh conserve habitat as opportunities arise.
- 1000 feet from Stillwater Ave. no development as buffer from road.
- 2000 feet from Stillwater Ave. transition zone from road.
- Conserve high value fields as opportunities arise.
- Maintain riparian connectivity with Caribou Bog Focus Area.

Data Source:  
Maine Office of GIS  
Digital Ortho Quad early 1990s

Scale 1:16,000 0 245490 980 1,470 1,960 Feet

recommendations for habitat conservation would be more extensive were it not for current land-use patterns.

Table 3: Core Habitat for Amphibians & Reptiles

SPECIES GROUP AFFECTED	CORE HABITAT FROM WETLAND EDGE	SUPPORTING LITERATURE	SPECIES IN PENJAJAWOC MARSH <sup>2</sup>
<b>Amphibians</b>	<b>159-290 meters</b> (520-950 feet) core habitat from wetland edge	Semlitsch, Raymond D. and J. Russell Bodie, Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibians and Reptiles, Conservation Biology, Volume 17, No. 5, October 2003, pp. 1219-1228.	Spring peeper Grey treefrog Wood frog Green frog Bullfrog Leopard frog Pickeral frog
<b>Reptiles</b>	<b>127-289 meters</b> (420-950 feet) core habitat from wetland edge	Semlitsch, Raymond D. and J. Russell Bodie, Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibians and Reptiles, Conservation Biology, Volume 17, No. 5, October 2003, pp. 1219-1228.	Snapping turtle <sup>3</sup>

To maintain the outstanding functions and values of Penjajawoc Marsh wetland complex and associated uplands, even given the level of human encroachment to date, managers should strive to meet the conservation strategies outlined below. We do not know what development the marsh could sustain and still function at the current high level, and the citizens of Bangor and beyond most likely don't want to test such limits. Penjajawoc is an outstanding resource in its own right with the added value of being a gem in a sea of rapid development.

*Core Habitat - 1000 ft from marsh perimeter*

**Desired Management Outcome:** Maintain the existing complex of forest and fields around the marsh that historically, and currently, supports a rich assemblage of birds, reptiles, amphibians, and mammals. Protect the water quality of the marsh from introduction of non-point and point sources of pollution and exotic flora and fauna.

**Rationale:** Negative effects of roads on wildlife, particularly birds, amphibians, and reptiles, has been documented from 625' (for grassland birds) to over 10 times that (6,500') for mammals, amphibians and reptiles (see Table 2). Therefore, our 1000' recommendation is the bare minimum needed to maintain the integrity of the marsh. This management zone would protect the marsh from development-related disturbance. It is the core habitat of a significant portion of amphibians and reptiles (see Table 3) and small and medium-sized mammals (e.g., voles, shrews, mink) and provides riparian habitat to larger mammals such as coyote, moose, and deer. Maintenance of this undisturbed zone would preserve current

<sup>2</sup> Species currently occurring in Penjajawoc Marsh that are relevant to the supporting literature.

<sup>3</sup> Not formally surveyed, other species expected

standards of water quality, and would discourage introduction of exotic and/or invasive marsh species.

**Recommended Guidelines:**

1. No development or impermeable surfaces occur in this zone.
2. This zone should be free of disturbance beyond maintaining the existing grasslands. Mowing of fields should be limited to post-fledging season for grassland birds (mid-August).

*Marsh Buffer Zone - extends 2000 ft from marsh*

**Desired Management Outcome:** Maintain the existing complex of forest and fields around the marsh that historically, and currently, supports a rich assemblage of birds, reptiles, amphibians, and mammals AND limit further encroachment of development in this biologically sensitive area.

**Rationale:** Stillwater Avenue, south and east of the marsh, Essex Street and two housing developments to the west of the marsh, already are encroaching on both the Core Habitat Zone and the Core Buffer Zone. Existing roads have negative impacts that reach into both these zones (see Table 2). We recommend this additional 1000' of management to, at a minimum, maintain the current ecological functions of this marsh.

