






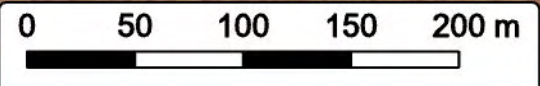
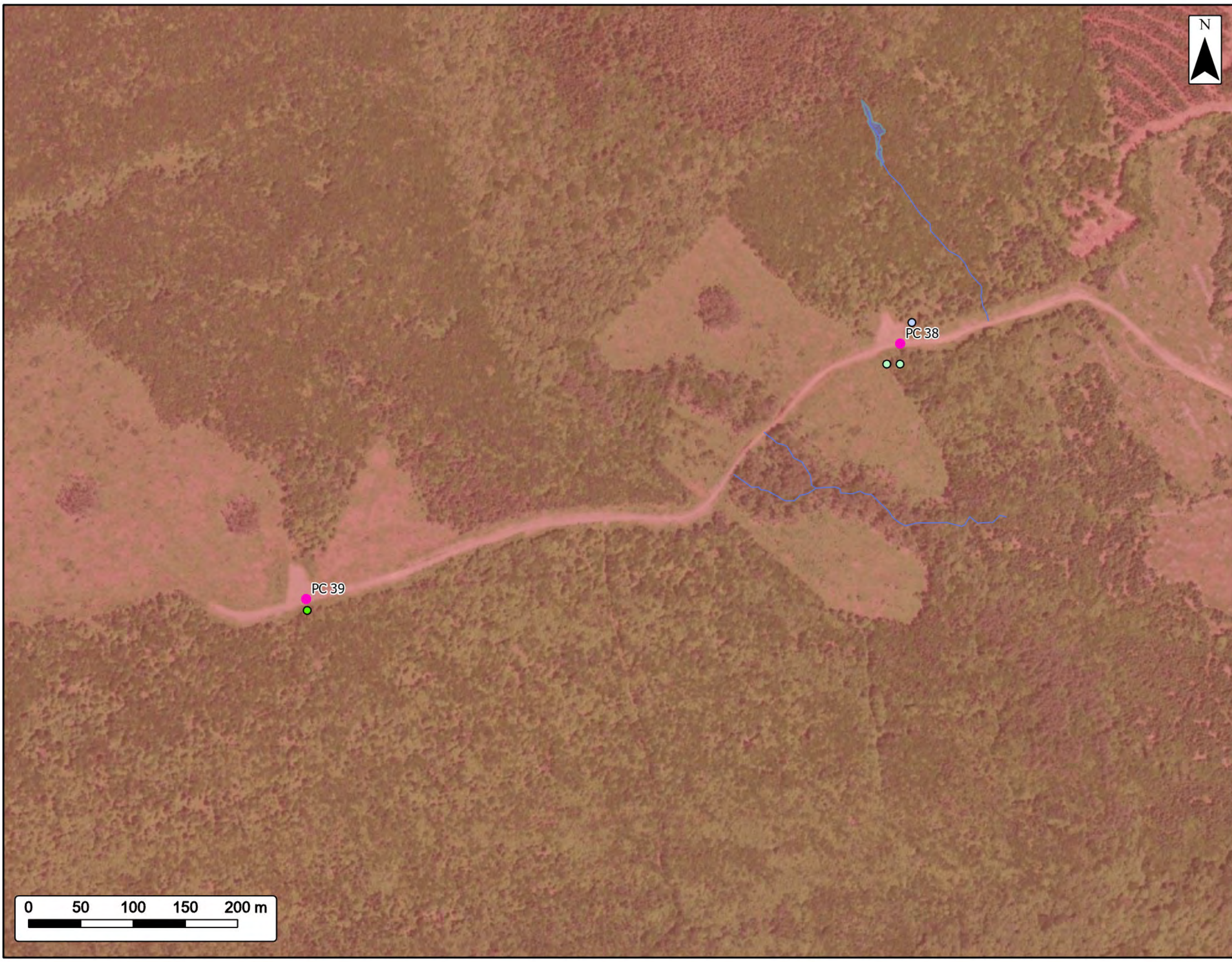




# Clydesdale Ridge Wind Project

Avian Species of Conservation Interest (SOCI) Field Observations

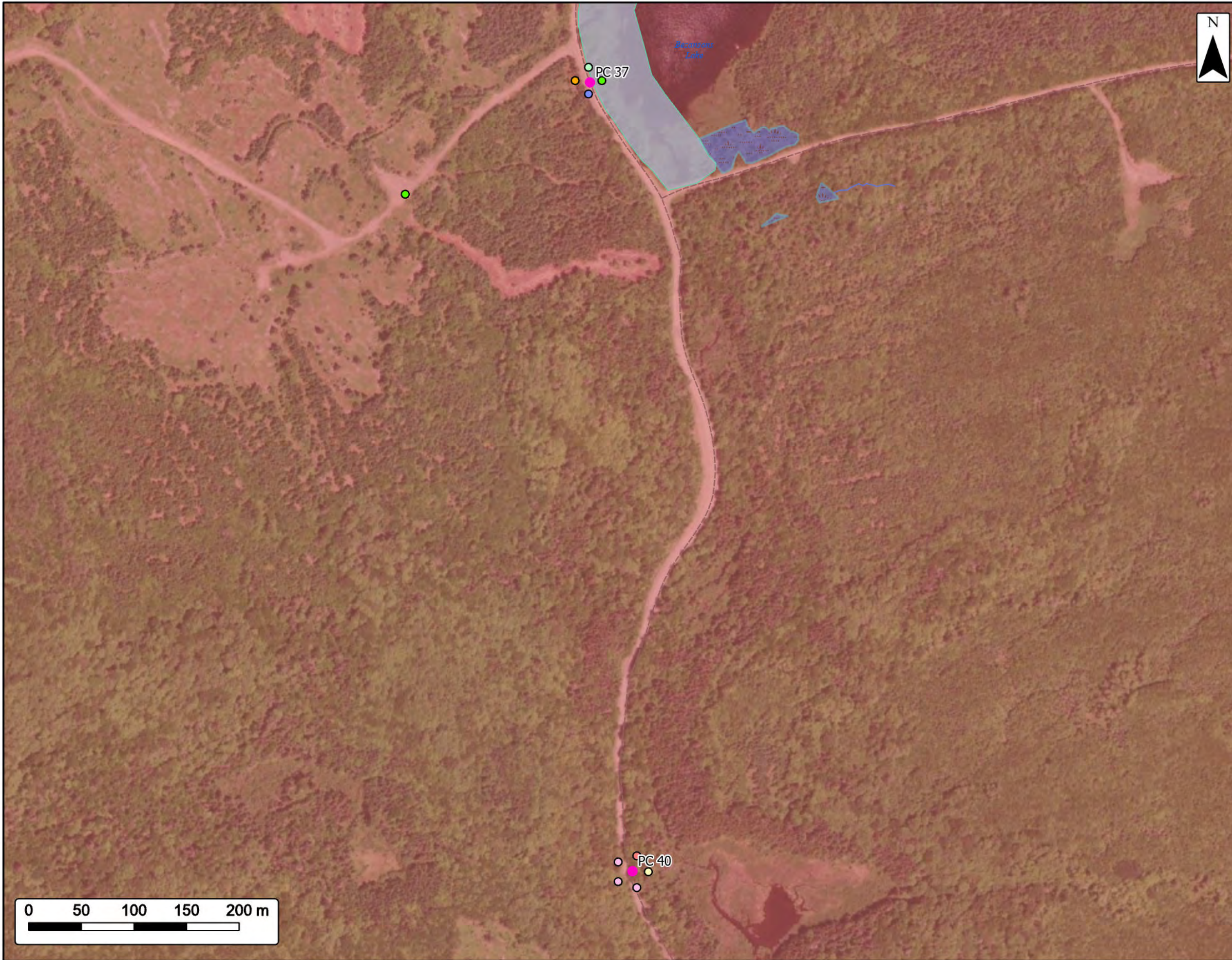
- Project Area 
- Spring & Fall Migration Survey Location 
- Species of Conservation Interest**
- Bay-breasted Warbler 
- Boreal Chickadee 
- Canada Jay 
- Field Delineated Watercourses within PDA 
- Field Delineated Wetlands within PDA 



Coordinate System: NAD83 UTM Zone 20N Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, IBA Canada, CNWI, HERE, Garmin, USGS

Date: Jun 2024	Project #: 24-10018
Scale: 1:3,500	Drawing #: <b>5</b>
Drawn By: K. Wallace	
Checked By: S. Stegen	

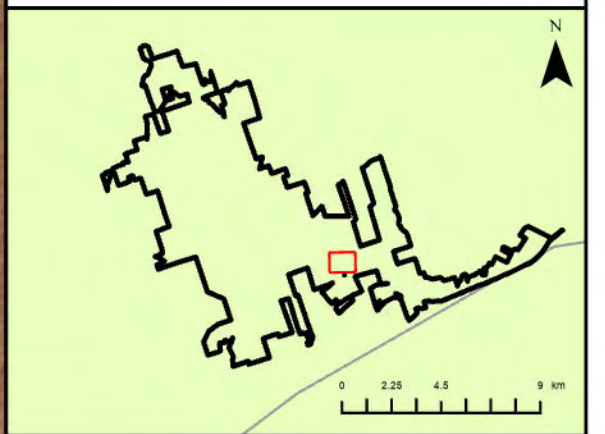




# Clydesdale Ridge Wind Project

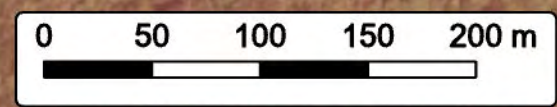
## Avian Species of Conservation Interest (SOCI) Field Observations

Project Area	
Spring & Fall Migration Survey Location	
<b>Species of Conservation Interest</b>	
Baltimore Oriole	
Boreal Chickadee	
Canada Jay	
Northern Pintail	
Pine Siskin	
Rose-breasted Grosbeak	
Turkey Vulture	
Field Delineated Watercourses within PDA	
Field Delineated Wetlands within PDA	
Field Delineated Open Water	
<b>Transportation</b>	
Unpaved Road	



Coordinate System: NAD83 UTM Zone 20N Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, IBA Canada, CNWI, HERE, Garmin, USGS

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APPENDIX B  
PRIORITY SPECIES LIST

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Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<b>AVIFAUNA</b>						
<i>Accipiter cooperii</i>	Cooper's Hawk	S1?B,SUN,SUM				Not common in Nova Scotia but does breed in the province. Found in mature forest, open woodlands, wood edges and river groves. Nests in coniferous, deciduous and mixed woods, typically those with tall trees and with openings or edge habitat nearby. Also found among trees along rivers through open country, and increasingly in suburbs and cities where tall trees exist for nesting (e.g. parks, open fields and even backyards with feeders). Breeds between April and July (Audubon and The Cornell Lab)
<i>Accipiter gentilis</i>	Northern Goshawk	S3S4				Found in coniferous and mixed forests. Generally restricted to wooded areas (along riparian corridors), but may be in relatively open woods or along edges. Often more common as a breeding bird in mixed woods (e.g. mature and old-growth forests with more than 60% closed canopy). In the East, goshawks seek out nest sites in mixed-hardwood forests where beeches, birch, hemlock and maples dominate. Goshawks often build nests near breaks in the canopy, such as a forest trail, road or opening created by a downed tree and prefer sites with a creek, pond or lake nearby. Breeds between April and July. May mate for life (Audubon and The Cornell Lab).
<i>Actitis macularius</i>	Spotted Sandpiper	S3S4B,S5M				Common near fresh and saltwater. Habitat includes pebbly lake shores, ponds and streamsides (and seashores in the winter). Spotted Sandpipers spend the winter along the coasts of North America. During migration and winter, this species is found along the coast on mudflats, beaches and breakwaters (also found in inland habitats such as sewage ponds and irrigation ditches). Breeds near the edge of fresh water in a wide variety of settings, including lakes, ponds, rivers and streams (in either open or wooded country). Breeding territories generally need to have a shoreline, a semi-open area for the nest and patches of dense vegetation to conceal the chicks. Breeds between April and July (Audubon and The Cornell Lab).
<i>Aegolius funereus</i>	Boreal Owl	S2?B,SUM				Year-round resident, mainly in Cape Breton (MBBA, as of July 2021). Does not migrate regularly, but is nomadic and moves outside of range when prey is scarce. Boreal Owls occur in stands of spruce, aspen, poplar, birch and fir in the boreal forest (muskeg, mixed-wood and conifer forests). They also occur in high elevation mountains with subalpine forests in Canada. In the winter, they forage in spruce-fir forests where uncrusted snow under the trees facilitates access to prey. In spring, they often forage in clearcuts and agricultural fields where small mammals are easier to locate. Beginning in late winter or early spring, male sings at night to defend territory and attract a female (Audubon and The Cornell Lab).
<i>Ammospiza nelsoni</i>	Nelson's Sparrow	S3S4B				They spend most of their time on or near the ground in dense marsh vegetation. Nelson's Sparrow breed mainly in fresh and saltwater marshes in the northern Great Plains and along the northern Atlantic Coast. Breeds between April and July (Audubon and The Cornell Lab)
<i>Anas acuta</i>	Northern Pintail	S1B,SUM				Found in marshes, prairies, fresh ponds, lakes and salt bays. Summers in wide variety of open habitats, including prairies, farmland, northern tundra and near bodies of water. Breeds in seasonal wetlands, open areas with short vegetation, wet meadows, grasslands and crop fields. During the nonbreeding season they use flooded and dry agricultural fields, lakes, reservoirs, estuaries, saltmarshes, freshwater and brackish wetlands and bays. Pintails also use different habitats depending on time of day (e.g. tend to forage in wetlands during the day). Breeds between April and July (Audubon and The Cornell Lab)
<i>Antrostomus vociferus</i>	Eastern Whip-Poor-Will	S1?B	Threatened	Threatened	Threatened	Roughly 50% of home ranges consisted of open habitats, used primarily for foraging. Common habitat choices include rock or sand barrens with scattered trees, savannahs, old burns or other disturbed sites in a state of early to mid-forest succession, or open conifer plantations. Accordingly, pine (barrens and plantations), oak (barrens and savannahs), and aspen and birch (early to mid-succession) are common tree species associations. Individuals will often feed in nearby shrubby pastures or wetlands where perches, and power-line and roadway corridors are also occupied. Other necessary habitat elements are thought to involve ground-level vegetation and woodland size. Areas with little ground cover are preferred.
<i>Asio flammeus</i>	Short-eared Owl	S1B	Threatened	Special Concern		Short-eared Owls breed primarily in well-drained grasslands near coastal wetlands. In areas with extensive coastlines, some caution is warranted in summarizing breeding habitat as inland marshes and bogs are less frequently monitored and thus may be under-represented in assessments of breeding habitat (COSEWIC Assessment and Status Report).
<i>Asio otus</i>	Long-eared Owl	S2S3				Known to breed throughout Nova Scotia. They occur at elevations ranging from near sea level to above 6,500 feet. May be nomadic at times, moving about in response to changing food supplies. Favored habitat includes dense trees for nesting and roosting and open country (e.g. grasslands and shrublands) for hunting. Inhabits a wide variety of such settings, including forest with extensive meadows to groves of conifers or deciduous trees. Generally avoids unbroken forest. Known to be an early breeder. Breeds between April and July (Audubon and The Cornell Lab).
<i>Botaurus lentiginosus</i>	American Bittern	S3S4B,S4S5M				Found in marshes and reedy lakes. Breeds in freshwater marshes, mainly large, shallow wetlands with a large amount of tall marsh vegetation (cattails, grasses and sedges) and areas of open shallow water. Sometimes feeds in dry grassy fields. They are rarely seen out in the open, prefers vegeation cover. Breeds between April and July (Audubon and The Cornell Lab)
<i>Bucephala clangula</i>	Common Goldeneye	S2S3B,S5N,S5M				Winters in Nova Scotia along the coast. Generally migrates late in fall and early in spring. Males tend to winter farther north than females. Found in shallow coastal bays, estuaries that offer good foraging sites: sand, gravel, rock and boulder substrates supporting mollusks and crustaceans. In the interior, wintering flocks gather on large lakes and rivers as far north as open water occurs. Breeds between April and July (Audubon and The Cornell Lab)
<i>Buteo lagopus</i>	Rough-legged Hawk	S3N				Common across Nova Scotia during nonbreeding (winter). Spends the winter in open country, including grasslands, coastal prairies, marshes, farmland and dunes. In tree-covered areas they hunt over open bogs and other clearings. Breeds mostly on tundra, in areas having cliffs for nest sites; some breed along northern edge of coniferous forest zone. Rough-legged Hawks breed in open country of the arctic, both in North America and Eurasia. Breeds between April and July. May mate for life (Audubon and The Cornell Lab).

Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<i>Accipiter cooperii</i>	Cooper's Hawk	S1?B,SUN,SUM				Not common in Nova Scotia but does breed in the province. Found in mature forest, open woodlands, wood edges and river groves. Nests in coniferous, deciduous and mixed woods, typically those with tall trees and with openings or edge habitat nearby. Also found among trees along rivers through open country, and increasingly in suburbs and cities where tall trees exist for nesting (e.g. parks, open fields and even backyards with feeders). Breeds between April and July (Audubon and The Cornell Lab)
<i>Calidris melanotos</i>	Pectoral Sandpiper	S3M				Common migrant in Nova Scotia. Compared to other shorebirds, migration is relatively early in spring and late in fall (adults before juveniles). During migration, they prefer wet, grassy environments such as prairie pools, muddy shores, fresh and tidal marshes. They prefer tundra in the summer. Migrants favor grassy places rather than open mudflats. Often seen along grassy edges of shores, at edges of tidal marshes, in flooded fields or wet meadows. Sometimes on dry prairie or even plowed fields. On breeding grounds, favours wet grassy areas of tundra dominated by grasses and sedges. Breeds between April and July (Audubon and The Cornell Lab).
<i>Calidris pusilla</i>	Semipalmated Sandpiper	S3M				Common migrant in Nova Scotia. Migrates in flocks (adults before juveniles). May make very long nonstop flights between major feeding areas on migration. Semipalmated Sandpipers nest in low tundra, usually not far from marshes or ponds (both dry upland habitats with sufficient vegetation cover). In preparation for migration, they gather into flocks in shallow-water mudflats or lakeshores. Migrating birds stop over at sewage ponds, ephemeral wetlands (rain pools), beaches, inlets, estuaries, tidal mudflat, sandbars and freshwater impoundments with shallow margins (edges of lakes and marshes). Breeds between April and July (Audubon and The Cornell Lab).
<i>Cardellina canadensis</i>	Canada Warbler	S3B	Special Concern	Threatened	Endangered	Forest undergrowth, shady thickets. Breeds in mature mixed hardwoods of extensive forests and streamside thickets. Prefers to nest in moist habitat: in luxuriant undergrowth, near swamps, on stream banks, in rhododendron thickets, in deep, rocky ravines and in moist deciduous second-growth.
<i>Cardellina pusilla</i>	Wilson's Warbler	S3B,S5M				Found in thickets along wooded streams, moist tangles, low shrubs, willows, alders. Breeds in thickets, second-growth, bogs, or in alder and willow groves near streams and ponds. In migration and winter, occurs from hot lowland thickets up to cool mountain woods; always in scrubby overgrown clearings and thin woods, not in the interior of dense forest. Breeds between April and July (Cornell Lab, Audubon).
<i>Cathartes aura</i>	Turkey Vulture	S2S3B,S4S5M				In past was not surveyed/very rare to see Turkey Vultures in Nova Scotia, but as the climate warms they are now sighted across the province (MBBA and Nova Scotia Bird Society). Look for Turkey Vultures as they soar high over open areas. They are particularly noticeable along roadsides and at landfills. At night, they roost in trees, on rocks and other high secluded spots. Most common over open or semi-open country (including mixed farmland, forest, rangeland and even small offshore islands), especially within a few miles of rocky or wooded areas providing secure nesting sites. Generally avoids densely forested regions. Breeds between April and July (Audubon and The Cornell Lab)
<i>Chordeiles minor</i>	Common Nighthawk	S3B	Special Concern	Special Concern	Threatened	Common Nighthawk breeds in a range of open and partially open habitats, including forest openings and post-fire habitats, prairies, bogs, and rocky or sandy natural habitats, as well as disturbed areas. It is also found in settled areas that meet its habitat needs, those with open areas for foraging and bare or short-cropped surfaces for nesting. The species use of a wide range of habitats makes it difficult to estimate trends in habitat availability, except in urban habitats, where their main nesting sites – flat graveled roofs – are disappearing.
<i>Chroicocephalus ridibundus</i>	Black-headed Gull	S3N				Most of this species in Nova Scotia likely comes from Iceland (followed by a sudden growth of the Icelandic nesting population in the 1930s). In winter, found primarily along seacoasts, estuaries and protected bays (generally rare on fresh waters well inland). Breeds along lakes, rivers, bogs, moors, grasslands, swamps and coastal marshes. Usually nests in colonies, sometimes in isolated pairs. Breeds in scattered colonies between April and July (Audubon and The Cornell Lab).
<i>Coccothraustes vespertinus</i>	Evening Grosbeak	S3B,S3N,S3M	Special Concern	Special Concern	Vulnerable	Evening Grosbeak breeding habitat generally includes open, mature mixedwood forests, where fir species and/or White Spruce are dominant, and Spruce Budworm is abundant. Outside the breeding season, the species seems to depend largely on seed crops from various trees such as firs and spruces in the boreal forest, but is also attracted to ornamental trees that produce seeds or fruit, and bird feeders stocked with sunflower seeds.
<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	S3B				Black-billed Cuckoos are birds of woodlands and thickets, including aspen, poplar, birch, sugar maple, hickory, hawthorn and willow. They tend to occur more frequently in larger and denser woodlands than the Yellow-billed Cuckoo. On their wintering grounds, they live in forest, woodlands and scrub. A long-distance migrant, going to South America for the winter. Migrates at night; sometimes heard calling in flight overhead at night during the spring. During migration, they seek any kind of dense vegetation cover (e.g. young trees or tall shrubs). Common breeder in Nova Scotia. Breeds mostly in deciduous thickets and shrubby places, often on the edges of woodland or around marshes. Also in second growth of mixed deciduous-coniferous woods, or along their brushy edges. Breeds between April and July (Audubon and The Cornell Lab).
<i>Contopus cooperi</i>	Olive-sided Flycatcher	S3B	Special Concern	Special Concern	Threatened	Olive-sided Flycatcher has been widely observed in open coniferous or mixed coniferous forests, often located near water or wetlands with the presence of tall snags or trees from which the species sallies for prey and advertises its territory. Mature conifer stands within patchy landscapes influenced by natural disturbance (e.g., recent burns) support the highest densities of Olive-sided Flycatcher. Nests are generally placed toward the tip of coniferous branches (although other tree types have been used).
<i>Contopus virens</i>	Eastern Wood-Pewee	S3S4B	Special Concern	Special Concern	Vulnerable	The Eastern Wood-pewee is mostly associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation. During migration, a variety of habitats are used, including forest edges, early and successional clearings.

Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<i>Coturnicops noveboracensis</i>	Yellow Rail	SUB	Special Concern	Special Concern		Yellow rail is distributed along northern Nova Scotia. Nesting Yellow Rails are typically found in marshes dominated by sedges, true grasses, and rushes, where there is little or no standing water (generally 0-12 cm water depth), and where the substrate remains saturated throughout the summer. They can be found in damp fields and meadows, on the floodplains of rivers and streams, in the herbaceous vegetation of bogs, and at the upper levels (drier margins) of estuarine and salt marshes. Nesting habitats usually have a dry mat of dead vegetation from previous growing seasons. A greater diversity of habitat types is used during migration and winter than during the breeding season. In winter, the rails are known to use coastal wetlands and rice fields. (COSEWIC Assessment and Status Report).
<i>Empidonax traillii</i>	Willow Flycatcher	S2B				Uncommon breeder throughout mainland Nova Scotia, not Cape Breton (MBBA, as of July 2021). In winter, they use shrubby clearings, pastures and woodland edges often near water. Migrates relatively late in spring and early in fall. Breeds in thickets of deciduous trees and shrubs, especially willows, or along woodland edges. Often near streams or marshes and may be found in drier habitats than the Alder Flycatcher. Breeds between April and July (Audubon and The Cornell Lab).
<i>Euphagus carolinus</i>	Rusty Blackbird	S2B	Special Concern	Special Concern	Endangered	Breeding habitat is characterized by coniferous-dominated forests adjacent to wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps and beaver ponds. On migration, the Rusty Blackbird is primarily associated with wooded wetlands. In winter, it occurs primarily in lowland forested wetlands, cultivated fields and pecan groves. Suitable habitat for the species appears to be decreasing on its breeding range and wintering grounds, due mainly to the loss and degradation of wetlands by human activities.
<i>Gallinago delicata</i>	Wilson's Snipe	S3B,S5M				Common across Nova Scotia during breeding and also known as a permanent resident in the southern areas of the province. Wilson's Snipes can be found in all types of wet, marshy settings, including wet fields, bogs, fens, swamps, wet meadows and along muddy edges of rivers and ponds. They avoid areas with tall, dense vegetation, but need patches of cover to hide in and to provide a safe lookout for predators. During the breeding season they are mainly found around fresh marshes and bogs, shrubby streambanks and northern tundra. Breeds between April and July (Audubon and The Cornell Lab).
<i>Gallinula galeata</i>	Common Gallinule	S1B				Common Gallinules use freshwater and brackish marshes, ponds and lakes that have a mix of submerged, floating and emergent aquatic vegetation and are open water year-round. They also use artificial aquaculture ponds, rice fields, sewage lagoons and urban stormwater retention ponds. May be on more open ponds with less marsh cover or on still, slow-moving waters. Found with American Coot in many places, but requires more marsh growth. Breeds between April and July (Audubon and The Cornell Lab).
<i>Haemorhous purpureus</i>	Purple Finch	S3S4N, S4S5B,S5M				Found throughout the entire province year-round. Purple finches can be found in woods, groves, suburbs. Breeds mostly in coniferous and mixed woods, both in forest interior and along edges. In migration and winter, found in a wide variety of wooded and semi-open areas, including forest, suburbs, swamps, and overgrown fields. Breeding occurs from April to July (The Cornell Lab, Audubon)
<i>Hirundo rustica</i>	Barn Swallow	S3B	Special Concern	Threatened	Endangered	Barn Swallows forage over a wide range of open and semi-open habitats including natural and anthropogenic grasslands, other farmland, open wetlands, open water, savannah, tundra, highways and other cleared right-of-ways, and cities and towns. They avoid forested regions and high mountains. Barn Swallows throughout the world have adapted to nesting in or on human structures, including buildings, barns, bridges, culverts, wells and mine shafts. Use of natural nest sites such as caves or rock cliffs with crevices or ledges protected by overhangs is rarely reported. Nocturnal roosts are typically in reed or cane beds or other dense vegetation, usually in or near water.
<i>Icterus galbula</i>	Baltimore Oriole	S2S3B,SUM				Baltimore Orioles are often very common in open woods and groves in summer. Found in open woods, riverside groves, elms, shade trees. Breeds in deciduous or mixed woodland, generally in open woods or edges rather than interior of dense forest. May be common in trees in towns (Audubon). Breeds between April and July (Audubon and The Cornell Lab).
<i>Ixobrychus exilis</i>	Least Bittern	SUB	Threatened	Threatened		The Least bittern has been observed in every Province in Canada. However, it is only probable to be located in Nova Scotia. The Least Bittern breeds strictly in marshes dominated by emergent vegetation surrounded by areas of open water. Most breeding grounds in Canada are dominated by cattails, but breeding also occurs in areas with other robust emergent plants and in shrubby swamps. The presence of stands of dense vegetation is essential for nesting because the nests of Least Bittern sit on platforms of stiff stems. The nests are almost always within 10 m of open water. This small heron prefers large marshes that have relatively stable water levels throughout the nesting period. Needs for wintering habitat are less specific, and appear to be met by a wide variety of wetlands—not only emergent marshes like those used for breeding, but also brackish and saline swamps (Environment Canada Recovery Strategy)
<i>Lanius borealis</i>	Northern Shrike	S3S4N				They occur in open but brushy habitats, and on calm, sunny days they may sit up on utility wires, bushes, and trees (Cornell Lab). Nests are usually placed in a low tree or large shrub, often in spruce or willow, usually 6-15' above the ground. Breeds between April and July (Audubon and The Cornell Lab).
<i>Limosa haemastica</i>	Hudsonian Godwit	S2S3M	Threatened	No Status		Hudsonian Godwit occurs regularly during breeding or migration in all three territories and in provinces from British Columbia to Québec, as well as occasionally in the fall in all of the Atlantic provinces. Hudsonian Godwit breeds in wetland habitats (sedge meadows and muskeg) in sub-Arctic and Boreal regions. It uses a wide variety of habitats on migration, including freshwater marshes, saline lakes, flooded fields, shallow ponds, coastal wetlands and mudflats (COSEWIC Assessment and Status Report).
<i>Loxia curvirostra</i>	Red Crossbill	S3S4				Found throughout the entire province year-round. Red Crossbills can be found in conifer forests and groves, and breeds in pines (predominately), spruce, hemlock, Douglas-fir, or other evergreens. Breeding occurs from April to July (The Cornell Lab, Audubon)

Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<i>Mimus polyglottos</i>	Northern Mockingbird	S1B				Year-round resident throughout Nova Scotia, less common in Cape Breton. Found year-round in areas with open ground and shrubby vegetation (e.g. dense, low shrubs - hedges, fruiting bushes and thickets). When foraging on the ground, it prefers grassy areas, rather than bare spots. Common places include roadsides, parkland, cultivated land, suburban areas, woodland edges and in second-growth habitat at low elevations. Breeds between April and July (Audubon and The Cornell Lab).
<i>Myiarchus crinitus</i>	Great Crested Flycatcher	S1B				Uncommon breeder throughout mainland Nova Scotia, not Cape Breton (MBBA, as of July 2021). Migrates mostly at night. Breeds mainly in deciduous forest or mixed forest, but avoids pure stands of conifers. May be found in either continuous deep forest or in more open wooded areas, around edges of clearings or abandoned orchards. Dead snags and dying trees are important sources of the cavities they need for nesting (will even search out cavities in old orchards and in woody urban areas like parks, cemeteries and golf courses). If there are enough trees, they will claim territories in pastures, along streams and rivers, and in swamps and wetlands. Breeds between April and July (Audubon and The Cornell Lab).
<i>Numenius phaeopus hudsonicus</i>	Whimbrel	S2S3M				Common migrant in Nova Scotia. Migrating whimbrels feed mostly on tidal mudflats and sandflats; they also forage in saltmarshes, lagoons, estuaries and on reefs and rocky shorelines where small crabs are available. When not feeding, Whimbrels roost in flocks in marshes, meadows, fields, dunes and oyster beds, as well as on small islands and even in mangrove trees. Migrating Whimbrels are known to also use coastal tundra and heath in Alaska and Canada. North American Whimbrels breed in subarctic and alpine tundra and taiga, nesting in drier upland environments (heath) or (mainly) wetter lowlands with grasses, sedges, mosses, lichens, small shrubs and stunted trees. Breeds between April and July (The Cornell Lab and eBird).
<i>Oxyura jamaicensis</i>	Ruddy Duck	S1B				Uncommon in Nova Scotia during migration. Only a few confirmed sightings in Cumberland and Antigonish county (MBBA, as of July 2021) - Migration extends over a considerable period in both spring and fall. Migrating Ruddy Ducks stop in a variety of habitats, mainly on large, permanent wetlands, ponds, marshes, lakes and reservoirs. About 86 percent of the breeding population is concentrated in the prairie pothole region of south-central Canada, hence why they are uncommon in Nova Scotia. Breeds between April and July (Audubon and The Cornell Lab)
<i>Passerella iliaca</i>	Fox Sparrow	S3S4B,S5M				Found year round in Cape Breton, and throughout the migration season (late March and early November) in the rest of the province. Migrates at night. Found in wooded areas, undergrowth, brush. Breeds in brushy areas including woodland edges and clearings, streamside thickets, scrubby second growth, stunted coastal forest. Winters in similar habitats, also in brushy fields, chaparral, well-vegetated suburbs and parks. Breeds from April to July (The Cornell Lab, Audubon)
<i>Passerina cyanea</i>	Indigo Bunting	S1?B,SUM				This species favors brushy edges rather than unbroken forest. Indigo Buntings breed in brushy and weedy areas. They're common on the edges of woods and fields; along roads, streams, rivers, and powerline cuts; in logged forest plots, brushy canyons, and abandoned fields where shrubby growth is returning. They are also in clearings within deciduous woods, edges of swamps. Breeds between April and July (Audubon and The Cornell Lab).
<i>Perisoreus canadensis</i>	Canada Jay	S3				Year-round resident throughout Nova Scotia and commonly referred to as the Gray Jay. No regular migration. On rare occasions, small invasions of Canada Jays will move a short distance out of boreal forest in winter. Prefers boreal and subalpine forests across northern North America, usually where black or white spruce trees are common (also aspen, white birch, balsam fir, sugar maple, jack pine, red spruce, eastern white cedar, etc.). Found in various kinds of coniferous and mixed forest, but rarely occurs where there are no spruce trees. Mated pairs stay together all year and defend permanent territories. Breeding and nesting for this species begins very early, during late winter, with breeding grounds still snow-covered. Breeds until, approximately, July (Audubon and The Cornell Lab).
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	S3B				Look for these birds in forest edges and woodlands. Rose-breasted Grosbeaks breed in moist deciduous forests, deciduous-coniferous forests, thickets, and semiopen habitats. They gravitate toward second-growth woods, suburban areas, parks, gardens, and orchards, as well as shrubby forest edges next to streams, ponds, marshes, roads, or pastures. They favor edges or openings with combination of shrubs and tall trees, rather than unbroken forest. Breeds from April to July (The Cornell Lab, Audubon)
<i>Picoides arcticus</i>	Black-backed Woodpecker	S3S4				Known throughout Nova Scotia year-round. Not strictly migratory, but may move around in response to changing conditions (e.g. destruction of habitat). Eastern birds occasionally stage southward irruptions in winter, with scattered individuals showing up well south of breeding range. Habitat includes boreal forests of firs and spruces (pine, Douglas-fir, hemlock, tamarack and spruce, especially spruce bogs). Favours areas of dead or dying trees (coniferous and deciduous), and may concentrate at burned or flooded areas with many standing dead trees. Frequents lowlands in the North and mountains in the West. Breeds between April and July (Audubon and The Cornell Lab).
<i>Pinicola enucleator</i>	Pine Grosbeak	S3B,S5N,S5M				Found throughout the province year-round. Pine grosbeaks can be found in conifers; in winter, other trees. Breeds in open coniferous forest, especially of spruce and fir. In winter often found in deciduous trees (especially fruiting trees), also in groves of pines and other conifers. Breeding occurs from April to July (The Cornell Lab, Audubon).
<i>Piranga olivacea</i>	Scarlet Tanager	S2B,SUM				These birds can be found in oak forests in summer, but they often remain out of sight as they forage in the leafy upper branches. Nest site is in tree (usually deciduous), typically 20-30' above ground. Found in forests and shade trees (especially oaks). Breeds mostly in deciduous forest, predominately oaks but also in maple, beech, mixed pine-oak woods, and coniferous woods dominated by pine or hemlock. Breeding Scarlet Tanagers prefer large forest tracts with large trees. During spring and fall they use similar forest habitats as well as open spaces such as parks and gardens. Breeds between April and July (The Cornell Lab, Audubon)

Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<i>Pluvialis squatarola</i>	Black-bellied Plover	S3M				Migrates through Nova Scotia. Found in mudflats, open marshes and beaches (tundra in the summer). Nesting occurs in drier tundra, often more barren ridges above lowland lakes and rivers (sometimes in lower wet tundra near coast). In winter, found mostly on open sand beaches and tidal flats. During migration will often stop in short-grass prairie or plowed fields, especially during high tides, when mudflats are underwater. In some places, they forage on rocky shorelines. Black-bellied Plovers roost together at high tide and overnight on beaches, saltmarshes and sometimes upland habitats such as farm fields. Most migrate along coast or over sea, but numbers stop over regularly at some inland sites. Breeds between April and July (Audubon and The Cornell Lab).
<i>Poecile hudsonicus</i>	Boreal Chickadee	S3				Year-round resident throughout Nova Scotia. Occasional small southward invasions in fall, with a few appearing south of breeding range (similar to Black-capped Chickadees invasions). Boreal Chickadees inhabit mostly mature coniferous forests (sometimes mixed forests), usually spruce and balsam fir, often near water. During late fall and winter irruptions, they tend to be found mostly in areas dominated by coniferous trees. Occurs in low stunted spruces as far North as treeline (e.g. spruce bogs). May mate for life, the birds remaining together all year. Nests in a hole in a tree, either a natural cavity or one they created (or from another species). Breeds between April and July (Audubon and The Cornell Lab).
<i>Rallus elegans</i>	King Rail	SNA	Endangered	Endangered		The species breeds only in the extreme southern part of Ontario. King Rails are found in a variety of freshwater marshes and marsh-shrub swamp habitats. The species occurs in areas where wild rice grows but also in sedge and cattail marshes. Most importantly, the species requires large marshes with open shallow water that merges with shrubby areas. In fact, birds only return in successive years to large marshes that are not overgrown with cattails. This Species are accidental to Nova Scotia.
<i>Rallus limicola</i>	Virginia Rail	S2S3B				Breeds across Nova Scotia, but more common in the northern region. Nests in a variety of marshy situations, mostly fresh, but also brackish marshes near the coast. Where this species and Sora breed in same marshes, Virginia Rail typically nests in drier spots. Often moves into salt marshes in winter. During migration, sometimes found in odd spots, even city streets. Virginia Rails occupy shallow (sometimes deeper) freshwater wetlands with tall stands of cattails and rushes (need areas with standing water typically less than 6 inches deep with a muddy bottom). They are most common in wetlands with 40–70% coverage of tall emergent vegetation, mixed with open water, mudflats and areas with matted vegetation. During the nonbreeding season, Virginia Rails use similar habitat, but may venture into more open areas. Breeds between April and July (Audubon and The Cornell Lab).
<i>Riparia riparia</i>	Bank Swallow	S2B	Threatened	Threatened		As with other swallow species, migratory stopover points are usually centred on large marshes where birds roost at night and disperse to forage throughout the day. There is little information available for Bank Swallows in terms of the importance of area requirements of these disparate habitats and their proximity to each other.
<i>Setophaga castanea</i>	Bay-breasted Warbler	S3S4B,S4S5M				Bay-breasted warblers are found in woodlands, conifers in summer. Usually breeds in northern coniferous forest, in thick stands of spruce and fir. They are preators of spruce budworm, and are abundant in spruce forests during outbreaks. Where spruce is not found, will nest in deciduous or mixed second-growth woods of birches, maples, firs, and pines. Breed from April to July, typically in the latter half of the breeding window (The Cornell Lab, Audubon)
<i>Setophaga pinus</i>	Pine Warbler	S2S3B,S4S5M				Pine Warblers live in pine or mixed pine-deciduous forest. Also sometimes in cedar or cypress. Various spottings throughout Nova Scotia, generally in the southern portion of the province. Breeds April to July (The Cornell Lab, Audubon)
<i>Setophaga striata</i>	Blackpoll Warbler	S3B,S5M				The blackpoll warbler can be found in conifers; broadleaf trees in migration. Breeds in low northern spruce forest. In migration, moves through forests, parks and gardens, they stop over in scrubby thickets and mature evergreen and deciduous forests. Found in the southern half of Nova Scotia during migration and the northern half during the breeding season. Breeding occurs from April to July (The Cornell Lab, Audubon).
<i>Setophaga tigrina</i>	Cape May Warbler	S3B,SUM				The Cape May Warbler can be found in spruce forest; other trees in migration. Breeds in spruce forest, especially during spruce budworm outbreaks, either in pure stands or mixed with firs or other trees, generally in more open woods or near the forest edge. During migration often favors conifers, but also forages in deciduous trees and thickets. Breeding occurs from April to July (The Cornell Lab, Audubon)
<i>Sialia sialis</i>	Eastern Bluebird	S3B				Uncommon breeder throughout Nova Scotia. In the north, arrives quite early in spring, and lingers late in fall. These birds live in semi-open country with scattered trees, but with little understory and sparse ground cover. Original habitats probably included open, frequently burned pine savannas, beaver ponds, mature (but open) woods and forest clearings/openings. Today, they are most common along pastures, roadsides, agricultural fields, suburban parks, backyards and golf courses. Breeds between April and July (Audubon and The Cornell Lab).
<i>Spatula clypeata</i>	Northern Shoveler	S2B,SUM				Migrates through all parts of Nova Scotia, except Cape Breton (uncommon for this species to breed in Nova Scotia). Migratory period is quite prolonged in both spring and fall, with many birds moving late in spring and early in fall. Northern Shovelers use shallow wetlands with submerged vegetation during the breeding season, nesting along the margins and in the neighboring grassy fields. Outside of the breeding season they forage in saltmarshes, estuaries, lakes, flooded fields, wetlands, agricultural ponds and wastewater ponds (and fields in vicinity of shallow water) with extensive muddy margins, including stagnant or polluted waters not much favored by other ducks. Pair formation begins in winter and continues during spring migration. Breeds between April and July (Audubon and The Cornell Lab)



Scientific Name	Common Name	SRank	COSEWIC	SARA	ESA	Habitat Description
<i>Spatula discors</i>	Blue-winged Teal	S3B				Found mainly in fresh ponds and marshes. In summer they use shallow freshwater marshes and ponds in open country, as well as brackish marshes near coast. In migration and winter they forage and stop in any kind of shallow waters, whether inland or coastal. Flocks in migration are sometimes seen over ocean, many miles offshore. They are flightless during their late summer molt, and they spend this time in prairie potholes or large marshes. Blue-winged Teal nest among grasses or herbaceous vegetation. Pair formation begins in early winter and continues during spring migration. Breeds between April and July (Audubon and The Cornell Lab)
<i>Spinus pinus</i>	Pine Siskin	S3				Found throughout the province year-round. Pine Siskins can be found in conifers, mixed woods, alders, weedy areas. Breeds mostly in coniferous and mixed woods, often around edges or clearings; sometimes in deciduous woods, isolated conifer groves. In migration and winter occurs in many kinds of semi-open areas, woodland edges, weedy fields. Breeding occurs from April to July (The Cornell Lab, Audubon)
<i>Toxostoma rufum</i>	Brown Thrasher	S1B				Not common and rarely seen in Nova Scotia, with no recorded sightings in Cape Breton (MBBA, as of July 2021). In eastern North America, Brown Thrashers nest in thickets, brush, shubbery, hedgerows, forest edges and overgrown clearings in deciduous forest. On rare occasions they breed in backyards and gardens with shrubs and hedges (but in general - areas of dense low growth, especially thickets around edges of deciduous or mixed woods, shrubby edges of swamps or undergrowth in open pine woods). Breeds between April and July (Audubon and The Cornell Lab).
<i>Tringa melanoleuca</i>	Greater Yellowlegs	S3B,S4M				Common migrant in Nova Scotia (migrates in flocks). During migration and throughout the winter, Greater Yellowlegs use a wide variety of fresh and brackish wetlands, including mudflats, estuaries, beaches, marshes, lake and pond edges, wet meadows, sewage ponds and flooded agricultural fields. Breeds in boggy and marshes places within northern coniferous forest. Breeds between April and July (Audubon and The Cornell Lab).
<i>Tringa semipalmata</i>	Willet	S3B				Willetts inhabit open beaches, wet meadows, bayshores, marshes, mudflats and rocky coastal zones. During the breeding season, these birds seek saltmarshes, barrier islands and barrier beaches for breeding. Often nests in colonies, especially along Atlantic Coast (prefers to nest in extensive salt marsh habitat). Breeds between April and July (Audubon and The Cornell Lab).
<i>Turdus migratorius</i>	American Robin	S3N, S5B				Common in most of Nova Scotia as a year-round resident and for breeding in the very Northern part of the province (mainly Cape Breton). This species occupies many habitat types, such as lawns, farmland, fields and city parks, as well as in more wild places like woodlands, forests, mountains up to near treeline, recently burned forests and tundra. During winter many robins move to moist woods where berry-producing trees and shrubs are common. Males arrive first in the breeding season. Nests where there are trees and mud for nest-making material. Breeds between April and July (Audubon and The Cornell Lab).
<i>Tyrannus tyrannus</i>	Eastern Kingbird	S3B				Common breeder throughout Nova Scotia. A long-distance migrant that uses many habitats and migrates in flocks. Unlike many of the migratory songbirds, kingbirds may travel mostly by day. The Eastern Kingbird usually breeds in fields with scattered shrubs and trees, in orchards and along forest edges (also clearings, roadsides, parks, newly burned forest, beaver ponds, golf courses and urban environments with tall trees and scattered open spaces). It is drawn to water, often nesting densely in trees that overhang rivers or lakes. In summer, requires open space for hunting. Often common around edges of marshes, farmland and native tallgrass prairie. Breeds between April and July (Audubon and The Cornell Lab).
<i>Vireo gilvus</i>	Warbling Vireo	S1B,SUM				Occurs in deciduous and mixed woods, aspen groves, poplars, shade trees. Breeds in open deciduous or mixed woodland; also in orchards, shade trees of towns (Audubon). They stay high in deciduous treetops (Cornell Lab). Breeds between April and July (Audubon and The Cornell Lab).
<i>Vireo philadelphicus</i>	Philadelphia Vireo	S2?B,SUM				Occurs in second growth; poplars, willows, alders. Breeds in deciduous and mixed woodlands, especially near their edges, or in the young growth of overgrown pastures. Also nests in willows and alders along streams, lakes, and ponds. Breeds between April and July (Audubon).

APPENDIX C  
ACCDC REPORT

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# DATA REPORT 7800: Clysdale Ridge, NS

Prepared 14 August 2023  
by C. Robicheau, Conservation Data  
Analyst

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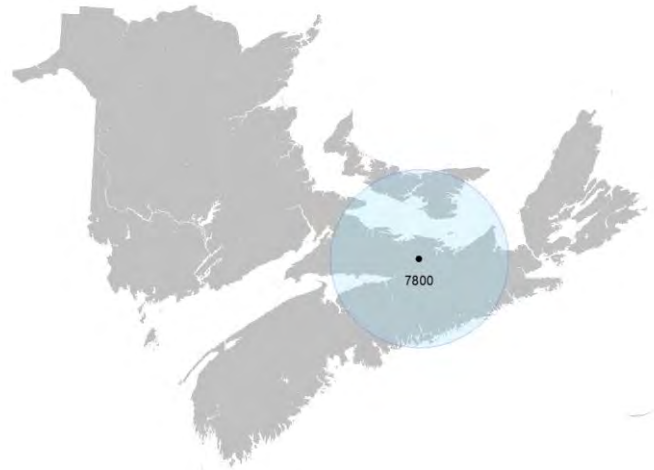
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**Map 1.** A 100 km buffer around the study area

## 1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; [www.accdc.com](http://www.accdc.com)) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

### 1.1 DATA LIST

Included datasets:

<u>Filename</u>	<u>Contents</u>
ClysdaleRidgNS_7800ob.xls	Rare or legally-protected Flora and Fauna in your study area
ClysdaleRidgNS_7800ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
ClysdaleRidgNS_7800msa.xls	Managed and Biologically Significant Areas in your study area
ClysdaleRidgNS_7800ff_py.xls	Rare Freshwater Fish in your study area (DFO database)

## 1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

- a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
- b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
- c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
- d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
- e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
- f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
- g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

## 1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

### Plants, Lichens, Ranking Methods, All other Inquiries

Sean Blaney  
Senior Scientist / Executive Director  
(506) 364-2658  
[sean.blaney@accdc.ca](mailto:sean.blaney@accdc.ca)

### Animals (Fauna)

John Klymko  
Zoologist  
(506) 364-2660  
[john.klymko@accdc.ca](mailto:john.klymko@accdc.ca)

### Data Management, GIS

James Churchill  
Conservation Data Analyst / Field Biologist  
(902) 679-6146  
[james.churchill@accdc.ca](mailto:james.churchill@accdc.ca)

### Billing

Jean Breau  
Financial Manager / Executive Assistant  
(506) 364-2657  
[jean.breau@accdc.ca](mailto:jean.breau@accdc.ca)

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

**Western:** Emma Vost  
(902) 670-8187  
[Emma.Vost@novascotia.ca](mailto:Emma.Vost@novascotia.ca)

**Western:** Sarah Spencer  
(902) 541-0081  
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**Central:** Kimberly George  
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**Eastern:** Elizabeth Walsh  
(902) 563-3370  
[Elizabeth.Walsh@novascotia.ca](mailto:Elizabeth.Walsh@novascotia.ca)

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.



### 3.0 SPECIAL AREAS

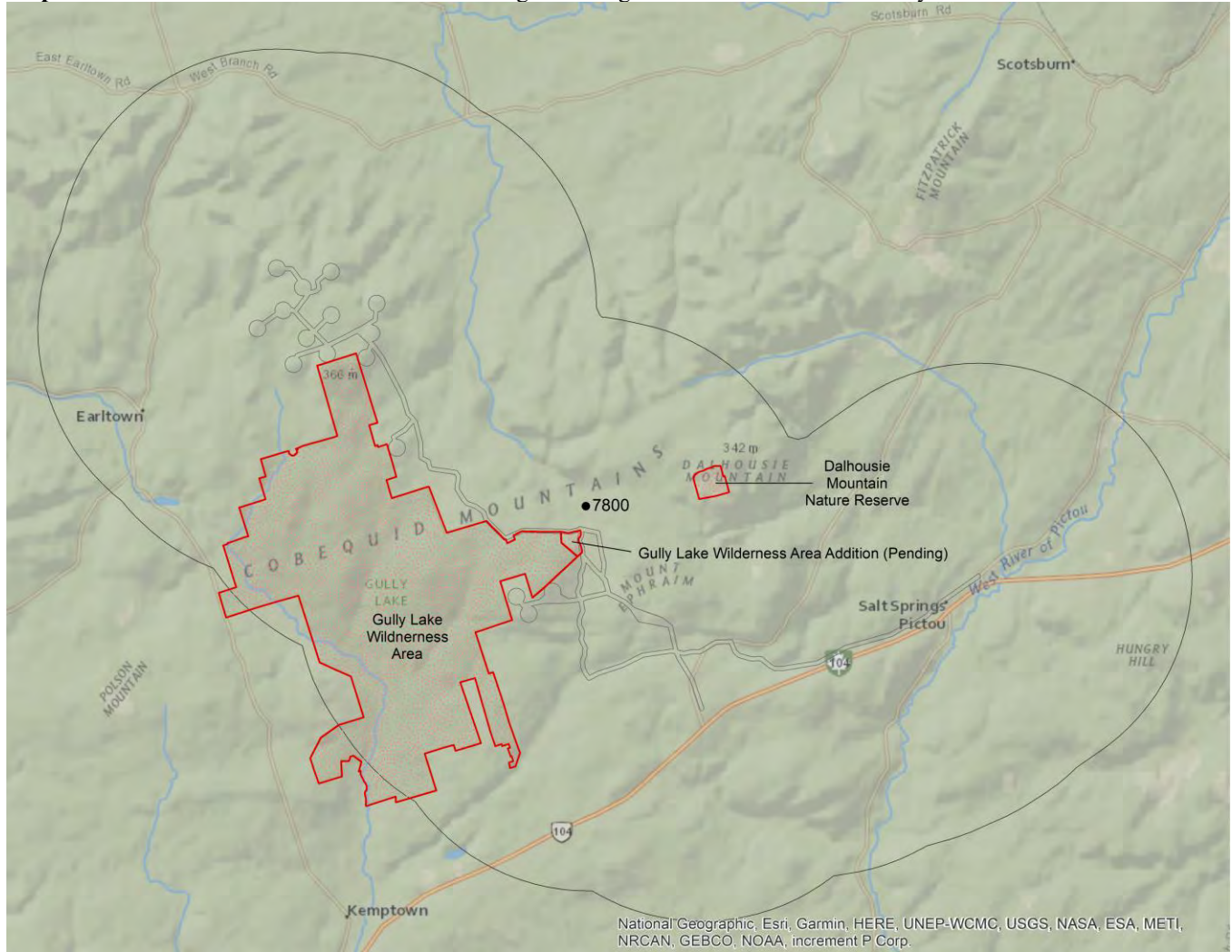
#### 3.1 MANAGED AREAS

The GIS scan identified 3 managed areas in the vicinity of the study area (Map 3 and attached file: \*ma\*.xls).

#### 3.2 SIGNIFICANT AREAS

The GIS scan identified no biologically significant sites in the vicinity of the study area (Map 3 and attached file: \*sa\*.xls).

**Map 3:** Boundaries and/or locations of known Managed and Significant Areas within the study area.



 Managed Area  Significant Area

## 4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding “location-sensitive” species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ( $\pm$  the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files \*ob.xls/\*ob.shp only.