**Recommended Guidelines:**

1. No development or impermeable surfaces should occur in this zone.
2. Actively pursue acquisition or easements within this zone particularly agricultural fields (see Options for Achieving Conservation Goals).
3. Look for opportunities to conserve the high value fields in this zone, as well as the forest-wetland complex to the east of the marsh (see map on page 11).
4. Conduct wildlife surveys in the fields to the north and west of the marsh to assess their use by birds

**Regulatory Review**

A project impacting the Penjajawoc Marsh may be subject to a variety of state laws. Some of the more likely applicable state laws include the Natural Resources Protection Act, the Site Location of Development Law, and the Wetlands Rules. Descriptions of these and other relevant regulatory programs are provided below.

The Natural Resources Protection Act (NRPA), 38 M.R.S.A. §§ 480-A - 480-AA, is designed to protect the State's significant natural resources. Relevant natural resources protected under this Act include: significant wildlife habitat, freshwater wetlands and streams or brooks. The Penjajawoc Marsh has not yet been designated a significant wildlife habitat (SWH) under the NRPA although it clearly qualifies due the presence of endangered

and threatened species and exemplary waterfowl and wading birds habitat. The definition of Significant Wildlife Habitat is in Appendix 4.

Activities require a NRPA permit if the activity is located in, on or over any protected natural resource or is located adjacent to: A coastal wetland, great pond, river, stream or brook or significant wildlife habitat contained within a freshwater wetland; or freshwater wetlands consisting of or containing (1) under normal circumstances, at least 20,000 square feet or aquatic vegetation, emergent marsh vegetation or open water, except for artificial ponds or impoundments; or (2) peatlands dominated by shrubs, sedges and sphagnum moss.<sup>4</sup>

Under NRPA, development activities would require NRPA permit in the Penjajawoc Marsh due to its size (approximately 300 acres or 13 million square ft), the existence of both emergent marsh vegetation and open water (depending on the current conditions) and the fact that the Penjajawoc Stream flows through the marsh. The surrounding upland habitat may also be included in the NRPA permit review because it is adjacent to the Penjajawoc stream and wetland.

The activities regulated under NRPA include: dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; draining or otherwise dewatering; filling, including adding sand or other material to a sand dune; or any construction, repair or alteration of any permanent structure.<sup>5</sup> Multiple activities have been designated as not needing a permit if the activity occurs in the area specified.<sup>6</sup> A number of these regulated activities have been identified as being less likely to significantly affect the environment if carried out according to the standards contained in the regulations and may be able to utilize the expedited Permit-by-Rule application process (see appendix 5).

The Department grants a permit when it finds that the applicant has demonstrated that the standards for each of the categories listed below, have been met:

1. Existing uses;
2. Soil erosion;
3. Harm to habitats; fisheries;
4. Interfere with natural water flow;
5. Lower water quality;
6. Flooding;
7. Sand supply;
8. Outstanding river segments; and
9. Dredging.

Please refer to Appendix 6 for the definition of the regulatory standards listed above.

#### Wetlands Protection

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<sup>4</sup> 38 M.R.S.A. §480-C (1).

<sup>5</sup> 38 M.R.S.A. §480-C (2).

<sup>6</sup> 38 M.R.S.A. §480-Q.

In addition to potentially being subject to federal regulations, projects impacting wetlands must comply with the State's wetlands statutes<sup>7</sup> which address the alteration of freshwater wetlands as well as rules<sup>8</sup> which apply to the alteration of several different types of water bodies including freshwater wetlands and streams. The wetland statutory section does not apply to activities otherwise qualifying for reduced review procedures, activities exempt from review under NRPA, or activities involving protected natural resources other than freshwater wetlands, such as great ponds, coastal wetlands and rivers, streams or brooks.<sup>9</sup>

Freshwater wetlands review is generally organized according to the size of the wetland alteration and is separated into three tiers. The Tier 1 review process applies to any activity that involves the smallest of freshwater wetland alteration up to 15,000 square feet and does not involve the alteration of an "ineligible freshwater wetland". The term *ineligible wetland* is defined in statute (see Appendix 7) but in general they require Tier 3 review which is the most stringent review.