### 4.1 FLORA

Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
N	<i>Peltigera hydrothyria</i>	Threatened	Threatened	Threatened	S1	3	0.8 $\pm$ 0.0
N	<i>Pectenia plumbea</i>	Special Concern	Special Concern	Vulnerable	S3	1	6.8 $\pm$ 0.0
N	<i>Phaeophyscia pusilloides</i>	Special Concern	Special Concern	Vulnerable	S3	2	9.9 $\pm$ 0.0
N	<i>Evermia prunastri</i>	Special Concern	Special Concern	Vulnerable	S3S4	1	1.2 $\pm$ 5.0
N	<i>Heterodermia neglecta</i>	Special Concern	Special Concern	Vulnerable	S3S4	1	7.2 $\pm$ 0.0
P	<i>Sanicula odorata</i>	Special Concern	Special Concern	Vulnerable	S1S2	1	11.4 $\pm$ 10.0
P	<i>Hepatica americana</i>	Special Concern	Special Concern	Vulnerable	S2	1	3.4 $\pm$ 0.0
P	<i>Lilium canadense</i>	Special Concern	Special Concern	Vulnerable	S2	1	7.2 $\pm$ 0.0
P	<i>Platanthera macrophylla</i>	Special Concern	Special Concern	Vulnerable	S2	8	12.2 $\pm$ 0.0
P	<i>Tiarella cordifolia</i>	Special Concern	Special Concern	Vulnerable	S2S3	10.1 $\pm$ 0.0	
P	<i>Eleocharis ovata</i>	Special Concern	Special Concern	Vulnerable	S2S3	2	10.0 $\pm$ 0.0
P	<i>Botrychium lanceolatum</i> ssp. <i>angustisegmentum</i>	Special Concern	Special Concern	Vulnerable	S2S3	207	
P	<i>Ophioglossum pusillum</i>	Special Concern	Special Concern	Vulnerable	S2S3	1	6.0 $\pm$ 1.0
P	<i>Conioselinum chinense</i>	Special Concern	Special Concern	Vulnerable	S2S3	1	6.9 $\pm$ 0.0
P	<i>Hieracium robinsonii</i>	Special Concern	Special Concern	Vulnerable	S3	1	8.5 $\pm$ 5.0
P	<i>Palustricodon aparinoides</i>	Special Concern	Special Concern	Vulnerable	S3	1	4.6 $\pm$ 7.0
P	<i>Stellaria longifolia</i>	Special Concern	Special Concern	Vulnerable	S3	2	10.0 $\pm$ 0.0
P	<i>Viburnum edule</i>	Special Concern	Special Concern	Vulnerable	S3	1	9.7 $\pm$ 0.0
P	<i>Polygala sanguinea</i>	Special Concern	Special Concern	Vulnerable	S3	3	3.1 $\pm$ 0.0
P	<i>Pyrola minor</i>	Special Concern	Special Concern	Vulnerable	S3	1	2.3 $\pm$ 0.0
P	<i>Viola nephrophylla</i>	Special Concern	Special Concern	Vulnerable	S3	1	7.6 $\pm$ 1.0
P	<i>Carex rosea</i>	Special Concern	Special Concern	Vulnerable	S3	1	11.4 $\pm$ 11.0
P	<i>Carex tenera</i>	Special Concern	Special Concern	Vulnerable	S3	2	9.0 $\pm$ 1.0
P	<i>Platanthera grandiflora</i>	Special Concern	Special Concern	Vulnerable	S3	37	2.2 $\pm$ 0.0
P	<i>Potamogeton preelongus</i>	Special Concern	Special Concern	Vulnerable	S3	1	9.8 $\pm$ 1.0
P	<i>Potamogeton richardsonii</i>	Special Concern	Special Concern	Vulnerable	S3	1	4.8 $\pm$ 7.0
P	<i>Sceptridium dissectum</i>	Special Concern	Special Concern	Vulnerable	S3	1	9.6 $\pm$ 5.0
P	<i>Polypodium appalachianum</i>	Special Concern	Special Concern	Vulnerable	S3	1	5.3 $\pm$ 0.0
P	<i>Hieracium paniculatum</i>	Special Concern	Special Concern	Vulnerable	S3S4	6	2.2 $\pm$ 0.0
P	<i>Fagus grandifolia</i>	Special Concern	Special Concern	Vulnerable	S3S4	14	1.0 $\pm$ 0.0
P	<i>Ulmus americana</i>	Special Concern	Special Concern	Vulnerable	S3S4	1	11.3 $\pm$ 2.0
P	<i>Verberna hastata</i>	Special Concern	Special Concern	Vulnerable	S3S4	1	10.0 $\pm$ 0.0
P	<i>Platanthera orbiculata</i>	Special Concern	Special Concern	Vulnerable	S3S4	9	12.2 $\pm$ 0.0
P	<i>Botrychium matricarifolium</i>	Special Concern	Special Concern	Vulnerable	S3S4	2	10.7 $\pm$ 1.0

### 4.2 FAUNA

Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	<i>Riparia riparia</i>	Threatened	Threatened	Endangered	S2B	5	11.2 $\pm$ 7.0
A	<i>Hylocichla mustelina</i>	Threatened	Threatened	Endangered	SUB	4	11.2 $\pm$ 7.0
A	<i>Salmo salar</i> pop. 12	Special Concern	Special Concern	Endangered	S1	3	11.5 $\pm$ 50.0
A	<i>Euphagus carolinus</i>	Special Concern	Special Concern	Endangered	S2B	3	11.2 $\pm$ 7.0
A	<i>Hirundo rustica</i>	Special Concern	Special Concern	Endangered	S3B	12	11.2 $\pm$ 7.0
A	<i>Cardellina canadensis</i>	Special Concern	Special Concern	Endangered	S3B	11	11.2 $\pm$ 7.0
A	<i>Chordeiles minor</i>	Special Concern	Special Concern	Threatened	S3B	1	11.2 $\pm$ 7.0

Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A <i>Cortopus cooperi</i>	Olive-sided Flycatcher	Special Concern	Special Concern	Threatened	S3B	8	11.2 ± 7.0
A <i>Dolichonyx oryzivorus</i>	Bobolink	Special Concern	Threatened	Vulnerable	S3B	7	11.2 ± 7.0
A <i>Coccythraustes vespertinus</i>	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B, S3N, S3M	6	10.9 ± 0.0
A <i>Cortopus virens</i>	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	11	1.6 ± 0.0
A <i>Aegolius funereus</i>	Boreal Owl	Not At Risk			S2?B, SUM	2	11.2 ± 7.0
A <i>Alces alces americana</i>	Moose			Endangered	S1	4	2.1 ± 0.0
A <i>Gallinula galeata</i>	Common Gallinule				S1B	1	11.2 ± 7.0
A <i>Myiarchus crinitus</i>	Great Crested Flycatcher				S1B	1	4.8 ± 7.0
A <i>Poocetes gramineus</i>	Vesper Sparrow				S1S2B, SUM	4	11.2 ± 7.0
A <i>Molothrus ater</i>	Brown-headed Cowbird				S2B	2	11.2 ± 7.0
A <i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B	2	11.2 ± 7.0
A <i>Setophaga pinus</i>	Pine Warbler				S2S3B, S4S5M	1	14.0 ± 0.0
A <i>Perisoreus canadensis</i>	Canada Jay				S3	9	11.2 ± 7.0
A <i>Poecile hudsonicus</i>	Boreal Chickadee				S3	9	3.5 ± 0.0
A <i>Spinus pinus</i>	Pine Siskin				S3	5	1.4 ± 0.0
A <i>Salvelinus fontinalis</i>	Brook Trout				S3	1	12.8 ± 0.0
A <i>Spatula discors</i>	Blue-winged Teal				S3B	1	11.2 ± 7.0
A <i>Charadrius vociferus</i>	Killdeer				S3B	6	11.2 ± 7.0
A <i>Tyrannus tyrannus</i>	Eastern Kingbird				S3B	4	11.2 ± 7.0
A <i>Pheucicus ludovicianus</i>	Rose-breasted Grosbeak				S3B	7	11.2 ± 7.0
A <i>Alosa pseudoharengus</i>	Alewife				S3B	1	12.8 ± 0.0
A <i>Falco sparverius</i>	American Kestrel				S3B, S4S5M	3	11.2 ± 7.0
A <i>Gallinago delicata</i>	Wilson's Snipe				S3B, S5M	5	11.2 ± 7.0
A <i>Setophaga striata</i>	Blackpoll Warbler				S3B, S5M	2	5.2 ± 7.0
A <i>Pinicola enucleator</i>	Pine Grosbeak				S3B, S5N, S5M	1	6.9 ± 0.0
A <i>Setophaga tigrina</i>	Cape May Warbler				S3B, SUM	2	4.8 ± 7.0
A <i>Picoides arcticus</i>	Black-backed Woodpecker				S3S4	3	3.4 ± 7.0
A <i>Setophaga castanea</i>	Bay-breasted Warbler				S3S4B, S4S5M	5	11.2 ± 7.0
A <i>Actitis macularius</i>	Spotted Sandpiper				S3S4B, S5M	2	4.8 ± 7.0
A <i>Leiothlypis peregrina</i>	Tennessee Warbler				S3S4B, S5M	3	11.2 ± 7.0
I <i>Danaus plexippus</i>	Monarch	Endangered	Special Concern	Endangered	S3	3	7.0 ± 0.0
I <i>Bombus terricola</i>	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S2?B, S3M	1	8.9 ± 0.0
I <i>Margaritifera margaritifera</i>	Eastern Pearlshell				S2	2	12.5 ± 0.0
I <i>Cecropterus pylades</i>	Northern Cloudywing				S3S4	1	6.5 ± 0.0

### 4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with “YES”.

#### Nova Scotia

Scientific Name	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
<b>Fraxinus nigra</b>	<b>Black Ash</b>		<b>Threatened</b>	<b>YES</b>
<i>Emydoidea blandingii</i>	<i>Blanding's Turtle - Nova Scotia pop.</i>	Endangered	Endangered	No
<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	No
<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrus pop.	<b>[Endangered]'</b>	Vulnerable	No
<b>Bat hibernaculum or bat species occurrence</b>		<b>[Endangered]'</b>	<b>[Endangered]'</b>	<b>YES</b>

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.



#### 4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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#### 5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 57012 records of 149 vertebrate and 1420 records of 72 invertebrate fauna; 8714 records of 262 vascular and 2844 records of 147 nonvascular flora (attached: \*ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including "location-sensitive" species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ( $\pm$  the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Myotis lucifugus</i>	Little Brown Myotis	Endangered	Endangered	Endangered	S1	104	8.1 ± 0.0	NS
A	<i>Myotis septentrionalis</i>	Northern Myotis	Endangered	Endangered	Endangered	S1	85	51.7 ± 0.0	NS
A	<i>Perimyotis subflavus</i>	Tricolored Bat	Endangered	Endangered	Endangered	S1	5	52.6 ± 5.0	NS
A	<i>Salmo salar pop. 1</i>	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered	Endangered	S1	25	13.7 ± 0.0	NS
A	<i>Salmo salar pop. 6</i>	Atlantic Salmon - Nova Scotia Southern Upland population	Endangered	Endangered	Endangered	S1	30	38.8 ± 0.0	NS
A	<i>Charadrius melodus melodus</i>	Piping Plover melodus subspecies	Endangered	Endangered	Endangered	S1B	2260	24.0 ± 0.0	NS
A	<i>Sterna dougallii</i>	Roseate Tern	Endangered	Endangered	Endangered	S1B	19	87.8 ± 0.0	NS
A	<i>Dermochelys coriacea pop. 2</i>	Leatherback Sea Turtle - Atlantic population	Endangered	Endangered	Endangered	S1S2N	1	99.4 ± 1.0	NB
A	<i>Morone saxatilis pop. 2</i>	Striped Bass - Bay of Fundy population	Endangered	Endangered	Endangered	S2S3B,S2S3N	2	70.4 ± 0.0	NS
A	<i>Lamna nasus</i>	Porbeagle Shark	Endangered	Endangered	Endangered	SNR	1	94.2 ± 1.0	NS
A	<i>Lasurus cinereus</i>	Hoary Bat	Endangered	Endangered	Endangered	SUB, S1M	3	75.7 ± 1.0	PE
A	<i>Catharus bicknelli</i>	Bicknell's Thrush	Threatened	Threatened	Endangered	S1B	1	76.2 ± 7.0	NS
A	<i>Asio flammeus</i>	Short-eared Owl	Threatened	Threatened	Special Concern	S1B	8	25.2 ± 7.0	NS
A	<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	Threatened	S2	8429	16.5 ± 1.0	NS
A	<i>Riparia riparia</i>	Bank Swallow	Threatened	Threatened	Endangered	S2B	2233	4.8 ± 7.0	NS
A	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	679	11.0 ± 7.0	NS
A	<i>Limosa haemastica</i>	Hudsonian Godwit	Threatened	Threatened	Endangered	S2S3M	369	28.5 ± 0.0	NS
A	<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	Threatened	Threatened	Endangered	S2S3N	5	56.9 ± 0.0	NS
A	<i>Hydrobates leucorhous</i>	Leach's Storm-Petrel	Threatened	Threatened	Endangered	S3B	39	87.3 ± 7.0	NS
A	<i>Tringa flavipes</i>	Lesser Yellowlegs	Threatened	Threatened	Endangered	S3M	1502	23.5 ± 0.0	NS
A	<i>Anguilla rostrata</i>	American Eel	Threatened	Threatened	Endangered	S3N	92	27.1 ± 0.0	NS
A	<i>Ixobrychus exilis</i>	Least Bittern	Threatened	Threatened	Endangered	SUB	3	97.8 ± 0.0	NS
A	<i>Hylodichthys mustelina</i>	Wood Thrush	Threatened	Threatened	Endangered	SUB	36	3.5 ± 0.0	NS
A	<i>Salmo salar pop. 12</i>	Atlantic Salmon - Gaspe - Southern Gulf of St. Lawrence population	Special Concern	Special Concern	Special Concern	S1	47	9.7 ± 50.0	NS
A	<i>Antronotomus vociferus</i>	Lawrence population	Special Concern	Special Concern	Threatened	S17B	9	61.7 ± 7.0	NS
A	<i>Passerculus sandwichensis princeps</i>	Eastern Whip-Poor-Will	Special Concern	Special Concern	Threatened	S1B	2	90.7 ± 0.0	NS
A	<i>Bucephala islandica</i>	Ipswich Sparrow	Special Concern	Special Concern	Special Concern	S1N,SUM	34	18.8 ± 0.0	NS
A	<i>Euphagus carolinus</i>	Barrow's Goldeneye	Special Concern	Special Concern	Endangered	S2B	276	4.8 ± 7.0	NS
A	<i>Phalaropus lobatus</i>	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3M	12	28.4 ± 0.0	NS
A	<i>Morone saxatilis pop. 1</i>	Red-necked Phalarope	Special Concern	Special Concern	Special Concern	S2S3N	1	84.9 ± 1.0	NS
A	<i>Histrionicus histrionicus pop. 1</i>	Striped Bass - Southern Gulf of St. Lawrence population	Special Concern	Special Concern	Special Concern	S2S3N,SUM	27	31.8 ± 0.0	NS
A	<i>Chelydra serpentina</i>	Hairquin Duck - Eastern population	Special Concern	Special Concern	Endangered	S3	154	17.4 ± 0.0	NS
A	<i>Hirundo rustica</i>	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3B	2353	4.8 ± 7.0	NS
A	<i>Cardellina canadensis</i>	Barn Swallow	Special Concern	Threatened	Endangered	S3B	1135	4.8 ± 7.0	NS
A	<i>Chordeiles minor</i>	Canada Warbler	Special Concern	Special Concern	Threatened	S3B	417	11.2 ± 7.0	NS
A	<i>Cotopuz cooperi</i>	Common Nighthawk	Special Concern	Special Concern	Threatened	S3B	1272	4.8 ± 7.0	NS
A	<i>Dolichonyx oryzivorus</i>	Olive-sided Flycatcher	Special Concern	Threatened	Vulnerable	S3B	2341	5.2 ± 7.0	NS
A	<i>Coccythraustes vesperfinus</i>	Bobolink	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	851	4.8 ± 7.0	NS
A	<i>Podiceps auritus</i>	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3N,SUM	13	27.2 ± 0.0	NS
A	<i>Cotopuz vires</i>	Horned Grebe	Special Concern	Special Concern	Vulnerable	S3S4B	1320	1.6 ± 0.0	NS
A	<i>Phocoena phocoena</i>	Harbour Porpoise	Special Concern	Special Concern	Vulnerable	S4	6	31.8 ± 0.0	NS
A	<i>Phocoena phocoena pop. 1</i>	Harbour Porpoise - Northwest Atlantic Population	Special Concern	Special Concern	Vulnerable	S4	1	35.8 ± 1.0	NS
A	<i>Chrysemys picta</i>	Painted Turtle	Special Concern	Special Concern	Special Concern	S4	7	21.8 ± 0.0	NS
A	<i>Chrysemys picta picta</i>	Eastern Painted Turtle	Special Concern	Special Concern	Special Concern	S4	84	26.2 ± 1.0	NS
A	<i>Accipiter cooperii</i>	Cooper's Hawk	Not At Risk	Special Concern	Special Concern	S17B,SUN,SUM	13	15.2 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Fulica americana</i>	American Coot	Not At Risk			S1B	30	19.5 ± 7.0	NS
A	<i>Chlidonias niger</i>	Black Tern	Not At Risk			S1B	70	97.3 ± 0.0	NS
A	<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrius	Not At Risk		Vulnerable	S1B,SUM	44	27.8 ± 0.0	NS
A	<i>Sorex dispar</i>	Long-tailed Shrew	Not At Risk			S2	1	57.2 ± 0.0	NS
A	<i>Aegolius funereus</i>	Boreal Owl	Not At Risk			S2?B,SUM	14	9.5 ± 0.0	NS
A	<i>Globocephala melas</i>	Long-finned Pilot Whale	Not At Risk			S2S3	1	62.0 ± 100.0	NS
A	<i>Hemidactyllum scutatum</i>	Four-toed Salamander	Not At Risk			S3	15	25.2 ± 0.0	NS
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B	508	18.2 ± 7.0	NS
A	<i>Sialia sialis</i>	Eastern Bluebird	Not At Risk			S3B	67	11.2 ± 7.0	NS
A	<i>Buteo lagopus</i>	Rough-legged Hawk	Not At Risk			S3N	12	24.8 ± 0.0	NS
A	<i>Accipiter gentilis</i>	Northern Goshawk	Not At Risk			S3S4	155	15.2 ± 7.0	NS
A	<i>Glaucomys volans</i>	Southern Flying Squirrel	Not At Risk			S3S4	1	41.1 ± 0.0	NS
A	<i>Lagenorhynchus acutus</i>	Atlantic White-sided Dolphin	Not At Risk			S3S4	3	60.5 ± 0.0	NS
A	<i>Ammospiza nelsoni</i>	Nelson's Sparrow	Not At Risk			S3S4B	401	20.7 ± 7.0	NS
A	<i>Calidris canutus rufa</i>	Red Knot rufa subspecies	E,SC	Endangered		S2M	491	24.0 ± 0.0	NS
A	<i>Calidris canutus</i>	Red Knot	E,SC	E,T		S2M	38	36.2 ± 0.0	NS
A	<i>Morone saxatilis</i>	Striped Bass	E,SC			S2S3B,S2S3N	16	31.7 ± 0.0	NS
A	<i>Gadus morhua</i>	Atlantic Cod	E,SC,DD			SNR	1	67.9 ± 0.0	NS
A	<i>Salmo salar</i>	Atlantic Salmon	E,T,SC			S1B,S1N	13	39.6 ± 0.0	NS
A	<i>Alces alces americana</i>	Moose			Endangered	S1	216	2.1 ± 0.0	NS
A	<i>Alces alces</i>	Moose			Endangered	S1	11	38.9 ± 0.0	NS
A	<i>Picoides dorsalis</i>	American Three-toed Woodpecker				S1?	8	67.9 ± 7.0	NS
A	<i>Uria aalge</i>	Common Murre				S1?B	1	88.7 ± 0.0	NS
A	<i>Passerina cyanea</i>	Indigo Bunting				S1?B,SUM	19	34.3 ± 0.0	NS
A	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron				S1B	1	87.5 ± 7.0	NS
A	<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B	24	19.8 ± 0.0	NS
A	<i>Gallinula galeata</i>	Common Gallinule				S1B	28	11.2 ± 7.0	NS
A	<i>Myiarchus cineritus</i>	Great Crested Flycatcher				S1B	16	4.8 ± 7.0	NS
A	<i>Cistothorus palustris</i>	Marsh Wren				S1B	24	86.4 ± 3.0	NB
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S1B	42	25.2 ± 7.0	NS
A	<i>Toxostoma rufum</i>	Brown Thrasher				S1B	10	25.2 ± 7.0	NS
A	<i>Charadrius semipalmatus</i>	Semipalmated Plover				S1B,S4M	1840	19.5 ± 7.0	NS
A	<i>Calidris minutilla</i>	Least Sandpiper				S1B,S4M	1159	23.3 ± 0.0	NS
A	<i>Anas acuta</i>	Northern Pintail				S1B,SUM	76	29.2 ± 0.0	NS
A	<i>Vireo gilvus</i>	Warbling Vireo				S1B,SUM	23	17.9 ± 7.0	NS
A	<i>Vespertilionidae sp.</i>	bat species				S1S2	81	7.0 ± 0.0	NS
A	<i>Poocetes gramineus</i>	Vesper Sparrow				S1S2B,SUM	60	4.8 ± 7.0	NS
A	<i>Vireo philadelphicus</i>	Philadelphia Vireo				S2?B,SUM	87	17.2 ± 0.0	NS
A	<i>Alca torda</i>	Razorbill				S2B	3	51.9 ± 2.0	NS
A	<i>Friatercula arctica</i>	Atlantic Puffin				S2B	3	85.4 ± 0.0	NB
A	<i>Empidonax traillii</i>	Willow Flycatcher				S2B	29	17.9 ± 7.0	NS
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S2B	201	4.8 ± 7.0	NS
A	<i>Spatula clypeata</i>	Northern Shoveler				S2B,SUM	67	23.4 ± 0.0	NS
A	<i>Mareca strepera</i>	Gadwall				S2B,SUM	108	26.8 ± 0.0	NS
A	<i>Piranga olivacea</i>	Scarlet Tanager				S2B,SUM	16	18.2 ± 7.0	NS
A	<i>Calidris alba</i>	Sanderling				S2N,S3M	1015	26.6 ± 0.0	NS
A	<i>Asio otus</i>	Long-eared Owl				S2S3	32	25.0 ± 7.0	NS
A	<i>Rallus limicola</i>	Virginia Rail				S2S3B	114	20.7 ± 7.0	NS
A	<i>Rissa tridactyla</i>	Black-legged Kittiwake				S2S3B	4	23.1 ± 0.0	NS
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B	358	4.8 ± 7.0	NS
A	<i>Phalacrocorax carbo</i>	Great Cormorant				S2S3B,S2S3N	176	24.5 ± 0.0	NS
A	<i>Cathartes aura</i>	Turkey Vulture				S2S3B,S4S5M	44	25.2 ± 0.0	NS
A	<i>Setophaga pinus</i>	Pine Warbler				S2S3B,S4S5M	28	14.0 ± 0.0	NS
A	<i>Bucephala clangula</i>	Common Goldeneye				S2S3B,S5N,S5M	185	22.0 ± 0.0	NS
A	<i>Icterus galbula</i>	Baltimore Oriole				S2S3B,SUM	80	18.2 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Pluvialis dominica</i>	American Golden-Plover				S2S3M	166	24.5 ± 0.0	NS
A	<i>Numerius phaeopus</i>	Whimbrel				S2S3M	8	29.3 ± 0.0	NS
A	<i>Numerius phaeopus hudsonicus</i>	Whimbrel				S2S3M	211	27.5 ± 0.0	NS
A	<i>Perisoreus canadensis</i>	Canada Jay				S3	616	4.4 ± 0.0	NS
A	<i>Poecile hudsonicus</i>	Boreal Chickadee				S3	961	3.5 ± 0.0	NS
A	<i>Spinus pinus</i>	Pine Siskin				S3	565	1.4 ± 0.0	NS
A	<i>Salvelinus fontinalis</i>	Brook Trout				S3	105	12.8 ± 0.0	NS
A	<i>Salvelinus namaycush</i>	Lake Trout				S3	2	47.6 ± 0.0	NS
A	<i>Pekania pennanti</i>	Fisher				S3	10	9.9 ± 0.0	NS
A	<i>Calcarius lapponicus</i>	Lapland Longspur				S3?N,SUM	11	33.2 ± 0.0	NS
A	<i>Spatula discors</i>	Blue-winged Teal				S3B	370	11.2 ± 7.0	NS
A	<i>Charadrius vociferus</i>	Killdeer				S3B	810	5.2 ± 7.0	NS
A	<i>Tringa semipalmata</i>	Willet				S3B	2173	18.2 ± 7.0	NS
A	<i>Sterna paradisaea</i>	Arctic Tern				S3B	43	80.6 ± 7.0	NS
A	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B	134	15.2 ± 7.0	NS
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3B	415	11.2 ± 7.0	NS
A	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak				S3B	877	4.8 ± 7.0	NS
A	<i>Aloa pseudoharengus</i>	Alewife				S3B	30	12.8 ± 0.0	NS
A	<i>Somateria mollissima</i>	Common Eider				S3B,S3M,S3N	356	27.5 ± 9.0	NS
A	<i>Tringa melanoleuca</i>	Greater Yellowlegs				S3B,S4M	2482	22.4 ± 0.0	NS
A	<i>Falco sparverius</i>	American Kestrel				S3B,S4S5M	592	5.2 ± 7.0	NS
A	<i>Gallinago delicata</i>	Wilson's Snipe				S3B,S5M	1165	4.8 ± 7.0	NS
A	<i>Setophaga striata</i>	Blackpoll Warbler				S3B,S5M	106	5.2 ± 7.0	NS
A	<i>Cardellina pusilla</i>	Wilson's Warbler				S3B,S5M	110	20.7 ± 7.0	NS
A	<i>Pinicola enucleator</i>	Pine Grosbeak				S3B,S5N,S5M	133	6.9 ± 0.0	NS
A	<i>Setophaga tigrina</i>	Cape May Warbler				S3B,SUM	333	4.8 ± 7.0	NS
A	<i>Brania bernicla</i>	Brant				S3M	8	73.0 ± 0.0	NS
A	<i>Pluvialis squatarola</i>	Black-bellied Plover				S3M	2092	23.5 ± 0.0	NS
A	<i>Arenaria interpres</i>	Ruddy Turnstone				S3M	895	23.2 ± 0.0	NS
A	<i>Callidris pusilla</i>	Semipalmated Sandpiper				S3M	1790	23.3 ± 0.0	NS
A	<i>Callidris melanotos</i>	Pectoral Sandpiper				S3M	178	24.1 ± 0.0	NS
A	<i>Limnodromus griseus</i>	Short-billed Dowitcher				S3M	1089	23.4 ± 0.0	NS
A	<i>Chroicocephalus ridibundus</i>	Black-headed Gull				S3N	52	29.4 ± 0.0	NS
A	<i>Picoides arcticus</i>	Black-backed Woodpecker				S3S4	192	3.4 ± 7.0	NS
A	<i>Loxia curvirostra</i>	Red Crossbill				S3S4	175	11.3 ± 7.0	NS
A	<i>Sorex albibarbis</i>	Eastern Water Shrew				S3S4	6	68.9 ± 0.0	PE
A	<i>Botaurus lentiginosus</i>	American Bittern				S3S4B,S4S5M	649	11.3 ± 7.0	NS
A	<i>Setophaga castanea</i>	Bay-breasted Warbler				S3S4B,S4S5M	694	4.8 ± 7.0	NS
A	<i>Actitis macularius</i>	Spotted Sandpiper				S3S4B,S5M	943	4.8 ± 7.0	NS
A	<i>Leiothlypis peregrina</i>	Tennessee Warbler				S3S4B,S5M	706	4.8 ± 7.0	NS
A	<i>Passerella iliaca</i>	Fox Sparrow				S3S4B,S5M	74	24.8 ± 0.0	NS
A	<i>Mergus serrator</i>	Red-breasted Merganser				S3S4B,S5M,S5	134	18.2 ± 7.0	NS
A	<i>Callidris maritima</i>	Purple Sandpiper				N	30	30.1 ± 0.0	NS
A	<i>Lanius borealis</i>	Northern Shrike				S3S4N	8	71.2 ± 1.0	PE
A	<i>Morus bassanus</i>	Northern Gannet				SHB	80	26.5 ± 4.0	NS
A	<i>Aythya americana</i>	Redhead				SHB	13	24.1 ± 0.0	NS
A	<i>Leucophaeus atricilla</i>	Laughing Gull				SHB	6	87.9 ± 0.0	NS
A	<i>Progne subis</i>	Purple Martin				SHB	13	67.9 ± 7.0	NS
A	<i>Eremophila alpestris</i>	Horned Lark				SHB,S4S5N,S5	25	29.6 ± 0.0	NS
I	<i>Bombus bohemicus</i>	Shorhorn Bumble Bee	Endangered	Endangered		M	34	30.8 ± 5.0	NS
I	<i>Danaus plexippus</i>	Monarch	Endangered	Special Concern	Endangered	S1	247	7.0 ± 0.0	NS
I	<i>Barnea truncata</i>	Atlantic Mud-piddock	Threatened	Threatened		S1	4	63.5 ± 1.0	NS
I	<i>Bombus suckleyi</i>	Suckley's Cuckoo Bumble Bee	Threatened	Threatened		SH	4	30.5 ± 5.0	NS
I	<i>Alasmidonta varicosa</i>	Brook Floater	Special Concern	Special Concern	Threatened	S3	16	39.4 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
	<i>Bombus terricola</i>	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S3	156	8.9 ± 0.0	NS
	<i>Coccinella transversoguttata richardsoni</i>	Transverse Lady Beetle	Special Concern	Endangered	Endangered	SH	8	11.3 ± 2.0	NS
	<i>Gomphurus ventricosus</i>	Skillet Clubtail	Special Concern	Endangered		SH	2	81.1 ± 0.0	NS
	<i>Eriola laeta</i>	Early Hairstreak	Special Concern			S1	1	77.0 ± 0.0	PE
	<i>Atlanticoncha ochracea</i>	Tidewater Mucket	Special Concern			S1	9	89.9 ± 0.0	NS
	<i>Polygonia satyrus</i>	Satyr Comma	Special Concern			S1?	23	26.3 ± 5.0	NS
	<i>Euphyes bimacula</i>	Two-spotted Skipper	Special Concern			S1S2	2	42.4 ± 0.0	NS
	<i>Boloria chariclea</i>	Arctic Fritillary	Special Concern			S1S2	1	26.2 ± 2.0	NS
	<i>Somatochlora brevicincta</i>	Quebec Emerald	Special Concern			S1S2	1	95.6 ± 0.0	NS
	<i>Tournotaris bimaculata</i>	Two-spotted Brachycerid Weevil	Special Concern			S2	1	89.7 ± 0.0	PE
	<i>Tharsalea dospassosi</i>	Maritime Copper	Special Concern			S2	94	26.3 ± 0.0	NS
	<i>Satyrium acadica</i>	Acadian Hairstreak	Special Concern			S2	16	24.6 ± 2.0	NS
	<i>Neurocordulia michaelsi</i>	Broad-tailed Shadowdragon	Special Concern			S2	26	44.5 ± 0.0	NS
	<i>Coenagrion resolutum</i>	Taiga Bluet	Special Concern			S2	57	47.3 ± 0.0	NS
	<i>Margaritifera margaritifera</i>	Eastern Pearlishell	Special Concern			S2	179	8.9 ± 0.0	NS
	<i>Pantala hymenaea</i>	Spot-Winged Glider	Special Concern			S2?B	1	81.6 ± 1.0	NS
	<i>Nymphalis l-album</i>	Compton Tortoiseshell	Special Concern			S2S3	12	26.3 ± 2.0	NS
	<i>Aglais milberti</i>	Milbert's Tortoiseshell	Special Concern			S2S3	21	26.3 ± 2.0	NS
	<i>Aglais milberti milberti</i>	Milbert's Tortoise Shell	Special Concern			S2S3	3	47.6 ± 0.0	NS
	<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	Special Concern			S2S3	8	57.3 ± 0.0	NS
	<i>Somatochlora kennedyi</i>	Kennedy's Emerald	Special Concern			S2S3	3	85.5 ± 1.0	PE
	<i>Somatochlora williamsoni</i>	Williamson's Emerald	Special Concern			S2S3	13	85.8 ± 0.0	PE
	<i>Williamsonia fletcheri</i>	Ebony Boghaunter	Special Concern			S2S3	7	45.2 ± 0.0	NS
	<i>Stylurus scuderi</i>	Zebra Clubtail	Special Concern			S2S3	4	71.7 ± 0.0	NS
	<i>Alasmidonta undulata</i>	Triangle Floater	Special Concern			S2S3	19	35.0 ± 0.0	NS
	<i>Astyleiopus variegatus</i>	Variegated Long-horned Beetle	Special Concern			S3	1	91.3 ± 0.0	NS
	<i>Psephenus herricki</i>	Herrick's Water Penny Beetle	Special Concern			S3	1	35.5 ± 0.0	NS
	<i>Hormorus undulatus</i>	Undulated Broad-nosed Weevil	Special Concern			S3	1	89.7 ± 0.0	PE
	<i>Carabus serratus</i>	Serrated Ground Beetle	Special Concern			S3	1	41.9 ± 0.0	NS
	<i>Chrysochus auratus</i>	Dogbane Leaf Beetle	Special Concern			S3	3	69.8 ± 3.0	NS
	<i>Naemia seriata</i>	Seaside Lady Beetle	Special Concern			S3	1	78.7 ± 0.0	NS
	<i>Chilocorus stigma</i>	Twice-stabbed Lady Beetle	Special Concern			S3	5	27.4 ± 0.0	NS
	<i>Myzia pullata</i>	Streaked Lady Beetle	Special Concern			S3	3	86.9 ± 0.0	PE
	<i>Ipthiminus opacus</i>	Cloudy Darkling Beetle	Special Concern			S3	1	60.8 ± 0.0	PE
	<i>Monochamus marmorator</i>	Balsam Fir Sawyer	Special Concern			S3	2	45.8 ± 0.0	NS
	<i>Astylopsis sexguttata</i>	Six-speckled Long-horned Beetle	Special Concern			S3	5	89.7 ± 0.0	PE
	<i>Satyrium calanus</i>	Banded Hairstreak	Special Concern			S3	3	28.1 ± 2.0	NS
	<i>Callophrys lanoraileensis</i>	Bog Elfin	Special Concern			S3	12	33.2 ± 0.0	NS
	<i>Strymon melinus</i>	Gray Hairstreak	Special Concern			S3	1	92.3 ± 2.0	NS
	<i>Phanogomphus descriptus</i>	Harpoon Clubtail	Special Concern			S3	4	52.4 ± 1.0	NS
	<i>Ophiogomphus aspersus</i>	Brook Snaketail	Special Concern			S3	4	69.6 ± 0.0	NS
	<i>Ophiogomphus mainensis</i>	Maine Snaketail	Special Concern			S3	14	40.8 ± 0.0	NS
	<i>Ophiogomphus rupinulensis</i>	Rusty Snaketail	Special Concern			S3	55	56.7 ± 0.0	NS
	<i>Epitheca princeps</i>	Prince Baskettail	Special Concern			S3	17	45.2 ± 0.0	NS
	<i>Somatochlora forcipata</i>	Forcipate Emerald	Special Concern			S3	3	78.8 ± 1.0	PE
	<i>Enallagma vernale</i>	Vernal Bluet	Special Concern			S3	5	51.8 ± 1.0	NS
	<i>Strophilus undulatus</i>	Creeping Question Mark	Special Concern			S3B	6	71.8 ± 1.0	NS
	<i>Polygonia interrogatoris</i>	Northern Cloudywing	Special Concern			S3S4	65	18.1 ± 0.0	NS
	<i>Cecropterus pylades</i>	Pepper and Salt Skipper	Special Concern			S3S4	27	6.5 ± 0.0	NS
	<i>Amblyscirtes hegon</i>	Eastern Tailed Blue	Special Concern			S3S4	18	24.6 ± 2.0	NS
	<i>Cupido comyntas</i>	Aphrodite Fritillary	Special Concern			S3S4	3	35.0 ± 0.0	NS
	<i>Argynnis aphrodite</i>	Aphrodite Fritillary	Special Concern			S3S4	26	29.6 ± 2.0	NS