The Tier 2 process applies to any activity that involves a freshwater wetland alteration from 15,000 square feet up to one acre and *does not* involve the alteration of an ineligible freshwater wetland. The Tier 3 review process applies to any activity that involves a freshwater wetland alteration of one acre or more or an alteration of an ineligible freshwater wetland. (Appendix 7)

For projects that require Tier 2 or Tier 3 review, any activity that is part of the overall project and involves a regulated freshwater wetland alteration also requires the same higher level of review, unless otherwise authorized by the Department of Environmental Protection. In determining the amount of freshwater wetland to be altered, all components of a project, including all phases of a multiphased project, are treated together as constituting one single and complete project.<sup>10</sup>

An applicant for Tier 1, Tier 2 or Tier 3 review must meet the following general requirements to obtain a permit: (1) Alteration of freshwater wetland areas on the property must be avoided to the extent feasible considering cost, existing technology and logistics based on the overall purpose of the project. (2) The area of the freshwater wetland to be altered must be limited to the minimum amount necessary to complete the project. An applicant for Tier 1 review must also meet the following requirements: Erosion control measures must be used to prevent sedimentation of protected natural resources. A 25 foot buffer must be maintained between the activity and the river, stream or brook.<sup>11</sup> The activity

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<sup>7</sup> 38 M.R.S.A. §480-X.

<sup>8</sup> DEP Ch. 310.

<sup>9</sup> 38 M.R.S.A. §480-X (1).

<sup>10</sup> 38 M.R.S.A. §480-X (2).

<sup>11</sup> 38 M.R.S.A. §480-X (3).

must also comply with applicable water quality standards.<sup>12</sup> Projects subject to Tier 2 and Tier 3 review must also meet all of the standards found under NRPA.<sup>13</sup>

In addition to the general requirements articulated above, specific requirements also apply depending upon which level of review the project is undergoing. Furthermore, the Department has defined wetlands of special significance, alterations of which usually require an individual permit (Tier 3 review).<sup>14</sup> Based upon the definition of wetlands of special significance (Appendix 8), the Penjajawoc Marsh would clearly require Tier 3 review for an alteration of any size. In addition, an alternatives analysis is required of all wetland alteration activity permit applications.<sup>15</sup>

### The Site Location of Development Law

The Site Law, 38 M.R.S.A. §§481-490, was designed to assure large developments are reviewed which may substantially affect the environment and quality of life in Maine. The review attempts to ensure that the location of such developments will have minimal adverse impact on the environment within the site and upon their surroundings.

The Site Law also regulates developments of state or regional significance that may substantially affect the environment.<sup>16</sup> Such development includes any federal, state, municipal, quasi-municipal, educational, charitable, residential, commercial or industrial development that: occupies a land or water area in excess of 20 acres, is a metallic mineral mining or advanced exploration activity, is a structure,<sup>17</sup> is a subdivision,<sup>18</sup> or is an oil terminal facility.<sup>19</sup> The most common types of projects that would be reviewed under the Site Law within the Penjajawoc Marsh area are projects of 20 acres or more or projects that qualify as a subdivision.

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<sup>12</sup> These standards are found in 38 M.R.S.A. §480-D (5). The Wetlands Rules provide additional general standards which articulate the approach to "avoid, minimize, and compensate". DEP Ch. 310 (5). In addition, the rules provide standards for wetland compensation and mitigation banking. Wetlands Rules, Chapter 310, (6), (7).

<sup>13</sup> 38 M.R.S.A. §480-D.

<sup>14</sup> DEP Ch. 310(4)(B).

<sup>15</sup> DEP Ch. 310(9).

<sup>16</sup> 38 M.R.S.A. §483-A.