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I	<i>Polygonia faunus</i>	Green Comma				S3S4	22	26.3 ± 2.0	NS
I	<i>Oeneis jutta</i>	Jutta Arctic				S3S4	18	42.1 ± 0.0	NS
I	<i>Aeschna clepsydra</i>	Mottled Darner				S3S4	10	74.1 ± 1.0	NS
I	<i>Aeshna stricta</i>	Lance-Tipped Darner				S3S4	38	16.6 ± 0.0	NS
I	<i>Boyeria graffiana</i>	Ocellated Darner				S3S4	15	27.6 ± 0.0	NS
I	<i>Gomphaeschna furcillata</i>	Hairlequin Darner				S3S4	9	25.2 ± 0.0	NS
I	<i>Somatochlora franklini</i>	Delicate Emerald				S3S4	7	53.6 ± 1.0	NS
I	<i>Erythrodiplax berenice</i>	Seaside Dragonlet				S3S4	4	49.9 ± 0.0	NS
I	<i>Nannothermis bella</i>	Elfin Skimmer				S3S4	21	20.8 ± 0.0	NS
I	<i>Sympetrum danae</i>	Black Meadowhawk				S3S4	7	75.3 ± 1.0	PE
I	<i>Enallagma vesperum</i>	Vesper Bluet				S3S4	1	88.8 ± 0.0	NS
I	<i>Amphiglion saucium</i>	Eastern Red Damselfly				S3S4	3	18.1 ± 0.0	NS
I	<i>Sphaerophoria pyrrhina</i>	Violaceous Globetail				SH	1	31.0 ± 5.0	NS
I	<i>Icaricia saepiolus</i>	Greenish Blue				SH	3	24.5 ± 2.0	NS
I	<i>Polygonia gracilis</i>	Hoary Comma				SH	2	26.3 ± 2.0	NS
N	<i>Erioderma mollissimum</i>	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	30	64.6 ± 0.0	NS
N	<i>Erioderma pedicellatum</i>	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1	518	57.8 ± 0.0	NS
N	<i>Peltigera hydrothyria</i>	Eastern Waterfern	Threatened	Threatened	Threatened	S1	82	0.8 ± 0.0	NS
N	<i>Pannaria lurida</i>	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S2S3	28	62.5 ± 1.0	NS
N	<i>Anzia colpodis</i>	Black-foam Lichen	Threatened	Threatened	Threatened	S3	37	39.1 ± 0.0	NS
N	<i>Fuscopannaria leucosticta</i>	White-rimmed Shingle Lichen	Threatened	Threatened	Threatened	S3	7	58.1 ± 0.0	NS
N	<i>Heterodermia squamulosa</i>	Scaly Fringe Lichen	Threatened	Threatened	Threatened	S3	8	73.5 ± 0.0	NS
N	<i>Pectenium plumbea</i>	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	179	6.8 ± 0.0	NS
N	<i>Sclerophora peronella</i>	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern	Special Concern	S3S4	24	63.2 ± 0.0	NS
N	<i>Pseudevernia cladonia</i>	Ghost Antler Lichen	Not At Risk	Not At Risk	Not At Risk	S2S3	8	61.8 ± 1.0	NS
N	<i>Fissidens exilis</i>	Pygmy Pocket Moss	Not At Risk	Not At Risk	Not At Risk	S3	10	40.4 ± 0.0	NS
N	<i>Chaenotheca servitii</i>	Flexuous Golden Stubble Moss	Data Deficient	Data Deficient	Data Deficient	S1	1	53.2 ± 1.0	NS
N	<i>Alcina brevirostris</i>	Short-Beaked Rigid Screw Moss				S1	1	80.0 ± 0.0	NS
N	<i>Orthotrichum gymnostomum</i>	Aspen Bristle Moss				S1	1	45.7 ± 0.0	NS
N	<i>Sematophyllum demissum</i>	a Moss				S1	1	95.0 ± 2.0	NS
N	<i>Tetradontium brownianum</i>	Little Georgia				S1	1	92.2 ± 0.0	NS
N	<i>Cyrt-hypnum minutulum</i>	Tiny Cedar Moss				S1	1	53.5 ± 0.0	NS
N	<i>Blennothalia crispa</i>	Crinkled Jelly Lichen				S1	1	90.2 ± 0.0	NS
N	<i>Cledonia brevis</i>	Short Peg Lichen				S1	1	98.1 ± 4.0	PE
N	<i>Scytinium schraderi</i>	Wrinkled Jellyskin Lichen				S1	1	53.9 ± 0.0	NS
N	<i>Lichina confinis</i>	Marine Seaweed Lichen				S1	2	88.9 ± 2.0	NS
N	<i>Polychidium muscicola</i>	Eyed Mossthorns				S1	1	45.3 ± 0.0	NS
N	<i>Peltigera lepidophora</i>	Woollybear Lichen				S1	3	53.6 ± 0.0	PE
N	<i>Hypogymnia hultenii</i>	Scaly Pelt Lichen				S1	12	90.0 ± 0.0	NS
N	<i>Calyptogea neogaea</i>	Powdered Honeycomb Lichen				S1?	1	81.5 ± 0.0	NS
N	<i>Jubula pernis/vanica</i>	Common Pouchwort				S1?	1	81.7 ± 0.0	NS
N	<i>Alcina rigida</i>	A liverwort				S1?	2	43.5 ± 0.0	NS
N	<i>Brachythecium erythrorhizon</i>	Aloe-Like Rigid Screw Moss				S1?	2	94.7 ± 0.0	PE
N	<i>Campylostellum saxicola</i>	Taiga Ragged Moss				S1?	2	76.7 ± 0.0	PE
N	<i>Tortula obtusifolia</i>	a Moss				S1?	3	28.3 ± 2.0	NS
N	<i>Didymodon tophaceus</i>	Olive Beard Moss				S1?	2	90.1 ± 4.0	NS
N	<i>Paludella squarrosa</i>	Tufted Fen Moss				S1?	3	97.0 ± 0.0	NS
N	<i>Schistostega pennata</i>	Luminous Moss				S1?	2	89.8 ± 0.0	NS
N	<i>Encylium limosum</i>	Lime-loving Tarpaper Lichen				S1?	3	79.6 ± 0.0	PE
N	<i>Scytinium intermedium</i>	Forty-five Jellyskin Lichen				S1?	2	85.6 ± 4.0	NS
N	<i>Armenopterum</i>	One-sided Groove Moss				S1S2	1	83.2 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	<i>heterosfichium</i>								
N	<i>Plagiothecium latebricola</i>	Alder Silk Moss				S1S2	1	86.8 ± 3.0	NS
N	<i>Seligeria dominiana</i>	Donian Beardless Moss				S1S2	1	93.2 ± 3.0	NS
N	<i>Sematophyllum marylandicum</i>	a Moss				S1S2	2	84.6 ± 6.0	NS
N	<i>Timmia megapolitana</i>	Metropolitan Timmia Moss				S1S2	3	42.4 ± 0.0	NS
N	<i>Pseudotaxiphyllum distichaceum</i>	a Moss				S1S2	2	88.4 ± 0.0	NS
N	<i>Haplodadium microphyllum</i>	Tiny-leaved Haplodadium Moss				S1S2	1	47.1 ± 5.0	NS
N	<i>Pleclidium squamulosum</i>	Limy Soil Stipplescale Lichen				S1S2	1	47.5 ± 6.0	NS
N	<i>Peltigera ponotensis</i>	Pale-bellied Pelt Lichen				S1S2	1	19.8 ± 0.0	NS
N	<i>Pilophorus cereolus</i>	Powdered Matchstick Lichen				S1S2	1	72.8 ± 3.0	NS
N	<i>Solorina spongiosa</i>	Blinking Owl Lichen				S1S2	7	73.4 ± 0.0	NS
N	<i>Parmeliella parvula</i>	Poor-man's Shingles Lichen				S1S2	13	70.8 ± 0.0	NS
N	<i>Heterodermia galactophylla</i>	Branching Fringe Lichen				S1S3	2	56.2 ± 0.0	NS
N	<i>Peltigera neckeri</i>	Black-saddle Pelt Lichen				S1S3	2	78.4 ± 0.0	NS
N	<i>Stereocaulon grande</i>	Grand Foam Lichen				S1S3	1	43.0 ± 0.0	NS
N	<i>Anacamptodon splachnoides</i>	a Moss				S2	1	86.8 ± 3.0	NS
N	<i>Sphagnum platyphyllum</i>	Flat-leaved Peat Moss				S2	2	90.8 ± 3.0	NS
N	<i>Sphagnum subnitens</i>	Lustrous Peat Moss				S2	1	90.0 ± 2.0	NS
N	<i>Scytinium imbricatum</i>	Scaly Jellyskin Lichen				S2	1	76.8 ± 4.0	NS
N	<i>Nephroma resupinatum</i>	a lichen				S2	3	90.7 ± 1.0	NS
N	<i>Pleocythium fiabelosum</i>	Scaly Ink Lichen				S2	1	72.5 ± 17.0	NS
N	<i>Anapychia crinalis</i>	Hanging Fringed Lichen				S2	1	98.1 ± 4.0	PE
N	<i>Moerckia floviriana</i>	Flotow's Ruffwort				S2?	2	88.0 ± 0.0	PE
N	<i>Riccardia multifida</i>	Delicate Germanewort				S2?	2	67.2 ± 0.0	NS
N	<i>Anomodon viticulosus</i>	a Moss				S2?	1	44.1 ± 5.0	NS
N	<i>Atrichum angustatum</i>	Lesser Smoothcap Moss				S2?	3	22.4 ± 2.0	NS
N	<i>Drepanocladus polygamus</i>	Polygamous Hook Moss				S2?	5	83.8 ± 0.0	PE
N	<i>Ditrichum rhynchostegium</i>	a Moss				S2?	1	52.4 ± 0.0	PE
N	<i>Fontinalis hypnoides</i>	a moss				S2?	1	96.8 ± 0.0	PE
N	<i>Kiaeria starkei</i>	Starke's Fork Moss				S2?	1	86.8 ± 10.0	NS
N	<i>Philonotis marchica</i>	a Moss				S2?	3	21.8 ± 0.0	NS
N	<i>Platydictya jungermannioides</i>	False Willow Moss				S2?	3	64.0 ± 0.0	NS
N	<i>Saelania glaucescens</i>	Blue Dew Moss				S2?	1	21.3 ± 0.0	NS
N	<i>Cyrtomnium hymenophylloides</i>	Short-pointed Lantern Moss				S2?	1	21.3 ± 0.0	NS
N	<i>Platyomeila lescurii</i>	a Moss				S2?	2	37.9 ± 0.0	NS
N	<i>Oxyrrhynchium hians</i>	Light Beaked Moss				S2S3	2	62.7 ± 25.0	NS
N	<i>Platydictya subtilis</i>	Bark Willow Moss				S2S3	3	76.7 ± 0.0	PE
N	<i>Scorpidium revolvens</i>	Limprichtia Moss				S2S3	2	83.8 ± 0.0	NS
N	<i>Moelleropsis nebulosa</i>	Blue-gray Moss Shingle Lichen				S2S3	56	48.8 ± 0.0	NS
N	<i>Moelleropsis nebulosa</i> ssp. <i>frullanae</i>	Blue-gray Moss Shingle Lichen				S2S3	3	68.8 ± 0.0	NS
N	<i>Ramalina thrausta</i>	Angelhair Ramalina Lichen				S2S3	15	32.4 ± 0.0	NS
N	<i>Collema leptaleum</i>	Crumpled Bat's Wing Lichen				S2S3	97	45.5 ± 0.0	NS
N	<i>Usnea ceratina</i>	Warty Beard Lichen				S2S3	1	83.0 ± 0.0	NS
N	<i>Usnea rubicunda</i>	Red Beard Lichen				S2S3	2	30.7 ± 0.0	NS
N	<i>Ahtiana aurescens</i>	Eastern Candlewax Lichen				S2S3	7	43.1 ± 6.0	NS
N	<i>Cladonia incrassata</i>	Powder-foot British Soldiers Lichen				S2S3	1	74.7 ± 0.0	NS
N	<i>Cladonia parasitica</i>	Fence-rail Lichen				S2S3	1	55.9 ± 1.0	NS
N	<i>Scytinium tenuissimum</i>	Birdnest Jellyskin Lichen				S2S3	17	31.0 ± 0.0	NS
N	<i>Melanohalea septentrionalis</i>	Northern Camouflage Lichen				S2S3	2	96.7 ± 0.0	PE

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N	<i>Parmelia fertilis</i>	Fertile Shield Lichen				S2S3	10	22.7 ± 0.0	NS
N	<i>Hypotrachyna minarum</i>	Hairless-spined Shield Lichen				S2S3	1	81.3 ± 0.0	NS
N	<i>Parmeliopsis ambigua</i>	Green Starburst Lichen				S2S3	3	25.8 ± 1.0	NS
N	<i>Fuscopannaria sorediata</i>	a Lichen				S2S3	6	62.0 ± 0.0	NS
N	<i>Stereocaulon condensatum</i>	Granular Soil Foam Lichen				S2S3	11	11.0 ± 0.0	NS
N	<i>Physcia subtilis</i>	Slender Rosette Lichen				S2S3	1	73.6 ± 0.0	NS
N	<i>Cladonia coccifera</i>	Eastern Boreal Pixie-cup Lichen				S2S3	2	52.6 ± 1.0	NS
N	<i>Cladonia deformis</i>	Lesser Sulphur-cup Lichen				S2S3	2	80.0 ± 0.0	PE
N	<i>Ephemerum serratum</i>	a Moss				S3	2	25.1 ± 3.0	NS
N	<i>Fissidens taxifolius</i>	Yew-leaved Pocket Moss				S3	7	15.3 ± 0.0	NS
N	<i>Anomodon tristis</i>	a Moss				S3	3	79.7 ± 0.0	NS
N	<i>Sphagnum contortum</i>	Twisted Peat Moss				S3	4	81.8 ± 4.0	NS
N	<i>Tetraplodon angustatus</i>	Toothed-leaved Nitrogen Moss				S3	3	71.3 ± 0.0	NS
N	<i>Rostania occultata</i>	Crusted Tarpaper Lichen				S3	5	73.2 ± 0.0	PE
N	<i>Collera nigrescens</i>	Blistered Tarpaper Lichen				S3	21	47.0 ± 2.0	NS
N	<i>Solorina saccata</i>	Woodland Owl Lichen				S3	6	64.8 ± 2.0	NS
N	<i>Fuscopannaria ahineri</i>	Corrugated Shingles Lichen				S3	88	8.4 ± 0.0	NS
N	<i>Scytinium lichenoides</i>	Tattered Jellyskin Lichen				S3	32	40.0 ± 0.0	NS
N	<i>Leptogium milligranum</i>	Stretched Jellyskin Lichen				S3	11	44.0 ± 0.0	NS
N	<i>Nephroma bellum</i>	Naked Kidney Lichen				S3	14	27.7 ± 0.0	NS
N	<i>Placynthium nigrum</i>	Common Ink Lichen				S3	4	47.6 ± 0.0	NS
N	<i>Platismatia norvegica</i>	Oldgrowth Rag Lichen				S3	1	93.8 ± 0.0	NS
N	<i>Punctelia appalachensis</i>	Appalachian Speckleback Lichen				S3	3	59.3 ± 0.0	NS
N	<i>Viridohelium virens</i>	a lichen				S3	2	78.1 ± 0.0	PE
N	<i>Epebe lanata</i>	Waterside Rockshag Lichen				S3	2	45.3 ± 0.0	NS
N	<i>Phaeophyscia adiaetola</i>	Powder-tipped Shadow Lichen				S3	4	59.6 ± 0.0	PE
N	<i>Phaeophyscia pusilloides</i>	Pompom-tipped Shadow Lichen				S3	11	9.9 ± 0.0	NS
N	<i>Peltigera collina</i>	Tree Pelt Lichen				S3	18	21.0 ± 0.0	NS
N	<i>Barbula convoluta</i>	Lesser Bird's-claw Beard Moss				S3?	1	53.2 ± 0.0	PE
N	<i>Calliergon giganteum</i>	Giant Spear Moss				S3?	1	84.6 ± 2.0	PE
N	<i>Elodium blandowii</i>	Blandow's Bog Moss				S3?	3	7.9 ± 3.0	NS
N	<i>Mnium stellare</i>	Star Leafy Moss				S3?	1	83.2 ± 1.0	NS
N	<i>Sphagnum linbergii</i>	Lindberg's Peat Moss				S3?	1	90.4 ± 0.0	NS
N	<i>Sphagnum riparium</i>	Streamside Peat Moss				S3?	2	77.0 ± 0.0	NS
N	<i>Cladonia stygia</i>	Black-footed Reindeer Lichen				S3?	17	72.8 ± 0.0	NS
N	<i>Dichelyma capillaceum</i>	Hairlike Dichelyma Moss				S3S4	1	99.1 ± 3.0	NS
N	<i>Encalypta protera</i>	Slender Extinguisher Moss				S3S4	10	84.6 ± 0.0	NS
N	<i>Myurella julacea</i>	Small Mouse-tail Moss				S3S4	1	21.3 ± 0.0	NS
N	<i>Splachnum ampullaceum</i>	Cruet Dung Moss				S3S4	3	68.3 ± 0.0	NS
N	<i>Thamnobryum alleghaniense</i>	a Moss				S3S4	5	83.8 ± 0.0	NS
N	<i>Tomentypnum nitens</i>	Golden Fuzzy Fen Moss				S3S4	2	80.1 ± 0.0	NS
N	<i>Schistidium agassizii</i>	Elf Bloom Moss				S3S4	2	93.2 ± 3.0	NS
N	<i>Hylocomium pyrenaicum</i>	a Feather Moss				S3S4	1	93.2 ± 3.0	NS
N	<i>Bryoria pseudofuscescens</i>	Mountain Horsehair Lichen				S3S4	24	59.3 ± 0.0	PE
N	<i>Encylium tenax</i>	Soil Tarpaper Lichen				S3S4	10	40.0 ± 0.0	NS
N	<i>Sticta fuliginosa</i>	Peppered Moon Lichen				S3S4	53	17.5 ± 1.0	NS
N	<i>Arctoparmelia incurva</i>	Finger Ring Lichen				S3S4	13	88.3 ± 0.0	NS
N	<i>Scytinium teretiunculum</i>	Curly Jellyskin Lichen				S3S4	13	32.3 ± 0.0	NS
N	<i>Leptogium acadense</i>	Acadian Jellyskin Lichen				S3S4	42	13.3 ± 0.0	NS
N	<i>Scytinium subtile</i>	Appressed Jellyskin Lichen				S3S4	35	52.7 ± 0.0	NS



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N	<i>Vahlia leucophaea</i>	Shelter Shingle Lichen				S3S4	11	59.5 ± 0.0	NS
N	<i>Heterodermia speciosa</i>	Powdered Fringe Lichen				S3S4	34	21.1 ± 0.0	NS
N	<i>Leptogium coriocola</i>	Blistered Jellyskin Lichen				S3S4	45	52.6 ± 0.0	NS
N	<i>Melanohalea olivacea</i>	Spotted Camouflage Lichen				S3S4	6	25.0 ± 3.0	NS
N	<i>Parmeliopsis hyperopta</i>	Gray Starburst Lichen				S3S4	5	8.6 ± 1.0	NS
N	<i>Parmotrema perlatum</i>	Powdered Ruffie Lichen				S3S4	1	87.0 ± 0.0	NS
N	<i>Petigera hymenina</i>	Cloudy Pelt Lichen				S3S4	1	81.3 ± 1.0	NS
N	<i>Sphaerophorus fragilis</i>	Fragile Coral Lichen				S3S4	3	92.9 ± 0.0	NS
N	<i>Coccocarpia palmicola</i>	Salted Shell Lichen				S3S4	731	39.1 ± 0.0	NS
N	<i>Physcia tenella</i>	Fringed Rosette Lichen				S3S4	6	56.8 ± 0.0	PE
N	<i>Anaptychia palmulata</i>	Shaggy Fringed Lichen				S3S4	70	19.2 ± 0.0	NS
N	<i>Evernia prunastri</i>	Valley Oakmoss Lichen				S3S4	85	1.2 ± 5.0	NS
N	<i>Heterodermia neglecta</i>	Fringe Lichen				S3S4	62	7.2 ± 0.0	NS
P	<i>Clethra ainifolia</i>	Coast Pepper-Bush	Endangered	Threatened	Vulnerable	S2	1	93.4 ± 0.0	PE
P	<i>Fraxinus nigra</i>	Black Ash	Threatened		Threatened	S1S2	1394	3.8 ± 0.0	NS
P	<i>Lilaopsis chinensis</i>	Eastern Lilaopsis	Special Concern	Special Concern	Vulnerable	S3	20	65.3 ± 0.0	NS
P	<i>Isaetes prototypus</i>	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S3	13	52.8 ± 0.0	NS
P	<i>Floerkea proserpinacoides</i>	False Mermaidweed	Not At Risk			S2S3	3	24.8 ± 7.0	NS
P	<i>Acer saccharinum</i>	Silver Maple				S1	5	74.7 ± 0.0	PE
P	<i>Nabalus racemosus</i>	Glaucous Rattlesnakeroot				S1	1	99.1 ± 20.0	PE
P	<i>Cochlearia tridactylites</i>	Limestone Scurvy-grass				S1	1	96.6 ± 0.0	NS
P	<i>Lobelia spicata</i>	Pale-Spiked Lobelia				S1	6	46.0 ± 7.0	NS
P	<i>Stellaria crassifolia</i>	Fleshy Stitchwort				S1	1	97.7 ± 5.0	PE
P	<i>Hudsonia tomentosa</i>	Woolly Beach-heath				S1	40	36.6 ± 7.0	NS
P	<i>Callitriche hermaphroditica</i>	Northern Water-starwort				S1	6	95.3 ± 0.0	PE
P	<i>Elatine americana</i>	American Waterwort				S1	1	73.6 ± 0.0	NS
P	<i>Ribes americanum</i>	Wild Black Currant				S1	2	30.3 ± 5.0	NS
P	<i>Utricularia ochroleuca</i>	Yellowish-white Bladderwort				S1	31	55.2 ± 0.0	NS
P	<i>Fraxinus pennsylvanica</i>	Red Ash				S1	1	45.5 ± 3.0	NS
P	<i>Persicaria careyi</i>	Carey's Smartweed				S1	31	47.2 ± 0.0	NS
P	<i>Ranunculus pensylvanicus</i>	Pennsylvania Buttercup				S1	1	63.3 ± 0.0	NS
P	<i>Salix myrtillofolia</i>	Blueberry Willow				S1	2	63.3 ± 0.0	NS
P	<i>Salix serissima</i>	Autumn Willow				S1	3	95.3 ± 0.0	NS
P	<i>Carex algopecoidea</i>	Foxtail Sedge				S1	4	15.9 ± 0.0	NS
P	<i>Carex garberi</i>	Garber's Sedge				S1	2	97.5 ± 0.0	NS
P	<i>Carex granularis</i>	Limestone Meadow Sedge				S1	1	92.1 ± 1.0	NS
P	<i>Carex ormostachya</i>	Necklace Spike Sedge				S1	4	24.1 ± 0.0	NS
P	<i>Carex plantaginea</i>	Plantain-Leaved Sedge				S1	1	85.6 ± 0.0	PE
P	<i>Carex prairea</i>	Prairie Sedge				S1	2	97.6 ± 0.0	NS
P	<i>Carex tenuiflora</i>	Sparse-Flowered Sedge				S1	6	92.1 ± 5.0	PE
P	<i>Carex tincta</i>	Tinged Sedge				S1	4	90.5 ± 0.0	NS
P	<i>Carex viridula</i> var. <i>saxillifloralis</i>	Greenish Sedge				S1	6	84.9 ± 0.0	NS
P	<i>Carex grisea</i>	Inflated Narrow-leaved Sedge				S1	18	30.1 ± 0.0	NS
P	<i>Cyperus lupulinus</i> ssp. <i>macilentus</i>	Hop Flatsedge				S1	2	57.6 ± 0.0	NS
P	<i>Scirpus atrovirens</i>	Dark-green Bulrush				S1	1	96.5 ± 5.0	PE
P	<i>Blysmopsis rufa</i>	Red Bulrush				S1	2	91.6 ± 1.0	PE
P	<i>Elodea nuttallii</i>	Nuttall's Waterweed				S1	2	78.8 ± 1.0	NS
P	<i>Iris prismatica</i>	Slender Blue Flag				S1	4	19.8 ± 0.0	NS
P	<i>Juncus vaseyi</i>	Vasey Rush				S1	1	75.5 ± 1.0	PE
P	<i>Trillium grandiflorum</i>	White Trillium				S1	3	82.4 ± 1.0	NS
P	<i>Malaxis monophyllos</i> var. <i>brachypoda</i>	North American White Adder's-mouth				S1	10	35.5 ± 1.0	NS
P	<i>Elymus hystrix</i>	Spreading Wild Rye				S1	7	29.0 ± 0.0	NS
P	<i>Adiantum pedatum</i>	Northern Maidenhair Fern				S1?	1	53.2 ± 7.0	NS
P	<i>Solidago hispida</i>	Hairy Goldenrod							

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P	<i>Suaeda rolandii</i>	Roland's Sea-Blite				S1?	1	73.7 ± 2.0	NS
P	<i>Carex pensylvanica</i>	Pennsylvania Sedge				S1?	3	47.2 ± 3.0	NS
P	<i>Bolboschoenus robustus</i>	Sturdy Bulrush				S1?	2	46.0 ± 7.0	NS
P	<i>Allium schoenoprasum</i>	Wild Chives				S1?	1	69.9 ± 0.0	PE
P	<i>Allium schoenoprasum</i> var. <i>sibiricum</i>	Wild Chives				S1?	1	31.8 ± 7.0	NS
P	<i>Cypripedium arietinum</i>	Ram's-Head Lady's-Slipper			Endangered	S1S2	33	45.1 ± 0.0	NS
P	<i>Sanicula odorata</i>	Clustered Sanicle				S1S2	6	11.4 ± 10.0	NS
P	<i>Ageratina altissima</i>	White Snakeroot				S1S2	2	85.8 ± 7.0	NS
P	<i>Proserpinaca intermedia</i>	Intermediate Mermaidweed				S1S2	1	66.4 ± 0.0	NS
P	<i>Anemone virginiana</i> var. <i>alba</i>	Virginia Anemone				S1S2	5	22.4 ± 5.0	NS
P	<i>Parnassia parviflora</i>	Small-flowered Grass-of-Parnassus				S1S2	1	68.9 ± 1.0	NS
P	<i>Carex haydenii</i>	Hayden's Sedge				S1S2	4	30.2 ± 1.0	NS
P	<i>Platanthera huronensis</i>	Fragrant Green Orchid				S1S2	2	65.2 ± 10.0	NS
P	<i>Calamagrostis stricta</i> ssp. <i>stricta</i>	Slim-stemmed Reed Grass				S1S2	25	78.6 ± 0.0	PE
P	<i>Carex vacillans</i>	Estuarine Sedge				S1S3	5	89.6 ± 0.0	NS
P	<i>Zizia aurea</i>	Golden Alexanders				S2	51	15.3 ± 1.0	NS
P	<i>Antennaria parlinii</i> ssp. <i>fallax</i>	Parlin's Pussytoes				S2	4	12.0 ± 0.0	NS
P	<i>Rudbeckia laciniata</i>	Cut-Leaved Coneflower				S2	26	10.8 ± 0.0	NS
P	<i>Arabis pycnocarpa</i>	Cream-flowered Rockcross				S2	1	86.9 ± 0.0	NS
P	<i>Hudsonia ericoides</i>	Pinebarren Golden Heather				S2	2	96.5 ± 5.0	PE
P	<i>Desmodium canadense</i>	Canada Tick-trefoil				S2	20	20.4 ± 0.0	NS
P	<i>Hydostemum glutinosum</i>	Large Tick-trefoil				S2	6	93.7 ± 0.0	NS
P	<i>Anemonestrum canadense</i>	Canada Anemone				S2	1	29.0 ± 0.0	NS
P	<i>Hepatica americana</i>	Round-lobed Hepatica				S2	32	3.4 ± 0.0	NS
P	<i>Galium boreale</i>	Northern Bedstraw				S2	6	53.4 ± 5.0	NS
P	<i>Comandra umbellata</i>	Bastard's Toadflax				S2	49	91.6 ± 5.0	NS
P	<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop				S2	21	38.6 ± 0.0	NS
P	<i>Dicra palustris</i>	Eastern Leatherwood				S2	19	60.9 ± 7.0	NS
P	<i>Carex chordeorrhiza</i>	Creeping Sedge				S2	35	91.6 ± 1.0	PE
P	<i>Carex gynocrates</i>	Northern Bog Sedge				S2	2	63.3 ± 0.0	NS
P	<i>Carex pellita</i>	Woolly Sedge				S2	12	20.2 ± 0.0	NS
P	<i>Carex livida</i>	Livid Sedge				S2	27	48.0 ± 0.0	NS
P	<i>Juncus Greenei</i>	Greene's Rush				S2	7	54.2 ± 1.0	NS
P	<i>Juncus alpinoarticulatus</i> ssp. <i>americanus</i>	Northern Green Rush				S2	6	89.9 ± 0.0	PE
P	<i>Luzula spicata</i>	Spiked Woodrush				S2	1	84.9 ± 0.0	NS
P	<i>Allium tricoccum</i>	Wild Leek				S2	10	10.6 ± 0.0	NS
P	<i>Lilium canadense</i>	Canada Lily				S2	151	7.2 ± 0.0	NS
P	<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	Yellow Lady's-slipper				S2	38	25.2 ± 7.0	NS
P	<i>Cypripedium reginae</i>	Showy Lady's-Slipper				S2	100	20.2 ± 0.0	NS
P	<i>Platanthera flava</i> var. <i>herbiola</i>	Pale Green Orchid				S2	8	11.0 ± 7.0	NS
P	<i>Platanthera macrophylla</i>	Large Round-Leaved Orchid				S2	16	6.7 ± 5.0	NS
P	<i>Bromus latiglumis</i>	Broad-Glumed Brome				S2	33	32.4 ± 0.0	NS
P	<i>Cinna arundinacea</i>	Sweet Wood Reed Grass				S2	19	36.5 ± 0.0	NS
P	<i>Elymus wiegandii</i>	Wiegand's Wild Rye				S2	20	16.0 ± 0.0	NS
P	<i>Festuca subverticillata</i>	Nodding Fescue				S2	6	60.1 ± 1.0	NS
P	<i>Cryptogramma stelleri</i>	Steller's Rockbrake				S2	1	72.4 ± 0.0	NS
P	<i>Cuscuta cephalanthi</i>	Buttonbush Dodder				S2?	9	22.4 ± 1.0	NS
P	<i>Rumex persicarioides</i>	Peach-leaved Dock				S2?	4	71.6 ± 5.0	PE
P	<i>Crataegus submollis</i>	Quebec Hawthorn				S2?	6	32.0 ± 5.0	NS
P	<i>Carex peckii</i>	White-Tinged Sedge				S2?	3	25.9 ± 0.0	NS
P	<i>Thuja occidentalis</i>	Eastern White Cedar			Vulnerable	S2S3	956	54.1 ± 0.0	NS

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P	<i>Osmorhiza longistylis</i>	Smooth Sweet Cicely				S2S3	23	12.3 ± 0.0	NS
P	<i>Bidens hyperborea</i>	Estuary Beggarticks				S2S3	3	66.3 ± 0.0	NS
P	<i>Erigeron philadelphicus</i>	Philadelphian Fleabane				S2S3	6	45.1 ± 5.0	NS
P	<i>Lactuca hirsuta</i>	Hairy Lettuce				S2S3	3	74.7 ± 5.0	PE
P	<i>Impatiens pallida</i>	Pale Jewelweed				S2S3	3	40.8 ± 0.0	NS
P	<i>Caulophyllum thalictroides</i>	Blue Cohosh				S2S3	104	10.5 ± 0.0	NS
P	<i>Boechera stricta</i>	Drummond's Rockcress				S2S3	8	20.4 ± 0.0	NS
P	<i>Stellaria humifusa</i>	Saltmarsh Starwort				S2S3	9	72.2 ± 1.0	PE
P	<i>Oxybasis rubra</i>	Red Goosefoot				S2S3	8	26.7 ± 0.0	NS
P	<i>Hypericum majus</i>	Large St. John's-wort				S2S3	21	47.2 ± 0.0	NS
P	<i>Hypericum x dissimulatum</i>	Disguised St. John's-wort				S2S3	6	54.1 ± 1.0	NS
P	<i>Empetrum atropurpureum</i>	Purple Crowberry				S2S3	2	94.9 ± 5.0	PE
P	<i>Euphorbia polygonifolia</i>	Seaside Spurge				S2S3	14	48.7 ± 1.0	PE
P	<i>Myriophyllum farwellii</i>	Farwells Water Milfoil				S2S3	10	37.2 ± 0.0	NS
P	<i>Hedeoma pulegioides</i>	American False Pennyroyal				S2S3	7	28.1 ± 5.0	NS
P	<i>Oenothera fruticosa</i> ssp. <i>tetragona</i>	Narrow-leaved Evening Primrose				S2S3	3	11.0 ± 7.0	NS
P	<i>Polygonum aviculare</i> ssp. <i>buxiforme</i>	Box Knotweed				S2S3	5	28.7 ± 0.0	NS
P	<i>Polygonum oxyspermum</i> ssp. <i>raili</i>	Ray's Knotweed				S2S3	4	93.7 ± 5.0	PE
P	<i>Rumex triangulivalvis</i>	Triangular-valve Dock				S2S3	4	49.0 ± 0.0	NS
P	<i>Primula mistassinica</i>	Mistassinii Primrose				S2S3	17	21.6 ± 0.0	NS
P	<i>Anemone quinquefolia</i>	Wood Anemone				S2S3	21	34.1 ± 0.0	NS
P	<i>Callitha palustris</i>	Yellow Marsh Marigold				S2S3	107	43.7 ± 0.0	NS
P	<i>Amelanchier fernaldii</i>	Fernald's Serviceberry				S2S3	1	80.2 ± 5.0	NS
P	<i>Potentilla canadensis</i>	Canada Cinquefoil				S2S3	1	50.1 ± 5.0	NS
P	<i>Galium obtusum</i>	Blunt-leaved Bedstraw				S2S3	1	92.1 ± 1.0	NB
P	<i>Salix pellita</i>	Satiny Willow				S2S3	5	38.4 ± 0.0	NS
P	<i>Tiarella cordifolia</i>	Heart-leaved Foamflower				S2S3	223	3.4 ± 0.0	NS
P	<i>Agalinis purpurea</i> var. <i>parviflora</i>	Small-flowered Purple False Foxglove				S2S3	33	19.6 ± 0.0	NS
P	<i>Boehmeria cylindrica</i>	Small-spike False-nettle				S2S3	3	71.4 ± 0.0	NS
P	<i>Carex adusta</i>	Lesser Brown Sedge				S2S3	6	30.9 ± 0.0	NS
P	<i>Carex capillaris</i>	Hairlike Sedge				S2S3	2	88.0 ± 0.0	NS
P	<i>Carex comosa</i>	Bearded Sedge				S2S3	17	36.2 ± 7.0	NS
P	<i>Carex houghtoniana</i>	Houghton's Sedge				S2S3	5	47.1 ± 1.0	NS
P	<i>Carex hystericina</i>	Porcupine Sedge				S2S3	7	20.2 ± 0.0	NS
P	<i>Eleocharis ovata</i>	Ovate Spikerush				S2S3	8	10.0 ± 0.0	NS
P	<i>Scirpus pedicellatus</i>	Stalked Bulrush				S2S3	8	37.5 ± 0.0	NS
P	<i>Vallisneria americana</i>	Wild Celery				S2S3	8	45.0 ± 1.0	NS
P	<i>Najas gracillima</i>	Thread-Like Naiad				S2S3	2	100.0 ± 0.0	NS
P	<i>Goodyera pubescens</i>	Downy Rattlesnake-Plantain				S2S3	6	53.9 ± 0.0	NS
P	<i>Spiranthes casei</i>	Case's Ladies'-Tresses				S2S3	1	92.6 ± 1.0	NS
P	<i>Spiranthes casei</i> var. <i>novaeaeccotiae</i>	Case's Ladies'-Tresses				S2S3	7	52.1 ± 0.0	NS
P	<i>Spiranthes lucida</i>	Shining Ladies'-Tresses				S2S3	25	16.8 ± 5.0	NS
P	<i>Calamagrostis stricta</i>	Slim-stemmed Reed Grass				S2S3	12	78.6 ± 0.0	PE
P	<i>Potamogeton frutescens</i>	Fries' Pondweed				S2S3	17	28.0 ± 5.0	NS
P	<i>Woodsia glabella</i>	Smooth Cliff Fern				S2S3	1	48.4 ± 1.0	NS
P	<i>Botrychium lanceolatum</i> ssp. <i>angustisegmentum</i>	Narrow Triangle Moonwort				S2S3	12	6.0 ± 1.0	NS
P	<i>Botrychium simplex</i>	Least Moonwort				S2S3	4	35.7 ± 0.0	NS
P	<i>Ophioglossum pusillum</i>	Northern Adder's-tongue				S2S3	9	6.9 ± 0.0	NS
P	<i>Potamogeton puicher</i>	Spotted Pondweed				S3	3	47.8 ± 2.0	NS
P	<i>Angelica atropurpurea</i>	Purple-stemmed Angelica				S3	13	37.7 ± 0.0	NS
P	<i>Conioselinum chinense</i>	Chinese Hemlock-parsley				S3	3	8.5 ± 5.0	NS
P	<i>Hieracium robinsonii</i>	Robinson's Hawkweed				S3	3	4.6 ± 7.0	NS