<sup>17</sup> Buildings, parking lots, roads, paved areas, wharves or areas to be stripped or graded and not to be revegetated that cause a total project to occupy a ground area in excess of 3 acres. Stripped or graded areas that are not revegetated within a calendar year are included in calculating the 3-acre threshold. 38 M.R.S.A. §482(6).

<sup>18</sup> A "subdivision" is the division of a parcel of land into 5 or more lots to be offered for sale or lease to the general public during any 5-year period, if the aggregate land area includes more than 20 acres; except that when all lots are for single-family, detached, residential housing, common areas or open space a "subdivision" is the division of a parcel of land into 15 or more lots to be offered for sale or lease to the general public within any 5-year period, if the aggregate land area includes more than 30 acres. The aggregate land area includes lots to be offered together with the roads, common areas, easement areas and all portions of the parcel of land in which rights or interests, whether express or implied, are to be offered. 38 M.R.S.A. §482(5). Also see 38 M.R.S.A. §482(5) for a list of exceptions.

<sup>19</sup> 38 M.R.S.A. §482(3-D).

The Department of Environmental Protection must approve the construction of a subdivision or development that may substantially affect the environment.<sup>20</sup> The project is evaluated according to the following standards: financial capacity, no adverse effect on the environment, soil types, stormwater management and erosion and sedimentation control, ground water, infrastructure, and flooding.<sup>21</sup> Multiple exemptions are available including certain subdivisions and development within designated growth areas.<sup>22</sup> Appendix 9 describes the statutory language for each of these standards.

A planning permit is also available. Planning permits allow approval of a development within a specified area and within specific parameters even though the exact nature and extent of the development or the timing of construction may not be known at the time of the application or even when the permit is issued.<sup>23</sup>

Common schemes of development are also subject to the Site Law. Common scheme of development means a plan or process of development which: (1) Takes place on contiguous or non-contiguous parcels or lots in the same immediate vicinity; and (2) Exhibits characteristics of a unified approach, method, or effect such as: (a) unified ownership, management, or supervision; (b) sharing of common equipment or labor; or (c) common financing.<sup>24</sup>

#### Other Related Site Law Rules

Projects proposed for the Penjajawoc Marsh area may also need to comply with a number of additional rules. The Storm Water Management Law requires most Site Law projects to meet quality and quantity standards. Projects that include 20,000 square feet or more of impervious area or 5 acres or more of disturbed area in the direct watershed of a body of water most at risk from new development or one acre or more of impervious area or 5 acres or more of disturbed area in any other area must comply with these rules.<sup>25</sup>

There also exists an erosion and sedimentation control standard that applies to the organized portion of the state. This standard prohibits any person disturbing soil from causing “unreasonable” erosion or sediment beyond the project site or into a protected natural resource.<sup>26</sup> Currently, the law doesn’t require reporting or a permit.

The Maine Department of Transportation has regulatory authority over traffic movement. DOT reviews any project that generates 100 or more passenger car equivalents at peak hour. During its review, DOT must determine that any traffic increase attributable to the project

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<sup>20</sup> 38 M.R.S.A. §483-A.

<sup>21</sup> 38 M.R.S.A. §484.

<sup>22</sup> See 38 M.R.S.A. §488.

<sup>23</sup> See DEP Ch. 380.

<sup>24</sup> DEP Ch. 370(1)(C).

<sup>25</sup> 38 M.R.S.A. §420-D. See 38 M.R.S.A. §420-D and DEP Ch. 502 Rules.

<sup>26</sup> 38 M.R.S.A. §420-C.

will not result in unreasonable congestion or unsafe conditions on a road in the vicinity of the proposed project.<sup>27</sup>

In addition to the traffic movement rules, DOT also has developed, under the Access Management Rules<sup>28</sup>, Driveway Rules and Entrance Rules to address safety issues and maintain posted speeds on arterial highways located outside urban compact areas. In both cases, the rules are designed around the function of the intersecting State highway. Fewer restrictions apply to minor collectors while more stringent rules apply to arterials.

The Driveway Rules require a permit for driveways accessing state or state aid highways located outside urban compact areas and apply to the design, location, construction, alteration, and closure of such driveways as well as to driveways where a proposed change in use serviced by the driveway will increase traffic volume.<sup>29</sup> Existing driveways are grandfathered until there is a change in grade, width, or location of the driveway. New driveways are required to meet standards set in the Driveway Rules regarding sight distance, width, corner clearance, turnaround area and turning radius, drainage, and parking.

The Entrance Rules require permits for entrances accessing state and state aid highways located outside Urban Compact Areas and apply to the design, location, construction, alteration, and closure of such entrances, as well as to instances in which a change in use serviced by an entrance increases traffic volume.<sup>30</sup> Existing entrances are grandfathered. The same standards apply to entrances as to driveways but there are additional requirements for entrances onto Major Collector and Arterials.<sup>31</sup>

#### Regulation of New Roads

A variety of projects in the Penjajawoc Marsh area could be subject to some or all of the aforementioned statutes and regulations. For example, a road across the Penjajawoc Stream in the area of the Penjajawoc Marsh would likely be subject to most, if not all, of the statutes and regulations. Certainly a road across the stream would be subject to the NRPA and the Wetland Rules given that significant wildlife habitat, freshwater wetlands of special significance and a stream would be involved. The Army Corps of Engineers would certainly also be involved due to the wetlands at stake. In addition, the Site Law and its accompanying regulatory programs would also apply as the definition of a structure includes roads. A road such as this would face significant regulatory hurdles and we believe it highly unlikely that it would receive approval.

### **Options for Achieving Conservation Goals**

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<sup>27</sup> DOT Ch. 305.

<sup>28</sup> DOT Ch. 299. Appendix F.

<sup>29</sup> DOT Ch. 299-A (1.3)(A).

<sup>30</sup> DOT Ch. 299-B (1.3)(A).

<sup>31</sup> DOT Ch. 299-B (2.3),(2.4).

The conservation plan for the marsh reflects a landscape view of conservation, based on an understanding of the unique natural values as well as the current threats. By design, the Penjajawoc Conservation Plan does not take into account factors such as current zoning, property lines or landowner preferences. However, these are key factors in determining the most appropriate or effective tools to use for conserving individual parcels. The Bangor Land Trust will need to decide which conservation tools are most appropriate.

### Standard Land Trust Options

As the Bangor Land Trust is undoubtedly aware, the Maine Coast Heritage Trust provides a variety of resources to land trusts interested in land conservation including *Conservation Options: A guide for Maine Landowners*. This comprehensive guide describes the tools available and is not summarized here, but can be accessed on the web at <http://www.mcht.org/options/>. It also includes a discussion on all aspects of buying land, easements, tax advantages etc. in detail. Maine Coast Heritage Trust also provides technical assistance to land trusts through their Maine Land Trust Network.

It is often said that the most certain vehicle for permanent conservation of a resource is to buy it (e.g. fee acquisition), but the hurdle of raising the required funds can be daunting. The Land for Maine's Future Board has been an excellent source for funding projects such as the Penjajawoc Marsh. This fund is not currently funded, but will likely become available in the future.

Below, we have described additional opportunities that may augment the standard land trust tools outlined in the guide referenced above.

### Landowner Incentive Program (LIP)

The unique qualities of the Penjajawoc Marsh may make the site eligible for funding through the Landowner Incentive Program. This program was designed to assist states by providing grants to protect and restore habitats on *private lands*, to benefit federally listed, proposed or candidate species or other species determined to be at risk, and to provide technical and financial assistance to private landowners for habitat protection and restoration. Although state agencies with primary responsibility for fish and wildlife must submit proposals, organizations or individuals may partner with or serve as a sub-grantee of our state fish and wildlife agency. All grants require a 25% match of non-federal dollars.

A steering committee was set up to provide programmatic guidance and oversight of LIP resources and a staff person hired to help run the program. A fact sheet describing the program is in Appendix 10.