Vulnerable

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	<i>Senecio pseudoarctica</i>	Seabeach Ragwort				S3	17	31.8 ± 7.0	NS
P	<i>Symphotrichum boreale</i>	Boreal Aster				S3	82	31.8 ± 7.0	NS
P	<i>Symphotrichum ciliolatum</i>	Fringed Blue Aster				S3	21	25.7 ± 0.0	NS
P	<i>Betula michauxii</i>	Michaux's Dwarf Birch				S3	34	54.2 ± 0.0	NS
P	<i>Betula pumila</i>	Bog Birch				S3	71	63.7 ± 0.0	NS
P	<i>Cardamine parviflora</i>	Small-flowered Bittercress				S3	4	91.4 ± 0.0	NS
P	<i>Palustricodon aparinoides</i>	Marsh Bellflower				S3	39	10.0 ± 0.0	NS
P	<i>Mononeuria groenlandica</i>	Greenland Stitchwort				S3	2	76.7 ± 0.0	NS
P	<i>Sagina nodosa</i>	Knotted Pearlwort				S3	9	90.1 ± 0.0	NS
P	<i>Sagina nodosa ssp. borealis</i>	Knotted Pearlwort				S3	10	89.1 ± 0.0	NS
P	<i>Stellaria longifolia</i>	Long-leaved Starnwort				S3	21	9.7 ± 0.0	NS
P	<i>Ceratophyllum echinatum</i>	Prickly Hornwort				S3	19	36.5 ± 0.0	NS
P	<i>Triosteum aurantiacum</i>	Orange-fruited Tinker's Weed				S3	140	10.7 ± 0.0	NS
P	<i>Viburnum edule</i>	Squashberry				S3	3	3.1 ± 0.0	NS
P	<i>Crassula aquatica</i>	Water Pygmyweed				S3	2	90.5 ± 5.0	PE
P	<i>Empetrum eamesii</i>	Pink Crowberry				S3	8	70.0 ± 5.0	PE
P	<i>Halenia deflexa</i>	Spurred Gentian				S3	1	90.9 ± 1.0	NS
P	<i>Geranium bicknellii</i>	Bicknell's Crane's-bill				S3	5	45.5 ± 2.0	NS
P	<i>Myriophyllum verticillatum</i>	Whorled Water Milfoil				S3	6	37.4 ± 0.0	NS
P	<i>Epiobium strictum</i>	Downy Willowherb				S3	74	29.9 ± 5.0	NS
P	<i>Polygala sanguinea</i>	Blood Milkwort				S3	38	2.3 ± 0.0	NS
P	<i>Persicaria arifolia</i>	Halberd-leaved Tearthumb				S3	68	12.9 ± 0.0	NS
P	<i>Plantago rugelii</i>	Rugel's Plantain				S3	7	20.4 ± 0.0	NS
P	<i>Samolus parviflorus</i>	Seaside Brookweed				S3	31	50.2 ± 0.0	NS
P	<i>Pyrola minor</i>	Lesser Pyrola				S3	3	7.6 ± 0.0	NS
P	<i>Anemone virginiana</i>	Virginia Anemone				S3	38	22.4 ± 0.0	NS
P	<i>Galium labradoricum</i>	Labrador Bedstraw				S3	113	36.1 ± 0.0	NS
P	<i>Salix pedicellaris</i>	Bog Willow				S3	62	32.2 ± 7.0	NS
P	<i>Salix sericea</i>	Silky Willow				S3	1	83.0 ± 1.0	NS
P	<i>Lindernia dubia</i>	Yellow-seeded False Pimpernel				S3	47	15.6 ± 0.0	NS
P	<i>Laportea canadensis</i>	Canada Wood Nettle				S3	54	10.1 ± 10.0	NS
P	<i>Pilea pumila</i>	Dwarf Cleanweed				S3	35	36.8 ± 0.0	NS
P	<i>Viola nephrophylla</i>	Northern Bog Violet				S3	9	7.6 ± 1.0	NS
P	<i>Carex bebbii</i>	Bebb's Sedge				S3	18	20.4 ± 0.0	NS
P	<i>Carex castanea</i>	Chestnut Sedge				S3	39	57.3 ± 0.0	NS
P	<i>Carex cryptolepis</i>	Hidden-scaled Sedge				S3	13	36.8 ± 0.0	NS
P	<i>Carex eburnea</i>	Bristle-leaved Sedge				S3	34	39.9 ± 0.0	NS
P	<i>Carex hirtifolia</i>	Pubescent Sedge				S3	59	10.4 ± 1.0	NS
P	<i>Carex lupulina</i>	Hop Sedge				S3	60	14.9 ± 0.0	NS
P	<i>Carex rosea</i>	Rosy Sedge				S3	35	11.4 ± 11.0	NS
P	<i>Carex tenera</i>	Tender Sedge				S3	10	9.0 ± 1.0	NS
P	<i>Carex tribuloides</i>	Blunt Broom Sedge				S3	12	20.5 ± 2.0	NS
P	<i>Carex tuckermanii</i>	Tuckerman's Sedge				S3	41	15.1 ± 0.0	NS
P	<i>Carex atratiformis</i>	Scabrous Black Sedge				S3	3	98.7 ± 1.0	NS
P	<i>Eleocharis nitida</i>	Quill Spikerush				S3	6	75.5 ± 7.0	NS
P	<i>Eleocharis flavescens</i> var. <i>olivacea</i>	Bright-green Spikerush				S3	7	36.2 ± 0.0	NS
P	<i>Eriophorum gracile</i>	Slender Cottongrass				S3	33	30.1 ± 10.0	NS
P	<i>Schoenoplectus americanus</i>	Olney's Bulrush				S3	1	84.9 ± 0.0	NS
P	<i>Juncus stygius</i> ssp. <i>americanus</i>	Moor Rush				S3	37	97.3 ± 0.0	NS
P	<i>Coelogyne viride</i>	Long-bracted Frog Orchid				S3	1	56.6 ± 0.0	NS
P	<i>Cypripedium parviflorum</i>	Yellow Lady's-slipper				S3	54	20.1 ± 0.0	NS
P	<i>Neottia biflora</i>	Southern Twayblade				S3	25	20.8 ± 0.0	NS
P	<i>Platanthera grandiflora</i>	Large Purple Fringed Orchid				S3	177	2.2 ± 0.0	NS
P	<i>Platanthera hookeri</i>	Hooker's Orchid				S3	27	45.1 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	<i>Dichanthelium linearifolium</i>	Narrow-leaved Panic Grass				S3	4	20.3 ± 0.0	NS
P	<i>Piptatheropsis canadensis</i>	Canada Ricegrass				S3	9	37.0 ± 1.0	NS
P	<i>Poa glauca</i>	Glaucous Blue Grass				S3	2	88.0 ± 0.0	NS
P	<i>Stuckenia filiformis</i>	Thread-leaved Pondweed				S3	6	86.7 ± 0.0	PE
P	<i>Potamogeton praelongus</i>	White-stemmed Pondweed				S3	50	9.8 ± 1.0	NS
P	<i>Potamogeton richardsonii</i>	Richardson's Pondweed				S3	7	4.8 ± 7.0	NS
P	<i>Potamogeton zosteriformis</i>	Flat-stemmed Pondweed				S3	19	38.1 ± 0.0	NS
P	<i>Asplenium viride</i>	Green Spleenwort				S3	10	54.8 ± 7.0	NS
P	<i>Dryopteris fragrans</i>	Fragrant Wood Fern				S3	11	17.8 ± 7.0	NS
P	<i>Sceptridium dissectum</i>	Dissected Moonwort				S3	6	9.6 ± 5.0	NS
P	<i>Polypodium appalachianum</i>	Appalachian Polypody				S3	13	5.3 ± 0.0	NS
P	<i>Persicaria amphibia</i> var. <i>emersa</i>	Long-root Smartweed				S3?	4	70.5 ± 0.0	NS
P	<i>Spiranthes ochroleuca</i>	Yellow Ladies'-tresses				S3?	55	17.3 ± 0.0	NS
P	<i>Diphysastrum x sabinifolium</i>	Savin-leaved Ground-cedar				S3?	10	12.0 ± 0.0	NS
P	<i>Bidens vulgata</i>	Tall Beggarticks				S3S4	5	30.2 ± 0.0	NS
P	<i>Erigeron hyssopifolius</i>	Hyssop-leaved Fleabane				S3S4	41	48.2 ± 0.0	NS
P	<i>Hieracium paniculatum</i>	Panicled Hawkweed				S3S4	7	2.2 ± 0.0	NS
P	<i>Bidens beckii</i>	Water Beggarticks				S3S4	14	30.2 ± 0.0	NS
P	<i>Packera pauperula</i>	Balsam Groundsel				S3S4	81	19.5 ± 0.0	NS
P	<i>Atriplex glabriuscula</i> var. <i>franktonii</i>	Frankton's Saltbush				S3S4	4	27.4 ± 2.0	NS
P	<i>Vaccinium boreale</i>	Northern Blueberry				S3S4	7	86.4 ± 0.0	NS
P	<i>Vaccinium cespitosum</i>	Dwarf Bilberry				S3S4	55	19.3 ± 0.0	NS
P	<i>Fagus grandifolia</i>	American Beech				S3S4	547	1.0 ± 0.0	NS
P	<i>Bartonia virginica</i>	Yellow Bartonia				S3S4	1	83.0 ± 7.0	NS
P	<i>Proserpinaca pectinata</i>	Comb-leaved Mermaidweed				S3S4	2	40.0 ± 1.0	NS
P	<i>Decodon verticillatus</i>	Swamp Loosestrife				S3S4	1	93.4 ± 0.0	PE
P	<i>Nuphar microphylla</i>	Small Yellow Pond-lily				S3S4	4	19.5 ± 2.0	NS
P	<i>Persicaria pennsylvanica</i>	Pennsylvania Smartweed				S3S4	23	19.7 ± 0.0	NS
P	<i>Fallopia scandens</i>	Climbing False Buckwheat				S3S4	46	19.4 ± 0.0	NS
P	<i>Rumex pallidus</i>	Seabeach Dock				S3S4	2	84.6 ± 0.0	NS
P	<i>Pyrola asarifolia</i>	Pink Pyrola				S3S4	15	16.1 ± 0.0	NS
P	<i>Endotropis alnifolia</i>	alder-leaved buckthorn				S3S4	476	36.2 ± 0.0	NS
P	<i>Amelanchier spicata</i>	Running Serviceberry				S3S4	14	17.8 ± 2.0	NS
P	<i>Crataegus succulenta</i>	Fleshy Hawthorn				S3S4	5	82.9 ± 5.0	PE
P	<i>Fragaria vesca</i> ssp. <i>americana</i>	Woodland Strawberry				S3S4	67	16.3 ± 1.0	NS
P	<i>Fragaria vesca</i>	Woodland Strawberry				S3S4	3	57.6 ± 0.0	NS
P	<i>Galium aparine</i>	Common Bedstraw				S3S4	20	32.0 ± 0.0	NS
P	<i>Geocalium lividum</i>	Northern Comandra				S3S4	16	28.6 ± 0.0	NS
P	<i>Limosella australis</i>	Southern Mudwort				S3S4	39	51.1 ± 0.0	NS
P	<i>Ulmus americana</i>	White Elm				S3S4	119	11.3 ± 1.0	NS
P	<i>Verbena hastata</i>	Blue Vervain				S3S4	257	10.0 ± 0.0	NS
P	<i>Viola sagittata</i> var. <i>ovata</i>	Arrow-Leaved Violet				S3S4	5	72.5 ± 1.0	PE
P	<i>Viola seikiikii</i>	Great-Spurred Violet				S3S4	5	56.6 ± 0.0	NS
P	<i>Symplocarpus foetidus</i>	Eastern Skunk Cabbage				S3S4	136	67.6 ± 0.0	NS
P	<i>Carex argyrantha</i>	Silvery-flowered Sedge				S3S4	1	64.1 ± 5.0	PE
P	<i>Triglochin gaspensis</i>	Gasp $\bar{r}$ Arrowgrass				S3S4	23	88.8 ± 0.0	NS
P	<i>Juncus acuminatus</i>	Sharp-Fruit Rush				S3S4	3	70.2 ± 2.0	NS
P	<i>Juncus subcaudatus</i>	Woods-Rush				S3S4	19	27.7 ± 5.0	NS
P	<i>Luzula parviflora</i> ssp. <i>melanocarpa</i>	Black-fruited Woodrush				S3S4	5	61.5 ± 0.0	NS
P	<i>Goodyera repens</i>	Lesser Rattlesnake-plantain				S3S4	11	49.0 ± 1.0	PE
P	<i>Liparis loeselii</i>	Loesel's Twayblade				S3S4	27	42.4 ± 1.0	NS
P	<i>Platanthera obtusata</i>	Blunt-leaved Orchid				S3S4	6	57.3 ± 1.0	NS
P	<i>Platanthera orbiculata</i>	Small Round-leaved Orchid				S3S4	38	4.5 ± 0.0	NS
P	<i>Alopecurus aequalis</i>	Short-awned Foxtail				S3S4	26	25.2 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	<i>Dichanthelium clandestinum</i>	Deer-tongue Panic Grass				S3S4	181	61.3 ± 5.0	NS
P	<i>Panicum philadelphicum</i>	Philadelphian Panicgrass				S3S4	13	46.7 ± 0.0	NS
P	<i>Koeleria spicata</i>	Narrow False Oats				S3S4	10	19.4 ± 0.0	NS
P	<i>Equisetum pratense</i>	Meadow Horsetail				S3S4	12	22.0 ± 0.0	NS
P	<i>Diphasiastrum complanatum</i>	Northern Ground-cedar				S3S4	17	25.6 ± 0.0	NS
P	<i>Diphasiastrum sitchense</i>	Sitka Ground-cedar				S3S4	4	23.4 ± 5.0	NS
P	<i>Huperzia appressa</i>	Mountain Firmoss				S3S4	9	22.2 ± 5.0	NS
P	<i>Sceptridium multifidum</i>	Leathery Moonwort				S3S4	16	26.1 ± 0.0	NS
P	<i>Botrychium matricarifolium</i>	Daisy-leaved Moonwort				S3S4	12	7.2 ± 10.0	NS
P	<i>Viola canadensis</i>	Canada Violet				SH	1	24.8 ± 7.0	NS

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The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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47		Churchill, J.L. 2020. Atlantic Canada Conservation Data Centre Fieldwork 2020. Atlantic Canada Conservation Data Centre, 1083 recs.
43		Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
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31		Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESEA). NB Dept of New Brunswick Inc. 6042 recs. <a href="https://doi.org/10.1037/arc0000014">https://doi.org/10.1037/arc0000014</a> .
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22		Cameron, R.P. 2018. Degelia plumbea records. Nova Scotia Environment.
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21		Churchill, J.L., Klymko, J.D. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre.
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20		Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
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19		Brazner, J. 2016. Nova Scotia Forested Wetland Bird Surveys. Nova Scotia Department of Lands and Forestry.
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- 13 Klymko, John. 2023. Atlantic Canada Conservation Data Centre zoological fieldwork 2022. Atlantic Canada Conservation Data Centre.
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- 13 Robinson, S.L. 2015. 2014 field data.
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- 10 Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (*Isoetes prototypus*). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
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- 9 Cameron, R.P. 2005. Erioderma pedicellatum unpublished data. NS Dept of Environment, 9 recs.
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8		Cameron, R.P. 2012. Rob Cameron 2012 vascular plant data. NS Department of Environment, 30 recs.
8		Curley, F.R. 2007. PEF&W Collection. PEI Fish & Wildlife Div., 199 recs.
8		e-Butterfly. 2019. Export of Maritimes records and photos submitted to MTRI from the 2021 field season. Mersey Tobateic Research Institute.
8		Huble, Nicole. 2022. Monarch ( <i>Danaus plexippus</i> ) records submitted to MTRI from the 2021 field season. Mersey Tobateic Research Institute.
8		Hughes, Cory. 2020. Atlantic Forestry Centre <i>Coccinella transversoguttata</i> collections. Canadian Forest Service, Atlantic Forestry Centre.
8		Manthorne, A. 2019. Incidental aerial insectivore observations. Birds Canada.
8		Nature Conservancy Canada, Prince Edward Island. 2022. NCC PEI 2022 occurrence data. NCC PEI. Pers. comm., 214 records.
7		Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
7		Beiland, R.J. 2012. PEI moss records from Devonian Botanical Garden. DBG Cryptogam Database, Web site: <a href="https://secure.devonian.ualberta.ca/bryo_search.php">https://secure.devonian.ualberta.ca/bryo_search.php</a> 748 recs.
7		Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avena, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
7		Blaney, C.S.; Mazerolle, D.M. 2009. Fieldwork 2009. Atlantic Canada Conservation Data Centre, Sackville NB, 13395 recs.
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7		Harding, R.W. 2008. Harding Personal Insect Collection 1999-2007. R.W. Harding, 309 recs.
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7		Neily, Tom. 2020. Lichen surveys for PEI Forested Landscapes Priority Place. Chapman, C.J. (ed.) Atlantic Canada Conservation Data Centre, 158 records.
7		Ogden, K. Nova Scotia Museum butterfly specimen database. Nova Scotia Museum. 2017.
7		Robinson, S.L. 2011. ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
7		Sabine, D.L. 2013. Dwayne Sabine butterfly records, 2009 and earlier.
7		Spicer, C.D. 2004. Specimens from CWS Herbarium. Mount Allison Herbarium Database. Mount Allison University, 5939 recs.
6		Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
6		Gallop, John. 2021. Sheet Harbour rare lichen observations. McCallum Environmental.
6		Hall, R. 2008. Rare plant records in old fieldbook notes from Turro area. Pers. comm. to C.S. Blaney, 6 recs. 6 recs.
6		Mazerolle, D.M. 2020. Atlantic Canada Conservation Data Centre botanical fieldwork 2019. Atlantic Canada Conservation Data Centre.
6		Neily, T.H. Tom Neily NS Sphagnum records (2009-2014). T.H. Neily, Atlantic Canada Conservation Data Centre, 2019.
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6		Stevens, C. 1999. Cam Stevens field data from PEI vegetation plots. Sent along with specimens to C.S. Blaney. UNB masters research project, 732 recs.
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5		Basquill, S.P. 2010. Plant data from Prince Edward Island National Park Forest Community Plots. Atlantic Canada Conservation Data Centre, 150 records.
5		Blaney, C.S. 2017. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
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5		Erskine, A.J. 1999. Maritime Nest Records Scheme (MNRS) 1937-1999. Canadian Wildlife Service, Sackville, 313 recs.
5		Feltham, Carter. 2022. Monarch ( <i>Danaus plexippus</i> ) and Milkweed MTRI records from the 2022 Field Season. Mersey Tobateic Research Institute.
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5		Kelly, G. 2005. <i>Fraxinus nigra</i> . Dept of Agriculture, Fisheries, Aquaculture & Forestry. Pers. comm. to C.S. Blaney, Mar. 2, 11 recs.
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5		Majka, C.G. 2008. Lepidoptera at St. Patricks, 1993-2007. Pers. comm. to R. Curley, 8 Jan. 29 recs, 29 recs.
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5		McNeill, J.A. 2020. Snapping Turtle and Eastern Painted Turtle records, 2020. Mersey Tobateic Research Institute.
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5		Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro, 2003.
5		Smith, M.E.M. 2008. AgCan Collection. Agriculture Canada, Charlottetown PE, 44 recs.
5		Towell, C. 2014. 2014 Northern Goshawk and Common Nighthawk email reports, NS. NS Department of Natural Resources.
5		Walker, J. 2017. Bird inventories at French River, NS, and Memramcook, NB, for Nature Conservancy of Canada. Pers. comm. to AC CDC.
4		Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centre, 30 recs.
4		Canadian National Collection of Insects Arachnids, and Nematodes Bombus specimen database export. Government of Canada. 2022.
4		Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
4		Mazerolle, D.M. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
4		O'Neill, S. 1998. Atlantic Salmon: Eastern Shore Nova Scotia SFA 20. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-10. 4 recs.
4		Pohl, G.P. Specimen data from Northern Forest Research Centre. Northern Forest Research Centre. 2022.
4		Prince Edward Island National Park. 2014. Prince Edward Island National Park Herbarium; Parks Canada Agency, PEINP, 39 recs.
3		Amirault, D.L. 1997-2000. Unpublished files. Canadian Wildlife Service, Sackville, 470 recs.
3		Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
3		Basquill, S.P., Porter, C. 2019. Bryophyte and lichen specimens submitted to the E.C. Smith Herbarium. NS Department of Lands and Forestry.
3		Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.

#	recs	CITATION
3		Benjamin, L.K. 2006. <i>Cyrtopodium arietinum</i> . Pers. comm. to D. Mazerolle. 9 recs, 9 recs.
3		Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
3		Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
3		Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
3		Calhoun, J.C. Butterfly records databased at the McGuire Center for Lepidoptera and Biodiversity. Calhoun, J.C. 2020.
3		Cameron, R.P. 2012. Additional rare plant records, 2009. , 7 recs.
3		Clayden, S.R. 2007. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, download Mar. 2007, 69 14 recs.
3		Dibblee, R.L. 1999. PEI Cormorant Survey. Prince Edward Island Fisheries, Aquaculture & Environment, 1p. 21 recs.
3		Gagnon, J. 2004. Specimen data from 2002 visit to Prince Edward Island. , 104 recs.
3		Heron, J. 2022. Bombus records communicated to J. Klymko over email in autumn 2022. Pers. comm.
3		Klymko, J.J.D. 2011. Insect fieldwork & submissions, 2010. Atlantic Canada Conservation Data Centre. Sackville NB, 742 recs.
3		McLelland, Don. 2021. Orchard observations on PEI. Don McLelland. Pers. comm. to C.S. Blaney.
3		McMullin, R.T.; van Milltenburg, N.; Atkinson, K.-L.; Ayles, P. 2022. A Provisional List of the Lichens and Allied Fungi of Prince Edward Island National Park. Canadian Museum of Nature, 37 pp.
3		Mersey Toboatic Research Institute. 2022. Nova Scotia Bobolink observations. pers. comm. to J. Churchill.
3		Neily, T.H. & Pepper, C.; Toms, B. 2018. Nova Scotia lichen database Update. Mersey Toboatic Research Institute, 14 recs.
3		Neily, T.H. 2016. Email communication (May 6, 2016) to Sean Blaney regarding Fissidens exilis observations made in 2016 in Nova Scotia. Pers. Comm., 3 recs.
3		Parker, M. 2016. Wood turtle ( <i>Glyptemys insculpta</i> ) Visual Surveys at Black, Wallace, Musquodobit and Sackville Rivers, Nova Scotia. East Coast Aquatics Inc., 3 records.
3		Sollows, M.C. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
3		Standley, L.A. 2002. Carex haydenii in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
3		Thompson, R. 2018. Williamsdale Quarry Expansion Project, NS. Environmental Assessment rare plants. Dexter Construction Company Limited.
3		Webster, R.P. & Edsall, J. 2007. 2005 New Brunswick Rare Butterfly Survey. Environmental Trust Fund, unpublished report, 232 recs.
2		Basquill, S.P. 2012. 2012 Bryophyte specimen data. Nova Scotia Department of Natural Resources, 37 recs.
2		Benedict, B. Connell Herbarium Specimens. University New Brunswick, Fredericton. 2003.
2		Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources. 143 recs.
2		Cameron, B. 2005. C. palmicola, E. pedicellatum records from Sixth Lake. Pers. comm. to C.S. Blaney. 3 recs, 3 recs.
2		Chapman, Cody. Unreported Species at Risk Records across Nova Scotia. Chapman, Cody, 5 records.
2		COSEWIC (Committee on the Status of Wildlife in Canada). 2013. COSEWIC Assessment and Status Report on the Eastern Waterfarn <i>Peltigera hydrothya</i> in Canada. COSEWIC, 46 pp.
2		Curley, F.R. 2003. Glen Kelly records for <i>Betula pumila</i> & <i>Asclepias syriaca</i> on PEI. , Pers. comm. to C.S. Blaney. 9 recs.
2		Curley, Rosemary. 2023. Bryophytes collected on Prince Edward Island in 2007. PEI Museum and Heritage Foundation. Pers. comm, 49 records.
2		de Graaf, M.; Miller, D. 2020. Records of <i>Cyrtopodium reginae</i> and <i>Equisetum variegatum</i> from CFI property at Scoudouc Road and Symlocarpus foetidus from CFI properties at Upper Cape. Westmorland County, NB. pers. comm. (ed.) Community Forests International. 4 records.
2		Doubt, J. 2013. Email to Sean Blaney with Nova Scotia records of <i>Fissidens exilis</i> at Canadian Museum of Nature. pers. comm., 3 records.
2		Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
2		Frittation, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers. comm. to S. Blaney Feb. 7. 34 recs.
2		Giroux, P. 2013. Personal communication concerning species at risk in and around PEI NP, PE. Winter 2013. Pers. comm.
2		Hill, N. 2003. <i>Floerkea proserpinacoides</i> at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2		Hill, Nick. 2021. <i>Fraxinus nigra</i> observations at Marshy Hope. Fern Hill Institute of Plant Conservation.
2		Layberry, R.A. 2012. Lepidopteran records for the Maritimes, 1974-2008. Layberry Collection, 1060 recs.
2		Macaulay, M. Notes on newly discovered <i>Hepatica nobilis</i> var. <i>obtusata</i> population in Cumberland Co. NS. Pers. comm. to S. Blaney, 1 rec.
2		McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
2		McAlpine, D.F. New Brunswick Museum bee specimens. New Brunswick Museum. 2013.
2		Munro, M. 2003. <i>Caulophyllum thalictroides</i> & <i>Carex hirtifolia</i> at Herbert River, Brooklyn, NS. , Pers. comm. to C.S. Blaney. 2 recs.
2		Munro, M. 2003. <i>Dirca palustris</i> & <i>Hepatica nobilis</i> var. <i>obtusata</i> at Cozmagun River, NS. , Pers. comm. to C.S. Blaney. 2 recs.
2		Neily, T.H.; Smith, C.; Whitman, E. 2011. NCC Logging Lake (Halifax Co. NS) properties baseline survey data. Nature Conservancy of Canada, 2 recs.
2		Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
2		Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program. Ottawa, 190 recs.
2		Thomas, H.H.; Jones, G.S. & Dibblee, R.L. 1980. <i>Sorex palustris</i> on Prince Edward Island. Can. Field Nat., vol 94:329-331. 2 recs.
2		Tingley, S. (compiler). 2001. Butterflies of New Brunswick. , Web site: <a href="http://www.geocities.com/Yosemite/8425/buttrfly">www.geocities.com/Yosemite/8425/buttrfly</a> . 142 recs.
2		Williams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
2		Zahavich, J. 2017. Canada Warbler and Olive-sided Flycatcher records 2017. Island Nature Trust, 14 recs.
1		Amirault, D.L. 2005. 2005 Peregrine Falcon Survey, Canadian Wildlife Service, Sackville, unpublished data. 27 recs.
1		Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1		Atlantic Canada Bank Swallow Working Group. 2022. 2021 Bank Swallow colony records.
1		Basquill, S.P. 2009. 2009 field observations. Nova Scotia Dept of Natural Resources.
1		Bateman, M.C. & Prescott, W.H. 1984. The Mammals of Prince Edward Island National Park. Canadian Wildlife Service, vol 2:5. 3 recs.
1		Beiland, R.J. 2012. PEI moss records from New York Botanical Garden. NYBG Virtual Herbarium. Web site: <a href="http://sciweb.nybg.org/science2/vii2.asp">http://sciweb.nybg.org/science2/vii2.asp</a> 135 recs.
1		Belliveau, A.G. E.C. Smith Herbarium Specimen Database 2019. E.C. Smith Herbarium, Acadia University. 2019.
1		Bonnyman, Vanessa. 2021. Eastern Wood-Pewee Observation on Bonshaw Trail, PEI.

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1	Bruce, J. 2014. 2014 Wood Turtle email report, Nine Mile River, NS. NS Department of Natural Resources.
1	Cairns, D. 1998. Atlantic Salmon: Prince Edward Island SFA 17. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-07. 1 rec.
1	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
1	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
1	Churchill, J.L. 2018. Atlantic Canada Conservation Data Centre Fieldwork 2018. Atlantic Canada Conservation Data Centre, 907 recs.
1	Clayden, S.R. 2006. Pseudevernia cladonia records. NB Museum. Pers. comm. to S. Blaney, Dec, 4 recs.
1	Clayden, S.R. 2020. Email to Sean Blaney regarding <i>Pliphorus cereus</i> and <i>P. fibula</i> at Fidèle Lake area, Charlotte County, NB. pers. comm., 2 records.
1	Curley, F.R. 2021. <i>Nymphalis l-album</i> record from near Belfast PEI. Pers. comm. to J. Klymko.
1	Day, R. & Catling, P.M. 1991. The Rare Vascular Plants of Prince Edward Island, 1st Ed. Canadian Museum of Nature, Ottawa. Syllogeus. 67.
1	Docherty, Joanne. 2022. Phone call to John Klymko about <i>Danaus plexippus</i> observation in Nova Scotia. Personal communication.
1	Doucet, D.A. 2007. PEI National Park Odonata Survey. Parks Canada, PEI National Park, 1 rec.
1	Doucet, D.A. ACCDC Reference Collection. Atlantic Canada Conservation Data Centre, Sackville NB, 2008.
1	e-Butterfly. 2018. Selected Maritimes butterfly records from 2016 and 2017. Maxim Larriwee, Sambo Zhang (ed.) e-butterfly.org.
1	Eastman, A. 2019. Snapping Turtle observation at Brookfield, Colchester Co. NS. Halifax Field Naturalists Nova Scotia Nature Archive Facebook Page, 1 record.
1	Gagnon, J. 2003. Prince Edward Island plant records. Société de la faune et des parcs Québec, 13 recs.
1	Golder Associates Ltd. 2021. Black Ash location from Goff's Quarry Expansion Environment Assessment, 2017. Golder Associates Ltd., 1 record.
1	Harling, L. & Silva, M. 2004. Abundance & species richness of shrews within forested habitats on PEI. Am. Midi. Nat., 151:399-407. 2 recs.
1	Harris, Megan. 2018. Miscellaneous <i>Sorex palustris</i> record. Pers. comm. to S. Blaney.
1	Hauglihan, S.R. 2018. Description of <i>Fuscopannaria leucosticta</i> field work in 2017. New Brunswick Museum, 314 recs.
1	Hill, N.M. 2021. Observation of <i>Carex haydenii</i> and black ash near Marshy Hope and Ponthook Lake. pers. comm.
1	Hinds, H.R. 1989. Greenwich, Blooming Point plant collections in Plant locations. Pers. Comm. to Robin Day (Ag. Can). 2pp, 8 recs, 8 recs.
1	Honeyman, K. 2019. Unique Areas Database, 2018. J.D. Irving Ltd.
1	Jacques Whitford Ltd. 2003. Canadian Lily location. Pers. Comm. to S. Blaney. 2pp, 1 rec, 1 rec.
1	Jardine, Don. 2022. Email to AC CDC reporting an Evening Grosbeak Sighting in Winsloe South, PEI. pers. comm.
1	Kelly, Glen 2004. Botanical records from 2004 PEI Forestry fieldwork. Dept of Environment, Energy & Forestry, 71 recs.
1	Klymko, J. Henry Hensel's Butterfly Collection Database. Atlantic Canada Conservation Data Centre, 2016.
1	Klymko, J. Partial database of the Agriculture Canada Charlottetown Research Station Insect Collection butterfly specimens. Atlantic Canada Conservation Data Centre. 2016.
1	Klymko, J.J.D. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 3 recs.
1	Klymko, J.J.D. 2012. Insect field work & submissions. Atlantic Canada Conservation Data Centre, 852 recs.
1	Macauley, M. 2008. Email to Sean Blaney regarding rich hardwood floodplain site at Howards Pool, Wallace River, NS.
1	MacAuley, M. 2020. Email to Sean Blaney regarding <i>Agalinis paupercula</i> var. <i>parviflora</i> at Malagash Station, NS. pers. comm., 2 records.
1	MacPhail, V. Bee and syrphid specimens from MSc research. Pers. comm. J. Klymko. 2006.
1	MacQuarrie, K. and R. Sharkie. 2004. Plant lists for selected areas at Brackley and Dalvay, Prince Edward Island National Park. Island Nature Trust, 168 recs.
1	Mazerolle, D.M. 2005. Bouctouche Irving Eco-Centre rare coastal plant fieldwork results 2004-05. Irving Eco-centre, la Dune du Bouctouche, 174 recs.
1	McNeil, J.A. 2019. Snapping Turtle records. 2019. Mersey Tobeaic Research Institute.
1	Morrison, Annie. 2010. NCC Properties Fieldwork: June-August 2010. Nature Conservancy Canada, 508 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
1	Neily, T.H. & Pepper, C.; Toms, B. 2019. Boreal Felt Lichen Observation, April 2019. Mersey Tobeaic Research Institute.
1	Neily, T.H. 2013. Email communication to Sean Blaney regarding <i>Agalinis paupercula</i> observations made in 2013 in Nova Scotia. , 1 rec.
1	Oehlke, W. 1999. Record of <i>Polygona satyrus</i> from Prince Edward Island. <a href="http://www.silkmoths.bizland.com/ppsatyr.htm">http://www.silkmoths.bizland.com/ppsatyr.htm</a> .
1	Parker, M. 2018. East Coast Aquatics ACCDC 2018 Report. East Coast Aquatics, 12 records.
1	Payzant, P. 2018. Satyr Comma record from Bible Hill, NS. <a href="https://novascotiabutterflies.ca">https://novascotiabutterflies.ca</a> .
1	Quigley, E.J. 2021. Email to Sean Blaney regarding Eastern White Cedar ( <i>Tuja occidentalis</i> ) stand near Shinimicas Bridge. NSDLF, 1 record.
1	Robinson, C.B. 1907. Early intervale flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	Sabine, M. 2016. NB DNR staff incidental Black Ash observations. New Brunswick Department of Natural Resources.
1	Shortt, R. UNB specimen data for various tracked species formerly considered secure. Connell Memorial Herbarium, UNB, Fredericton NB. 2019.
1	Skevington, Jeffrey H. 2020. Syrphid records used for the Field Guide to the Flower Flies of Northeastern North America. Canadian National Collection of Insects.
1	Sollows, M.C. 2008. NBM Science Collections databases: herpetiles. New Brunswick Museum, Saint John NB, download Jan. 2008, 8636 recs.
1	teRaa, J. 2016. Island Naturalist. Nature PEI, 219.
1	Whitlam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
1	Wilson, G. 2013. 2013 Snapping Turtle email report, Wentworth, NS. Pers. comm.