In 2004, Maine applied for LIP funds and received \$1.3 million for protecting rare plants and ecosystems, endangered and threatened wildlife and their habitats. The next LIP funds are scheduled to be awarded in the spring of 2005.

The Penjajawoc Marsh is within what is known as the Caribou Bog Focus Area (see Appendix 1), which has been designated as a conservation priority by a collaborative process involving state agencies and nonprofit organizations. The program responsible for designating areas is called *Beginning with Habitat* and is non-regulatory. Areas were chosen using an objective science-based approach. Under the LIP program, any privately owned land would be eligible to apply for funding for easements or even long-term management agreements. Proposals are scored based on standardized criteria. Although the LIP program is currently focused on southern Maine, all projects are eligible for funding and can apply at any time.

### Wetland Mitigation

While state and federal laws clearly establish that avoiding loss of or damage to wetlands is the prime objective, the laws recognize that there will be occasions when avoidance is not possible. In instances where a development project causes loss or damage to a wetland's functions or values, the law requires that the party causing the loss or damage must act to mitigate these effects or compensate for them. It is important to note that wetland mitigation can only be utilized in cases of wetland loss. This mitigation can take one of four forms, in order of preference:

1. **Restoration**, returning a damaged wetland as close as possible to its original condition prior to the damage;
2. **Enhancement**, making changes or improvements to wetlands to replace the functions or values performed by the wetlands lost or damaged;
3. **Preservation**, protecting wetlands in an adjacent area that are equivalent to the area damaged and that might otherwise be subject to an unregulated activity;
4. **Creation**, converting a non-wetland area into a wetland with all of the physical and biological characteristics to replace the area lost or damaged.

The rules under the Natural Resources Protection Act also allow for "mitigation banking." This allows an applicant who will be negatively impacting a wetland to create, restore, enhance or *preserve* wetlands as "credit" to offset future project impacts. Currently, wetland banking is limited because the compensation work must take place in the same watershed or in the project vicinity of any future alteration work planned and as close as possible to the proposed wetland alteration site(s). In addition, no applicant may propose to use mitigation banking to compensate for more than 25 acres of wetlands alteration in any one year period. The best use of mitigation in the Bangor region would be to focus money on preserving the Penjajawoc Marsh, rather than spending it on smaller, less significant wetlands in the area.

Recently, the Department of Transportation developed a mitigation project using information from the Beginning with Habitat Focus Areas of Statewide Ecological Significance. Reconstruction of a 6.6 mile section of Route 112 resulted in 1.6 acres of wetland impacts. A mitigation package was put together with a willing seller that resulted in conservation of 45 acres including a section of the Saco Heath, approximately 1000 ft of stream frontage as well as shrub and forested wetlands. The option was acceptable to the USFWS even though it was preservation and not restoration. This was due to the exemplary nature of the

community that was being protected. The mitigation site was acquired and transferred to The Nature Conservancy.

### Regulatory Options

Shoreland zoning, wetlands rules, designation of key habitats as “Significant Wildlife Habitat” (SWH) under the Natural resources Protection Act (NRPA) and the Site Law all help protect the State’s most significant resources and redirect development projects. Each has strengths and weaknesses. Below are some options for strengthening these tools to help protect the Penjajawoc Marsh.

**Shoreland zoning** is a locally administered regulation and must meet minimum standards set by the State. All shoreland zoning ordinances, including any changes to existing ordinances, must be reviewed by the DEP to assure minimum standards are being met. However, local governments have great latitude in creating an ordinance that goes beyond the minimum set by the state, particularly if they wish to provide greater protection for a locally valuable resource. For example, in Casco, Maine the Shoreland District disallows any construction within 100 feet of lakes, ponds or rivers; within 250 feet in a resource protection area; and within 130 feet of streams or wetlands within the shoreland zone (Casco website: <http://www.cascomaine.org/comp/landuse.html>). Expanding the shoreland zone around the Penjajawoc Marsh could help keep larger developments out of the Core Habitat and guide smaller developments away from the edge of the marsh. Currently, the City of Bangor has defined the shoreland zone around the Penjajawoc Marsh as only 75 feet. Recently, this 75 foot shoreland zone was also designated as “resource protection” but this designation did not substantially enhance the area’s protection. .

The literature supports increasing the Shoreland Zone for wildlife values to as much as 600 feet. For example, in *Vegetated Buffers in the Coastal Zone; a Summary Review and Bibliography* (Desbonnet et al. 1994), the authors state “At 200 m (660feet), 90% of pollutants can be removed and there is excellent general wildlife habitat likely to support a diverse community”; Spackman and Hughes (1995) Vermont study found that 90% of bird species are included within 150-175 m(492-574 ft) buffers along most streams; Vander Haegen and deGraaf (1996) Maine study >150 m (492 ft) buffer strips along riparian zones to reduce edge-related nest predation; and, *Buffers for Habitat for the Connecticut River Watershed* (2000) 600 feet for wildlife dependent on wetlands or watercourses, specifically Bald eagle, nesting heron, cavity nesting ducks and 660 ft for songbirds, specifically Scarlet tanager, American redstart, rufous-sided towhee.

**Significant Wildlife Habitat** designation is currently an arduous and redundant process. There are two aspects that could be altered to address the administrative red tape and allow for these habitats have the protection they need.

Although the statute requires a SWH to be mapped before it can be officially recognized, this is not true of other types of regulated habitats. For example, it is standard for developers themselves to delineate wetlands prior to obtaining a permit. We propose that the mapping requirement be removed for several SWH including waterfowl and wading bird habitat.

DIFW would then adopt a definition of the SWH and standards for its protection through rulemaking. For many of these habitats, the general location is already known. This change must be made in statute and has been proposed for the current legislative session.

The second change we propose would be to streamline the process of adoption of SWH. Policy at DIFW has been to develop criteria for designation, delineate the habitat on maps *and* go through the public process of “rule-making” *separate* from the DEP. DEP must then go through its own rulemaking process. The redundancy of two separate rulemaking processes and the requirement to have each habitat mapped has contributed to a virtual halt in designating SWH. Therefore, developers may be under the impression that SWH does not occur on their property since it has not been designated. By encouraging DIFW and DEP to conduct joint rulemaking, developers would be getting the most up-to-date information from the agencies to use in their planning process at the onset.

Great frustration on the part of both developers and environmental groups has occurred by *not* designating SWH. In the case of the Penjajawoc Marsh, developers have claimed that they only “found out” about the significance of the marsh after many of their plans had been made. In this case, the lack of identifying SWH probably promoted a more adversarial process.

#### Public Outreach and Education

There is always a need to conduct outreach and educational programs when working towards conservation. The opportunities are almost endless. Below, we’ve selected a few activities that might be of interest to the Bangor Land Trust or collaborators.

- Work with the city of Bangor to develop an Open Space plan as part of the comprehensive plan. This is a public process with opportunity for community engagement in developing a vision.
- Create and share outreach materials about the marsh with land owners and community members.
- Work with willing landowners to develop voluntary management agreements, especially related to managing fields and grasslands for wildlife.
- Wildlife Habitat Incentives Program: A federal program that provides technical assistance and cost-sharing payments to implement habitat management practices on private land. May be useful for grassland management on private lands (see website: <http://www.me.nrcs.usda.gov/> and Appendix 11).

## Conclusion

The Penjajwoc Marsh is indeed an outstanding wetland with significant challenges for any organization attempting to conserve the marsh's functions and values for future generations. The species richness and diversity, its proximity to the undeveloped Caribou Bog area, adjacent field habitats all make it a unique and beautiful place. The pattern of ownership and proximity to the Bangor Mall will make carrying out this plan a challenge, but one worth the effort.