APPENDIX D  
MARITIME BREEDING BIRD ATLAS SQUARES

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## Square Summary (20MR93)

#species (1st atlas) #species (2nd atlas) #hours #pc done  
 poss prob conf total poss prob conf total 1st 2nd road offrd

9 24 21 54 21 42 21 84 4 23.9 0 0

## Region summary (#21: Cobequid)

#squares #sq with data #species #pc done target #pc  
 1st 2nd 1st 2nd

67 62 65 146 167 508 251

**Target number of point counts in this square:** 13 road side, 2 off road (1 in Mature coniferous, 1 in Mature deciduous). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.

SPECIES	Code		%		SPECIES	Code		%		Code		%			
	1st	2nd	1st	2nd		1st	2nd	1st	2nd	1st	2nd	1st	2nd		
<u>Canada Goose</u>		0	53		Northern Harrier	H	H	46	76	North Saw-whet Owl			11	36	
<u>Wood Duck</u>		20	52		Sharp-shinned Hawk			22	38	<u>Common Nighthawk</u> †			29	55	
Gadwall †		0	3		Northern Goshawk			12	20	Chimney Swift †		P	32	23	
Eurasian Wigeon †		0	0		<u>Broad-winged Hawk</u>			32	55	Ruby-thr Hummingbird		FY	61	100	
American Wigeon		12	26		Red-tailed Hawk	H		46	72	Belted Kingfisher		H	P	51	93
American Black Duck	P	H	66	81	Virginia Rail †			6	9	Yellow-bellied Sapsucker		T	50	83	
Mallard		P	9	60	Sora		S	16	52	Downy Woodpecker		S	48	89	
Blue-winged Teal			27	26	Common Gallinule †			3	1	Hairy Woodpecker		P	FY	54	87
Northern Shoveler †			3	4	American Coot †			4	0	Am Three-toed Woodpecker †			0	0	
Northern Pintail			8	1	Semipalmated Plover †			6	0	Black-back Woodpecker		H	20	26	
Green-winged Teal	P		24	56	Piping Plover †		DD	56	64	Pileated Woodpecker		FL	T	80	98
Ring-necked Duck	P	P	32	72	Killdeer			50	70	American Kestrel		P	H	50	75
Greater Scaup †			0	0	Spotted Sandpiper		H	50	70	<u>Merlin</u>		H	16	47	
Common Eider †§			0	1	Greater Yellowlegs †			14	24	Olive-sided Flycatcher †		FL	S	38	66
<u>Hooded Merganser</u>			9	50	Willet			62	73	Eastern Wood-Pewee		S	56	70	
<u>Common Merganser</u>			25	55	Wilson's Snipe		H	62	73	Yellow-bellied Flycatcher		T	30	56	
Red-breast Merganser			4	7	American Woodcock		H	22	81	Alder Flycatcher		T	79	100	
Gray Partridge			6	4	Ring-billed Gull †§			8	10	Willow Flycatcher †			1	1	
Ring-necked Pheasant	P		20	69	Herring Gull §			8	6	Least Flycatcher		T	D	59	84
Ruffed Grouse	T		58	86	Great Black-backed Gull §			9	12	<u>Eastern Phoebe</u>			12	58	
Spruce Grouse			20	30	Common Tern §			1	0	Gr Crested Flycatcher			6	4	
<u>Common Loon</u>	P		29	35	Arctic Tern †§			0	3	Eastern Kingbird			45	47	
Pied-billed Grebe			24	30	Black Guillemot †§			59	78	Blue-headed Vireo		T	T	61	92
Double-crest Cormorant §			8	12	Rock Pigeon		AE	27	95	Philadelphia Vireo †			1	3	
<u>American Bittern</u>			22	55	Mourning Dove		FY	9	26	Red-eyed Vireo		T	CF	82	100
<u>Great Blue Heron §</u>	H		29	13	Black-billed Cuckoo			40	63	<u>Gray Jay</u>			45	58	
Turkey Vulture †‡			0	0	<u>Great Horned Owl</u>			35	69	Blue Jay		H	FY	70	96
<u>Osprey</u>			22	50	Barred Owl		S	1	1	American Crow		FL	T	87	100
<u>Bald Eagle</u> ‡			27	83	Short-eared Owl †										

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## Maritimes Breeding Bird Atlas - Summary Sheet for Square 20MR93 (page 2 of 2)

SPECIES	Code		%		SPECIES	Code		%		SPECIES	Code		%	
	1st	2nd	1st	2nd		1st	2nd	1st	2nd		1st	2nd	1st	2nd
Common Raven	FL	T	69	100	Tennessee Warbler	T	S	75	43	Scarlet Tanager †			4	1
Horned Lark †			1	1	Nashville Warbler	FL	T	48	86	Northern Cardinal †			0	10
Tree Swallow	H	FY	80	93	Mourning Warbler	FL	CF	33	49	Rose-breast Grosbeak	FL	S	69	56
Bank Swallow \$			56	43	Common Yellowthroat	T	CF	82	100	Indigo Bunting †			1	3
Cliff Swallow \$			38	36	American Redstart	T	T	85	98	<u>Bobolink</u>			70	69
Barn Swallow	FL	V	85	90	Cape May Warbler			32	16	Red-wing Blackbird		CF	67	84
Black-capp Chickadee		CF	67	98	Northern Parula	T	T	72	96	Rusty Blackbird †			24	21
Boreal Chickadee	FL	T	53	66	Magnolia Warbler	T	CF	72	96	Common Grackle		CF	75	96
Red-breast Nuthatch	FL	T	70	81	Bay-breasted Warbler		S	40	49	Brown-head Cowbird			43	18
White-breast Nuthatch			11	15	Blackburnian Warbler	T	T	54	83	Baltimore Oriole			11	13
Brown Creeper		S	14	50	Yellow Warbler	FL	T	74	92	Pine Grosbeak			29	4
Winter Wren		T	38	80	Chestn-sided Warbler	T	T	61	86	Purple Finch		AY	67	93
Golden-crown Kinglet	FL	T	69	87	Blackpoll Warbler			12	12	House Finch †			1	4
Ruby-crown Kinglet	T	T	79	92	Black-thr Blue Warbler		S	8	43	Red Crossbill †			17	15
Eastern Bluebird †			1	16	Palm Warbler		D	22	75	White-winged Crossbill		FL	54	64
<u>Veery</u>			54	61	Yellow-rumped Warbler		T	67	98	Pine Siskin		H	59	58
Bicknell's Thrush †	T	T	66	89	Black-thr Green Warbler		AY	69	83	American Goldfinch		P	82	100
Swainson's Thrush	T	T	74	96	Canada Warbler †		S	35	52	Evening Grosbeak		T	50	55
Hermit Thrush			4	9	Wilson's Warbler		AY	T	69	<u>House Sparrow</u>		H	79	36
Wood Thrush †					Chipping Sparrow			4	10					
American Robin	FL	CF	90	100	Vesper Sparrow †			74	86					
<u>Gray Catbird</u>			54	58	Savannah Sparrow		T	CF	74	86				
Northern Mockingbird †			4	3	Nelson's Sh.-tail Sparrow			16	21					
European Starling	FL	AE	77	93	Song Sparrow		T	T	87	100				
Bohemian Waxwing †			0	0	Lincoln's Sparrow		AY	S	45	63				
Cedar Waxwing		T	70	100	Swamp Sparrow		T	T	51	95				
Ovenbird	D		70	93	White-throat Sparrow		AY	CF	77	100				
North Waterthrush		A	30	55	White-crown Sparrow †			0	1					
Black-white Warbler	T	T	77	87	Dark-eyed Junco		FL	FY	70	92				

This list includes all species found during the Maritimes Breeding Bird Atlas (1st atlas: 1986-1990, 2nd atlas: 2006-2010) in the region #21 (Cobequid). Underlined species are those that you should try to add to this square (20MR93). They have not yet been reported during the 2nd atlas, but were found during the 1st atlas in this square or have been reported in more than 50% of the squares in this region during the 2nd atlas so far. "Code" is the code for the highest breeding evidence for that species in square 20MR93 during the 2nd and 1st atlas respectively. The % columns give the percentage of squares in that region where that species was reported during the 2nd and 1st atlas (this gives an idea of the expected chance of finding that species in region #21). Rare/Colonial Species Report Forms should be completed for species marked: \$ (Colonial), † (regionally rare), ‡ (rare in the Maritimes) or ♂ (rare in the Maritimes, documentation only required for confirmed records). Current as of 13/06/2024. An up-to-date version of this sheet is available from <http://www.mba-aom.ca/jsp/summaryform.jsp?squareID=20MR93?lang=en>

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## Square Summary (20MR94)

#species (1st atlas) #species (2nd atlas) #hours #pc done  
 poss prob conf total poss prob conf total 1st 2nd road offrd  
 12 24 39 75 9 27 54 90 21 50.6 17 0

## Region summary (#21: Cobequid)

#squares #sq with data #species #pc done target #pc  
 1st 2nd 1st 2nd  
 67 62 65 146 167 508 251

**Target number of point counts in this square:** 12 road side, 3 off road (3 in Mature deciduous). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.

SPECIES	Code		%		SPECIES	Code		%		Code		%	
	1st	2nd	1st	2nd		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Canada Goose			0	53	Northern Harrier	NY	46	76					
Wood Duck	FL	20	52		Sharp-shinned Hawk	H	22	38					
Gadwall †		0	3		Northern Goshawk		12	20					
Eurasian Wigeon †		0	0		Broad-winged Hawk		32	55			H	A	61
American Wigeon		12	26		Red-tailed Hawk	CF	46	72			T	CF	51
American Black Duck	H	66	81		Virginia Rail †		6	9			H	T	50
Mallard		9	60		Sora	H	16	52			AY	AE	48
Blue-winged Teal		27	26		Common Gallinule †		3	1			H	T	54
Northern Shoveler †		3	4		American Coot †		4	0					0
Northern Pintail		8	1		Semipalmated Plover †		6	0			H		20
Green-winged Teal		24	56		Piping Plover †		3	3			FL	FY	80
Ring-necked Duck	FY	32	72		Killdeer		56	64			FL	T	45
Greater Scaup †		0	0		Spotted Sandpiper	ON	50	70					50
Common Eider †§		0	1		Greater Yellowlegs †		0	3					16
Hooded Merganser	FY	9	50		Willet		14	24			AY	T	38
Common Merganser	P	25	55		Wilson's Snipe	DD	H	62	73				56
Red-breast Merganser		4	7		American Woodcock	T	22	81			AY	T	30
Gray Partridge		6	4		Ring-billed Gull †§		0	0			T	CF	79
Ring-necked Pheasant	FY	20	69		Herring Gull §		8	10					1
Ruffed Grouse	H	A	58	86	Great Black-backed Gull §		8	6			T	CF	59
Spruce Grouse	H	D	20	30	Common Tern §		9	12			NY		12
Common Loon		29	35		Arctic Tern †§		1	0			P		6
Pied-billed Grebe		24	30		Black Guillemot †§		0	3			H		45
Double-crest Cormorant §		8	12		Rock Pigeon	FY	59	78			T	FY	61
American Bittern		22	55		Mourning Dove	T	27	95					1
Great Blue Heron §	H	29	13		Black-billed Cuckoo		9	26			AY	CF	82
Turkey Vulture †±		0	0		Great Horned Owl	T	40	63			FL	FY	45
Osprey		22	50		Barred Owl	H	T	35	69		H	FY	70
Bald Eagle ±	P	27	83		Short-eared Owl †		1	1			H	FY	87

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## Maritimes Breeding Bird Atlas - Summary Sheet for Square 20MR94 (page 2 of 2)

SPECIES	Code		%		SPECIES	Code		%		SPECIES	Code		%	
	1st	2nd	1st	2nd		1st	2nd	1st	2nd		1st	2nd	1st	2nd
Common Raven	FL	FY	69	100	<u>Tennessee Warbler</u>	T		75	43	Scarlet Tanager †			4	1
Horned Lark †			1	1	Nashville Warbler	H		48	86	Northern Cardinal †			0	10
Tree Swallow	FL	AE	80	93	Mourning Warbler	AY	T	33	49	Rose-breast Grosbeak	T	P	69	56
Bank Swallow \$	AY	AE	56	43	Common Yellowthroat	AY	CF	82	100	Indigo Bunting †			1	3
Cliff Swallow \$	AE	AE	38	36	American Redstart	AY	CF	85	98	<u>Bobolink</u>			70	69
Barn Swallow	FL	AE	85	90	<u>Cape May Warbler</u>	T		32	16	<u>Red-wing Blackbird</u>			P	67
Black-capp Chickadee	T	FY	67	98	Northern Parula	T	CF	72	96	Rusty Blackbird †			NB	24
Boreal Chickadee	FL	T	53	66	Magnolia Warbler	AY	CF	72	96	Common Grackle	FL	CF	75	96
Red-breast Nuthatch	FL	S	70	81	Bay-breasted Warbler	FL	S	40	49	<u>Brown-head Cowbird</u>			C	43
White-breast Nuthatch	FY	FY	11	15	Blackburnian Warbler	AY	T	54	83	Baltimore Oriole				11
<u>Brown Creeper</u>			14	50	Yellow Warbler	CF		74	92	Pine Grosbeak				29
Winter Wren	T	T	38	80	Chestn-sided Warbler	T	CF	61	86	Purple Finch	FL	CF	67	93
Golden-crown Kinglet	FL	T	69	87	Blackpoll Warbler			12	12	House Finch †			1	4
Ruby-crown Kinglet	T	CF	79	92	Black-thr Blue Warbler	T	T	8	43	Red Crossbill †				17
Eastern Bluebird †	FL		54	61	Palm Warbler	CF		22	75	White-winged Crossbill	FL	P	54	64
<u>Veery</u>			1	16	Yellow-rumped Warbler	AY	CF	67	98	Pine Siskin	T	H	59	58
Bicknell's Thrush †	AY	FY	66	89	Black-thr Green Warbler	AY	CF	69	83	American Goldfinch	FL	FY	82	100
Swainson's Thrush	AY	CF	74	96	Canada Warbler †			CF	35	Evening Grosbeak	P	T	50	55
Hermit Thrush	T	S	4	9	Wilson's Warbler	AY	CF	69	86	House Sparrow				79
Wood Thrush †	FL	CF	90	100	Chipping Sparrow	T	FY	4	10					
American Robin	A		54	58	Vesper Sparrow †	AY	FY	74	86					
<u>Gray Catbird</u>			4	3	Savannah Sparrow			16	21					
Northern Mockingbird †	H	AE	77	93	Nelson's Sh.-tail Sparrow	AY	CF	87	100					
European Starling	FL	CF	70	100	Song Sparrow	AY	CF	45	63					
Bohemian Waxwing †	T	CF	70	93	Lincoln's Sparrow	AY	CF	51	95					
Cedar Waxwing	T	A	30	55	Swamp Sparrow	AY	CF	77	100					
Ovenbird	T	CF	77	87	White-throat Sparrow			0	1					
North Waterthrush	T	CF	77	87	White-crown Sparrow †	T	CF	70	92					
Black-white Warbler					Dark-eyed Junco									

This list includes all species found during the Maritimes Breeding Bird Atlas (1st atlas: 1986-1990, 2nd atlas: 2006-2010) in the region #21 (Cobequid). Underlined species are those that you should try to add to this square (20MR94). They have not yet been reported during the 2nd atlas, but were found during the 1st atlas in this square or have been reported in more than 50% of the squares in this region during the 2nd atlas so far. "Code" is the code for the highest breeding evidence for that species in square 20MR94 during the 2nd and 1st atlas respectively. The % columns give the percentage of squares in that region where that species was reported during the 2nd and 1st atlas (this gives an idea of the expected chance of finding that species in region #21). Rare/Colonial Species Report Forms should be completed for species marked: \$ (Colonial), † (regionally rare), ‡ (rare in the Maritimes) or ♂ (rare in the Maritimes, documentation only required for confirmed records). Current as of 13/06/2024. An up-to-date version of this sheet is available from <http://www.mba-aom.ca/jsp/summaryform.jsp?squareID=20MR94?lang=en>

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## Square Summary (20MR95)

#species (1st atlas) #species (2nd atlas) #hours #pc done  
 poss prob conf total poss prob conf total 1st 2nd road offrd  
 11 37 34 82 21 48 25 94 13 21.2 0 0

## Region summary (#21: Cobequid)

#squares #sq with data #species #pc done target #pc  
 1st 2nd 1st 2nd 1st 2nd  
 67 62 65 146 167 508 251

**Target number of point counts in this square:** 14 road side, 1 off road (1 in Mature coniferous). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.

SPECIES	Code		% SPECIES		Code		% SPECIES		Code		% SPECIES	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Canada Goose	FY	0	53	Northern Harrier	T	H	46	76	Boreal Owl †	T	0	1
Wood Duck	P	H	20	52	Sharp-shinned Hawk	H	22	38	North Saw-whet Owl	H	T	11
Gadwall †		0	3	Northern Goshawk			12	20	Common Nighthawk †	S	29	55
Eurasian Wigeon †		0	0	Broad-winged Hawk	S	32	55	Chimney Swift †		32	23	
American Wigeon		12	26	<u>Red-tailed Hawk</u>	T	46	72	Ruby-thr Hummingbird	T	H	61	100
American Black Duck	FL	T	66	81	Virginia Rail †		6	9	Belted Kingfisher	FL	H	51
Mallard	FY	9	60	<u>Sora</u>		16	52	Yellow-bellied Sapsucker	T	NY	50	83
Blue-winged Teal	P	27	26	Common Gallinule †	H	3	1	Downy Woodpecker	T	H	48	89
Northern Shoveler †		3	4	American Coot †		4	0	Hairy Woodpecker	T	NY	54	87
Northern Pintail		8	1	Semipalmated Plover †		6	0	Am Three-toed Woodpecker †		0	0	0
Green-winged Teal	P	24	56	Piping Plover †		3	3	Black-back Woodpecker		20	26	
Ring-necked Duck	FY	32	72	Killdeer	T	FY	56	64	Northern Flicker	AY	T	80
Greater Scaup †		0	0	<u>Spotted Sandpiper</u>	H	50	70	Pileated Woodpecker	FL	T	45	80
Common Eider †§		0	1	Greater Yellowlegs †		0	3	American Kestrel	T	D	50	75
Hooded Merganser	FY	9	50	Willet		14	24	Merlin		16	47	
Common Merganser	FL	P	25	55	Wilson's Snipe	H	DD	62	73	Olive-sided Flycatcher †	CF	38
Red-breast Merganser		4	7	American Woodcock	T	22	81	<u>Eastern Wood-Pewee</u>	T	56	70	
Gray Partridge		6	4	Ring-billed Gull †§		0	0	Yellow-bellied Flycatcher	AY	S	30	56
<u>Ring-necked Pheasant</u>		20	69	Herring Gull §		8	10	Alder Flycatcher	T	S	79	100
Ruffed Grouse	FL	T	58	86	Great Black-backed Gull §		8	6	Willow Flycatcher †		1	1
Spruce Grouse		20	30	Common Tern §		9	12	Least Flycatcher	T	FY	59	84
Common Loon		29	35	Arctic Tern †§		1	0	Eastern Phoebe	NY	12	58	
Pied-billed Grebe	T	24	30	Black Guillemot †§		0	3	Gr Crested Flycatcher		6	4	
Double-crest Cormorant §		8	12	Rock Pigeon	FL	P	59	78	Eastern Kingbird	FL	T	45
<u>American Bittern</u>		22	55	Mourning Dove	H	T	27	95	Blue-headed Vireo	A	61	92
<u>Great Blue Heron §</u>	H	29	13	Black-billed Cuckoo		9	26	Philadelphia Vireo †		1	3	
Turkey Vulture †§		0	0	Great Horned Owl	T	T	40	63	Red-eyed Vireo	NY	T	82
<u>Osprey</u>		22	50	Barred Owl	T	T	35	69	<u>Gray Jay</u>	FL	45	58
Bald Eagle ♂	H	NY	27	83	Short-eared Owl †		1	1	Blue Jay	FL	T	70

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## Maritimes Breeding Bird Atlas - Summary Sheet for Square 20MR95 (page 2 of 2)

SPECIES	Code		%		SPECIES		Code		%						
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd					
American Crow	NY	H	87	100	Black-white Warbler	T	T	77	87	Dark-eyed Junco	NY	P	70	92	
Common Raven	H	FY	69	100	Tennessee Warbler	T	D	75	43	Scarlet Tanager †			4	1	
Horned Lark †			1	1	Nashville Warbler	T		48	86	Northern Cardinal ‡			0	10	
Tree Swallow	FL	FY	80	93	<u>Mourning Warbler</u>	T		33	49	Rose-breast Grosbeak	AY	S	69	56	
<u>Bank Swallow §</u>	ON		56	43	Common Yellowthroat	AY	CF	82	100	Indigo Bunting ‡			1	3	
<u>Cliff Swallow §</u>	V		38	36	American Redstart	T	CF	85	98	Bobolink	NY	D	70	69	
Barn Swallow	AY	V	85	90	Cape May Warbler			32	16	Red-wing Blackbird	T	P	67	84	
Black-capp Chickadee	T	FY	67	98	Northern Parula	T	DD	72	96	Rusty Blackbird †			H	24	21
<u>Boreal Chickadee</u>			53	66	Magnolia Warbler	T	D	72	96	Common Grackle	ON	FY	75	96	
Red-breast Nuthatch	T	FY	70	81	Bay-breasted Warbler	T	S	40	49	<u>Brown-head Cowbird</u>	FL		43	18	
White-breast Nuthatch			11	15	Blackburnian Warbler	T	CF	54	83	<u>Baltimore Oriole</u>	H		11	13	
<u>Brown Creeper</u>	H		14	50	Yellow Warbler	AY	T	74	92	Pine Grosbeak			29	4	
Winter Wren	T	T	38	80	Chestn-sided Warbler	T		61	86	Purple Finch	FL	T	67	93	
Golden-crown Kinglet	T	T	69	87	Blackpoll Warbler			12	12	House Finch †			1	4	
Ruby-crown Kinglet	T	T	79	92	Black-thr Blue Warbler	T	S	8	43	Red Crossbill †			17	15	
Eastern Bluebird †			1	16	Palm Warbler	T	FY	22	75	<u>White-winged Crossbill</u>	FL		54	64	
Veery	T	S	54	61	Yellow-rumped Warbler	FL	T	67	98	Pine Siskin	H	T	59	58	
Bicknell's Thrush †			1	0	Black-thr Green Warbler	T	T	69	83	American Goldfinch	AY	P	82	100	
Swainson's Thrush	T	S	66	89	Canada Warbler †		S	35	52	Evening Grosbeak	FL	H	50	55	
Hermit Thrush	T	T	74	96	Wilson's Warbler			11	10	<u>House Sparrow</u>	AY		79	36	
<u>Wood Thrush †</u>	T		4	9	Chipping Sparrow	T	T	69	86						
American Robin	NY	FY	90	100	<u>Vesper Sparrow †</u>	T		4	10						
Gray Catbird	AY	S	54	58	Savannah Sparrow	T	T	74	86						
<u>Northern Mockingbird †</u>	H		4	3	Nelson's Sh.-tail Sparrow			16	21						
European Starling	NY	FY	77	93	Song Sparrow	FL	T	87	100						
Bohemian Waxwing ‡			0	0	Lincoln's Sparrow		A	45	63						
Cedar Waxwing	FL	T	70	100	Swamp Sparrow		T	51	95						
Ovenbird	T	T	70	93	White-throat Sparrow	T	DD	77	100						
North Waterthrush	T		30	55	White-crown Sparrow ‡			0	1						

This list includes all species found during the Maritimes Breeding Bird Atlas (1st atlas: 1986-1990, 2nd atlas: 2006-2010) in the region #21 (Cobequid). Underlined species are those that you should try to add to this square (20MR95). They have not yet been reported during the 2nd atlas, but were found during the 1st atlas in this square or have been reported in more than 50% of the squares in this region during the 2nd atlas so far. "Code" is the code for the highest breeding evidence for that species in square 20MR95 during the 2nd and 1st atlas respectively. The % columns give the percentage of squares in that region where that species was reported during the 2nd and 1st atlas (this gives an idea of the expected chance of finding that species in region #21). Rare/Colonial Species Report Forms should be completed for species marked: § (Colonial), ‡ (regionally rare), † (rare in the Maritimes) or ♂ (rare in the Maritimes, documentation only required for confirmed records). Current as of 13/06/2024. An up-to-date version of this sheet is available from <http://www.mba-aom.ca/jsp/summaryform.jsp?squareID=20MR95?lang=en>

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APPENDIX J  
AVIAN MORTALITY ESTIMATES REPORT

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# strum

CONSULTING



**AVIAN MORTALITY ESTIMATES REPORT**  
**Clydesdale Ridge Wind Project**

**July 2, 2024**



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& LABRADOR

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July 2, 2024

**Mr. Kellan Duke**

**Natural Forces**

1701 Hollis Street, Suite 1200  
Halifax, NS B3K 1A5

Dear Mr. Duke,

**Re: Avian Mortality Estimates Report – Clydesdale Ridge Wind Project**

---

Attached is the Avian Mortality Estimates Report prepared for the Clydesdale Ridge Wind Project.