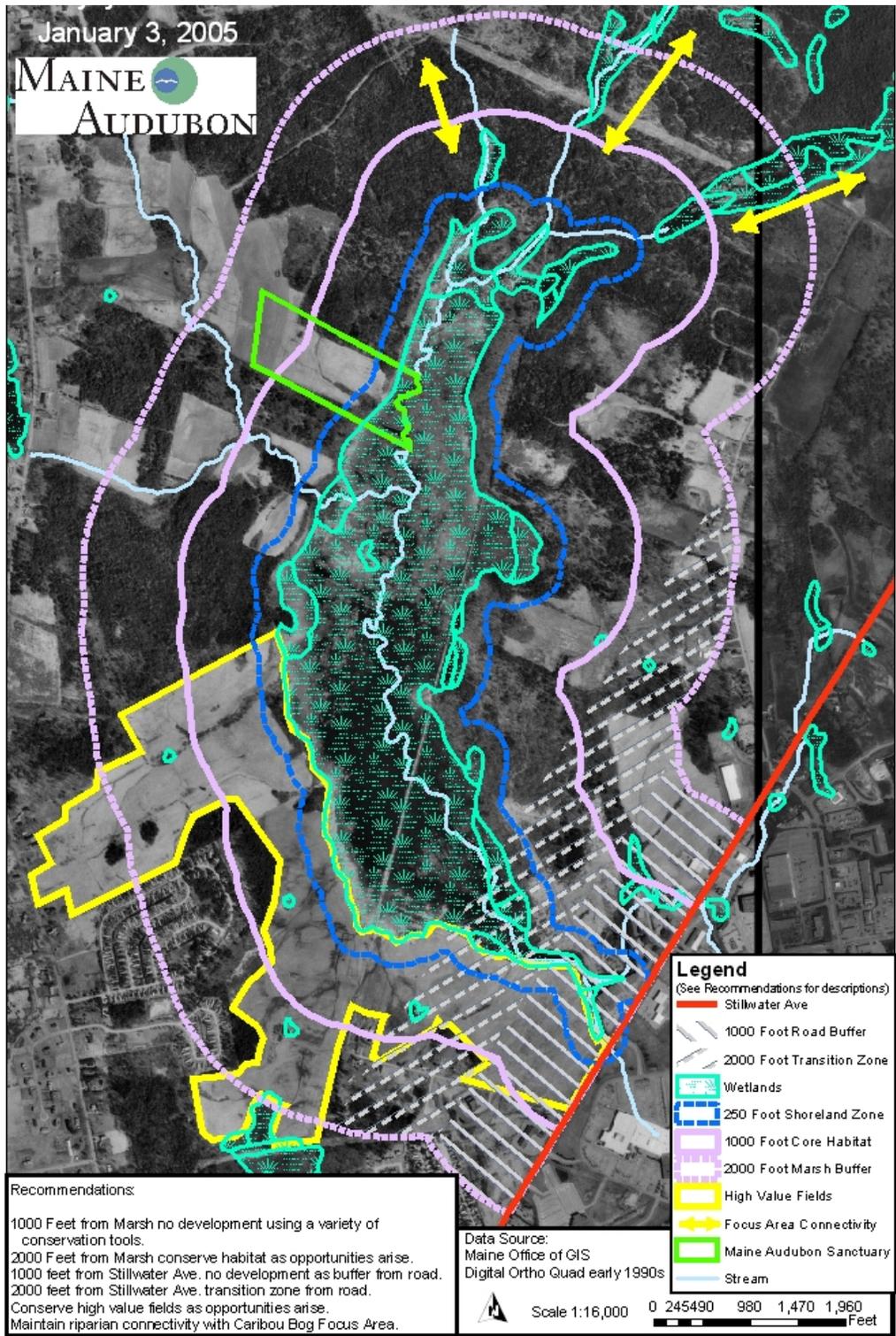
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# Appendix D: Site Maps. Figure 4. Penjajawoc Marsh Conservation Plan.



# Appendix D: Site Maps. Figure 5. Beginning with Habitat Analysis of Caribou Bog.