The report documents our observations, and findings.

We trust this to be satisfactory at this time. Once you have had an opportunity to review this correspondence, please contact us to address any questions you may have.

Thank you,

Mark MacDonald, MEM  
Senior Environmental Scientist  
Environmental Assessment & Approvals  
[mmacdonald@strum.com](mailto:mmacdonald@strum.com)

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## 1.0 AVIAN MORTALITY ESTIMATES

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### 1.1 Introduction

The following sections outline the methods used for calculating avian mortality estimates that may result from interactions with Project infrastructure. An overview of avoidance rates and collision risks used in these estimates is also provided, as these variables and their associated assumptions play heavily in our calculations.

### 1.2 Overview of Avoidance Rates/Collision Risk

The Scottish Natural Heritage (SNH) Collision Risk Model (CRM) (also known as the Band model) is a method based on vantage point data to estimate the number of birds with the potential to collide with turbines at a proposed wind project (Scottish Natural Heritage, October 2016). The guidance is intended for anyone involved with collision risk modelling for birds at onshore wind projects.

Although birds may avoid a wind project (for example, some may be displaced from the area, while others may avoid turbines or take other evasive action to prevent a collision), the CRM accounts for this by applying an avoidance rate.

The guidance provided by SNH recommends avoidance rates for a number of key species for use in the SNH CRM (Scottish Natural Heritage, October 2016). It replaces the previous version (2010) and incorporates robust new information, where available, on some species. The recommended default avoidance rate for species not listed specifically in the guidance document is 98%, and has been used in the avoidance rate calculations.

Band et al. (2007) stated that birds with flight heights coinciding with the rotor swept area (RSA) of turbines have a higher likelihood of collision. However, it should be noted that having the highest collision exposure index does not allow us to predict which species are most prone to collision, as species-specific behaviours may affect collision rates. Fatality rates do not depend on bird abundance alone, but on other factors, such as differential use of areas within a wind farm (Ferrer et al. 2012). Collision mortality has been shown to not simply increase with abundance alone; factors such as frequency of passage, flight behaviour, weather, and topography influence collision risk (Lucas, Janss, Whitfield, and Ferrer, 2008). Verification of collision impacts can only be confirmed through post-construction mortality monitoring.

In Canada, 69% of bird fatalities recorded from wind power projects were passerines (Bird Studies Canada 2016). It is likely that passerines make up an even larger percentage of fatalities than estimated, due to the difficulty in detection of individuals during surveys than larger birds (Erickson, Wolfe, Bay, Johnson, and Gehring, 2014), as well as rapid scavenger removal (70-80% within two days; Lekuona and Ursua, 2007).

Avoidance behaviour varies between species (Whitfield 2009), with raptors appearing to be more vulnerable to collision with turbines than most other avian groups (Erickson et al. 2002;



Young, Erickson, Strickland, Good, and Sernka, 2003). Behaviour of diurnal migrants such as raptors makes them potentially more vulnerable to collisions with wind turbines, particularly during hunting (Higgins, Osborne, and Naugle, 2007), or while utilizing thermal updrafts to increase altitude, and conserve energy. Barrios and Rodriguez (2004) reported increased mortality during fall/winter migration, with birds flying closer to turbines. Some studies have also correlated raptor abundance with a higher collision risk; breeding grounds and areas with foraging habitat have been identified as sites that increase high flight abundance (Bevanger et al. 2010; Eichhorn, Johst, Seppelt, and Drechsler, 2012). Additionally, diurnal migrants (raptors, vultures, etc.) are more constrained by topographical features than nocturnal migrants – they tend to be concentrated along linear features such as rivers, ridges, and valleys (Richardson 2000); resulting mitigation suggests turbine placement away from such features.

Ferrer et al. (2012) further suggests there is clear evidence that the likelihood of bird collisions with turbines depends critically on species behaviour and topographic factors, and not only on local abundance. Birds do not move over the area at random, but follow main wind currents, which are affected by topography. Therefore, certain locations of wind turbines could be harmful for birds even where there is a relatively low density of birds, whereas other locations would be relatively risk free even with higher densities of birds (Ferrer et al. 2012).

The risk to avian species for collision with wind turbines is highest during migration periods (Alberta Environment and Parks 2016), when the most fatalities tend to be reported. Fatalities can also occur from meteorological evaluation towers (MET) and guywires, or through nest mortality/disturbance from clearing of vegetation/loss of habitat (Band, Madders, and Whitfield, 2007). Bird fatalities due to turbine collision have been consistently identified as a leading ecological shortcoming to wind energy (Drewitt and Langston, 2006), however, mitigating for this consequence is not forthright, due to the complexity of factors influencing collisions (Marques et al. 2014).

Bird collision likelihood depends on species, turbine height and elevation, implicating species-specific and topographic factors in collision mortality. There was no evidence of an association between collision likelihood, and turbine type or the position of a turbine in a row (Lucas, Janss, Whitfield, and Ferrer, 2008).

Populations of several groups vulnerable to collisions are increasing across Canada (e.g., waterfowl and raptors). This suggests collision mortality at current levels does not limit population growth. The factors that contribute to a species' vulnerability to collisions include species that flock, have rapid flight, and are large with slow maneuverability (high wing loading and low wing aspect ratio) (Rioux, Savard, and Gerick, 2013).

### **1.3 Mortality Estimate**

To estimate bird mortality associated with this Project, a guidance document from SNH (2000) was followed. This estimating method was previously used in the Environmental

Effects Assessment of the Stirling Wind Project, Alberta that was conducted by McCallum Environmental Ltd (now Strum Consulting). That project was subject to an Alberta Utility Commission (AUC) regulatory hearing, and was subsequently approved. That project is currently under construction. The Stirling Wind Project determined appropriate amendments to calculations, which have subsequently been carried forward here.

The guidance document from SNH (2000) provides guidance on calculating a theoretical collision risk for birds, and wind power projects assuming there's no avoidance behaviour (Scottish Natural Heritage, 2000).

However, in reality, most birds do use avoidance behaviours to avoid the turbine structures. Therefore, the results of the no avoidance calculations are moderated by an important factor that represents the proportion of birds often hit which are likely to take effective avoidance action. There are approaches that may be appropriate depending on the species and flight behaviour to determine the probability of birds flying through a RSA, and using the guidance document the assumption is where a bird population makes regular flights through the wind farm in a reasonably defined direction (Scottish Natural Heritage, 2000).

Avian species were surveyed at the Clydesdale Ridge Wind Project using point count (PC) plots and radar tracking methods. The data sets generated by these surveys differ to a large degree in timing, area coverage, and resolution, among others, resulting in incompatibility when calculating mortality estimates. For this reason, estimates were made separately using each data set as a means to highlight information unique to those surveys. Multiple estimates also provide a measure by which we can scrutinize our outputs.

#### **Important notes regarding this Project:**

- The appended avian biophysical baseline and radar reports can be referenced regarding limitations with the data. An important note on the radar data is that it assumed that most targets it detected are migratory birds, but some proportion may also be insects, bats, ground clutter, and precipitation. Detections at very low altitudes (e.g., below RSA) are difficult to capture due to ground clutter and background noise due to vegetation. This is also known as interference. Due to the placement of the radar, differing filtering criteria, and weather conditions it is difficult and unrealistic to compare different projects and sites and the focus of the radar data is to provide an overall comparison between seasons. Overall, the radar results showed that more birds migrate during the fall than in the spring and this is likely due to the influx of juveniles in addition to the adult birds that arrived during spring migration.

The calculations are completed in two stages and adapted as follows (Scottish Natural Heritage, 2000):

**Stage 1:**

1. Identify a 'risk window': i.e. a window of width equal to the length of the windfarm across the general flight direction of the birds, and of height extending from the minimum height of the rotor to the maximum height of the highest turbine. The cross-sectional area  $W = \text{width} \times (\text{maximum rotor height} - \text{minimum rotor height})$ .
2. Estimate the number of bird flights (n) flying through this risk window per hour. This data was taken from the total bird species counted and the subsequent population estimate. The population estimate calculated as follows:
  - a. Number of sampling plots
  - b. Individual plot areas ( $\pi R^2$ ) were calculated
  - c. SWP area ( $m^2$ )
  - d. Average # birds / plot = total birds counted / (a)
  - e. Population = (c / b) x (d)
3. For estimates based on point count data, the total hour time estimates for spring, fall, and summer frames are based on a specific number of hours within the assessment season. The assumption of 12 hours of flight time per day was used.

For estimates using radar data, survey time covered the daily nocturnal migration period (dusk to dawn), and varied depending on time of year. Total survey hours for each season (spring and fall) were used to calculate estimates. See appended report on radar surveys for further detail.

4. The number of birds in the risk window was calculated by multiplying the total number of bird flights per hour by the total number of survey hours.
5. Calculate the area presented by the wind farm rotors: assuming the rotors are aligned in the plane of the risk window, any reduction in cross-sectional area because the rotors are at an oblique angle is offset by the increased risk to birds which must make a longer transit through the rotors. Where rotors overlap when viewed in cross-section, allow for the full cross-sectional area of separate rotors as the risk to birds is doubled if passing through two successive rotors:

$$A = N \times \pi R^2 \text{ where } N \text{ is the number of rotors and } R \text{ is the rotor radius}$$

6. Express the total rotor area as a proportion  $A / W$  of the risk window.
7. Number of birds passing through rotors = number of birds through risk window x proportion occupied by rotors =  $n \times (A / W)$

8. The weighted average within the rotor swept area was multiplied by the total bird flights in the risk area to estimate the number of bird flights through the rotor swept area. This number was carried forward into stage 2.

### **Stage 2: Probability (pr) of bird collision when flying through the rotor swept area**

This stage computes the probability of a bird being hit when making a transit through a rotor. The probability depends on the size of the bird (both length and wingspan), the breadth and pitch of the turbine blades, the rotation speed of the turbine, and of course the flight speed of the bird.

To facilitate calculation, many simplifications must be made. The bird is assumed to be of simple cruciform shape, with the wings at the halfway point between nose and tail. The turbine blade is assumed to have a width and a pitch angle (relative to the plane of the turbine), but to have no thickness.

For ease of use, the calculations are provided on a pre-formatted spreadsheet at SNH Society website (NatureScot, 2020). The spreadsheet calculates  $p(r)$  at intervals of  $0.05 R$  from the rotor centre (i.e. evaluating equation (2)), and then undertakes a numerical integration from  $r=0$  to  $r=R$  (i.e. evaluating equation (1)). The spreadsheet is set out as follows:

1. The input parameters are in the first two columns. Bird aspect ratio  $\beta$  is calculated.
2. Collision probabilities are then calculated for radii at intervals of  $0.05 R$  from the hub to the tip. Each radius is represented by a row in the table, with the value of the radius  $r/R$  in the first column.
3. The second column of the table is the chord width at radius  $r$  as a proportion of the maximum chord width. The taper profile here is that of a modern Aerpac turbine blade. The taper will differ for different turbine blades.
4. Factor  $\alpha$  is calculated.
5. The 'collide length' is the entire factor within square brackets within equation (2) above, using the upwind case.
6.  $p(\text{collision})$  is  $p$  at radius  $r$ , as calculated by equation (2). It is however limited to a maximum value of 1.
7. 'contribution from radius  $r$ ' is the integrand of equation (1) (including the factor 2) prior to integration.
8. The total risk is then the summation of these contributions.
9. The calculation is then repeated for the downwind case.
10. The spreadsheet then shows a simple average of upwind and downwind values.
11. The result is an average collision risk for a bird passing through a rotor.

The inputs provided for the models are based upon average characteristics of species as follows:

1. Waterfowl: Bird Length<sup>1</sup> = 0.6 m  
Wingspan = 0.8 m  
F: Flapping (0) or Gliding (1) = 1  
Bird Speed<sup>2</sup> = 20 m/sec
2. Shorebirds: Bird Length = 0.3 m  
Wingspan = 0.4 m  
F: Flapping (0) or Gliding (1) = 0  
Bird Speed<sup>3</sup> = 14 m/sec
3. Passerines Bird Length = 0.2 m  
Wingspan = 0.35 m  
F: Flapping (0) or Gliding (1) = 0  
Bird Speed<sup>4</sup> = 15 m/sec

Mortality estimates for point count plot data were calculated by bird group, five in total, as resolution of this data set allowed for analysis at this scale. Estimates using radar tracking data are made based on all bird passes as this survey does not differentiate to the species level.

### Model Testing

In an effort to determine the validity of the above noted mortality estimating method, the mortality estimate method as described above was tested using an existing Alberta Wind Power Project. In November of 2016, McCallum Environmental Ltd. (now Strum) requested mortality data collected from post construction monitoring for the Halkirk Wind Power Project, owned by Capital Power Corporation. Following a Freedom of Information and Protection of Privacy Act (FOIPOP) request from AEP, bird and bat mortality data was provided in the form of annual reports, from 2013, 2014, and 2015 (bat data only).

Strum obtained copies of the pre-construction environmental assessment from public databases, with relevant population counts, species counts and identifications, and relevant inputs to be used in the aforementioned calculations. This was completed to determine if the mortality estimating model was a valid method for further use. The results of those inputs and calculations estimates are provided in Table 1.1.

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1 All lengths and wingspan taken from Cornell Lab of Ornithology. 2016. All about birds. [www.allaboutbirds.org](http://www.allaboutbirds.org).

2 R. Meinertzhagen, 1954. Speed and Altitude of Bird Flight. Journal of Avian Science. Vol 97. – Mallard.

3 R. Meinertzhagen, 1954. Speed and Altitude of Bird Flight. Journal of Avian Science. Vol 97. – Killdeer.

4 R. Meinertzhagen, 1954. Speed and Altitude of Bird Flight. Journal of Avian Science. Vol 97. – Horned Lark.

**Tabler 1.1: Collision Estimates per Species Group**

Species group	Total Collision Estimates <sup>5</sup>	Estimated Mortality: Birds / Turbine / Year
Waterfowl	126.21	1.26
Shorebirds	10.84	0.11
Passerines	247.68	2.48
Raptors	8.68	0.09
<b>Total</b>	<b>393.41</b>	<b>3.93</b>

2013 corrected mortality obtained from Annual Report <sup>6</sup>	<b>5.32 birds / turbine / year</b>
2014 corrected mortality obtained from Annual Report <sup>7</sup>	<b>4.30 birds / turbine / year</b>

### 1.3.1 Results – Point Count Data

The estimated results for the Clydesdale Ridge Wind Project are presented in Tables 1.2 through 1.18.

#### 1.3.1.1 Waterfowl

As per the methods of analysis previously provided, the following population estimates were estimated for waterfowl:

**Table 1.2: Population Estimate for Waterfowl - Spring/Fall**

<b>Sampling Plots</b>	42
<b>Plot area (m<sup>2</sup>)</b>	125,664
<b>Project Area (m<sup>2</sup>)</b>	5,894,110
<b>Avg # Birds / plot</b>	3
<b>Population</b>	131

**Table 1.3: Population Estimate for Waterfowl – Summer**

<b>Sampling Plots</b>	38
<b>Plot area (m<sup>2</sup>)</b>	125,664
<b>Project Area (m<sup>2</sup>)</b>	5,894,110
<b>Avg # Birds / plot</b>	0.11
<b>Population</b>	5

<sup>5</sup> Baseline data used for the calculations was collected from Greengate Halkirk Wind Project. A Report to ASRD in Support of an AUC Rule 007 Application: Vegetation and Wildlife Overview. Jacques Whitford Stantec Axys Ltd., February 2009.

<sup>6</sup> Halkirk Wind Project – Bird and Bat Monitoring, 2013 Annual Report. January 2014. Prepared by Hemmera Envirochem Inc.

<sup>7</sup> Annual Report Halkirk Wind Project – Bird and Bat Monitoring 2014. January 2015. Prepared by Hemmera Envirochem Inc.

**Table 1.4: Estimated Mortality for Waterfowl**

Characteristic	Notes	Value
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Actual Rotor Height (m)		160
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (mins)	Spring: 5 rounds x 10 minutes / location x 42 locations	2,100
	Fall: 5 rounds x 10 minutes / location x 42 locations	2,100
	Summer: 2 rounds x 10 minutes / location x 38 locations	760
Survey Time (hrs)		83
Total number of birds identified in survey time (Tn)	Fall	22
	Spring	95
	Summer	4
Population estimate (n)		136
Fall	% within RSA	9.2%
Spring	% within RSA	46.8%
	Weighted Average within RSA	39.7%
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	1.64
Total hours estimate for Spring (Sh)	March 15 - May 30 = 76 days x 12hrs flight time / day	912
Total hours estimate for Fall (Fh)	Sept 1 - October 15 = 45 days x 12 hrs flight time / day	540
Total hours estimate for Summer (Su)	June 1 - August 31 = 92 days x 12hrs flight time / day	1,104
Number of birds in risk window (n)	bch*(Sh+Fh)	4,193
Area presented by wind farm rotors (A) m2	N x ?R2	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds in Risk Area		612
Weighted Average within RSA	Wrsa	0.40
Number of birds through rotors	n x Wrsa	243
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.066
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	16
Collisions during study period with 75% operation and no avoidance	75% x above number	12
SNH recommended avoidance rate	98.00%	0.020

Characteristic	Notes	Value
Collisions during study period with 75% operational rate and 98% avoidance		0.24
	<b>Birds/Turbine/Year</b>	0.01

The estimated mortality for waterfowl associated with the Project at 98% avoidance is 0.18 waterfowl (or approximately 0.01 birds/turbine/year).

### 1.3.1.2 Shorebirds

As per the methods of analysis previously provided, the following population estimates were determined for shorebirds:

**Table 1.5: Population Estimate for Shorebirds – Spring/Fall**

Sampling Plots	42
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	0
Population	17

**Table 1.6: Population Estimate for Shorebirds – Summer**

Sampling Plots	38
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	0.18
Population	9

**Table 1.7: Estimated Mortality for Shorebirds**

Characteristic	Notes	Value
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Actual Rotor Height (m)		160
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (mins)	Spring: 5 rounds x 10 minutes / location x 42 locations	2,100
	Fall: 5 rounds x 10 minutes / location x 42 locations	2,100
	Summer: 2 rounds x 10 minutes / location x 38 locations	760
Survey Time (hrs)		83
Total number of birds identified in survey time (Tn)	Fall	8



Characteristic	Notes	Value
	Spring	7
	Summer:	7
Population Estimate		25
Fall	% within RSA	36.3%
Spring	% within RSA	51.9%
	Weighted Average within RSA	43.6%
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	0.31
Total hours estimate for Spring (Sh)	March 15 - May 30 = 76 days x 12hrs flight time / day	912
Total hours estimate for Fall (Fh)	Sept 1 - October 15 = 45 days x 12 hrs flight time / day	540
Total hours estimate for Summer (Su)	June 1 - August 31 = 92 days x 12hrs flight time / day	1,104
Number of birds in risk window (n)	bch*(Sh+Fh)	785
Area presented by wind farm rotors (A) m <sup>2</sup>	N x ?R <sup>2</sup>	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds in Risk Area		115
Weighted Average within RSA	Wrsa	0.44
Number of birds through rotors	n x Wrsa	50
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.071
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	4
Collisions during study period with 75% operation and no avoidance	75% x above number	3
SNH recommended avoidance rate	98.00%	0.020
Collisions during study period with 75% operational rate and 98% avoidance		0.05
<b>Bird Mortality / Turbine / Year</b>		<b>0.003</b>

The estimated mortality for shorebirds associated with the Project at 98% avoidance is 0.054 waterfowl per year (approximately 0.003 birds/turbine/year.).

### 1.3.1.3 Passerines

As per the methods of analysis previously provided, the following population estimates were determined for passerines:

**Table1 1.8: Population Estimate for Passerines– Spring/Fall**

Sampling Plots	42
Plot area (m <sup>2</sup> )	125,664
Project Area (m <sup>2</sup> )	5,894,110
Avg # Birds / plot	130
Population	6,101

**Table 1.9: Population Estimate for Passerines – Summer**

<b>Sampling Plots</b>	38
<b>Plot area (m<sup>2</sup>)</b>	125,664
<b>Project Area (m<sup>2</sup>)</b>	5,894,110
<b>Avg # Birds / plot</b>	20.45
<b>Population</b>	959

**Table 1.10: Estimated Mortality for Passerines**

<b>Characteristic</b>	<b>Notes</b>	<b>Value</b>
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Actual Rotor Height (m)		160
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (mins)	Spring: 5 rounds x 10 minutes / location x 42 locations	2,100
	Fall: 5 rounds x 10 minutes / location x 42 locations	2,100
	Summer: 2 rounds x 10 minutes / location x 38 locations	780
Survey Time (hrs)		83
Total number of birds identified in survey time (Tn)	Fall	1,980
	Spring	3,483
	Summer	777
Population Estimate		7,060
Fall	% within RSA	1.8%
Spring	% within RSA	76.5%
	Weighted Average within RSA	49.4%
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	85.06
Total hours estimate for Spring (Sh)	March 15 - May 30 = 76 days x 12hrs flight time / day	912
Total hours estimate for Fall (Fh)	Sept 1 - October 15 = 45 days x 12 hrs flight time / day	540
Total hours estimate for Summer (Su)	June 1 - August 31 = 92 days x 12hrs flight time / day	1,104
Number of bird flights in risk window (n)	bch*(Sh+Fh)	217,411
Area presented by wind farm rotors (A) m2	N x ?R2	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds in Risk Area		31,753
Weighted Average within RSA	Wr <sub>rsa</sub>	0.49

Characteristic	Notes	Value
Number of birds through rotors	n x Wrsa	15,694
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.060
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	942
Collisions during study period with 75% operation and no avoidance	75% x above number	706
SNH recommended avoidance rate	98.00%	0.020
Collisions during study period with 75% operational rate and 98% avoidance		14.12
<b>Bird Mortality / Turbine / Year</b>		<b>0.785</b>

The estimated mortality for passerines associated with the Project at 98% avoidance is 14.13 passerines per year (or approximately 0.785 birds/turbine/year).

#### 1.3.1.4 Raptors

As per the methods of analysis previously provided, the following population estimates were determined for raptors:

**Table 1.11: Population Estimate for Raptors– Spring/Fall**

Sampling Plots	42
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	1
Population	30

**Table 1.12: Population Estimate for Raptors – Summer**

Sampling Plots	38
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	0.03
Population	1

**Table 1.13: Estimated Mortality for Raptors**

Characteristic	Notes	Value
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Actual Rotor Height (m)		160
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (mins)	Spring: 5 rounds x 10 minutes / location x 42 locations	2,100

Characteristic	Notes	Value
	Fall: 5 rounds x 10 minutes / location x 42 locations	2,100
	Summer: 2 rounds x 10 minutes / location x 38 locations	760
Survey Time (hrs)		83
Total number of birds identified in survey time (Tn)	Fall	17
	Spring	10
	Summer	1
Population Estimate		31
Fall	% within RSA	50.0%
Spring	% within RSA	13.5%
	Weighted Average within RSA	36.5%
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	0.38
Total hours estimate for Spring (Sh)	March 15 - May 30 = 76 days x 12hrs flight time / day	912
Total hours estimate for Fall (Fh)	Sept 1 - October 15 = 45 days x 12 hrs flight time / day	540
Total hours estimate for Summer (Su)	June 1 - August 31 = 92 days x 12hrs flight time / day	1,104
Number of bird flights in risk window (n)	bch*(Sh+Fh)	970
Area presented by wind farm rotors (A) m2	N x ?R2	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds flights in Risk Area		142
Weighted Average within RSA	Wrsa	0.36
Number of bird flights through rotors	n x Wrsa	52
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.165
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	9
Collisions during study period with 75% operation and no avoidance	75% x above number	6
SNH recommended avoidance rate	99.00%	0.010
Collisions during study period with 75% operational rate and 99% avoidance		0.06
<b>Bird Mortality / Turbine / Year</b>		<b>0.004</b>

The estimated mortality for raptors associated with the Project at 99% avoidance is 0.072 raptors per year (or approximately 0.004 birds/turbine/year).

#### 1.3.1.5 Other Landbirds

As per the methods of analysis previously provided, the following population estimates were determined for other landbirds:

**Table 1.14: Population Estimate for Other Landbirds – Spring/Fall**

Sampling Plots	42
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	7
Population	335

**Table 1.15: Population Estimate for Other Landbirds – Summer**

Sampling Plots	38
Plot area (m <sup>2</sup> )	125,664
Project Area	5,894,110
Avg # Birds / plot	0.47
Population	22

**Table 1.16: Estimated Mortality for Other Landbirds**

Characteristic	Notes	Value
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Actual Rotor Height (m)		160
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (mins)	Spring: 5 rounds x 10 minutes / location x 42 locations	2,100
	Fall: 5 rounds x 10 minutes / location x 42 locations	2,100
	Summer: 2 rounds x 10 minutes / location x 38 locations	760
Survey Time (hrs)		83
Total number of birds identified in survey time (Tn)	Fall	133
	Spring	167
	Summer	18
Population Estimate		357
Fall	% within RSA	1.8%
Spring	% within RSA	76.5%
	Weighted Average within RSA	43.4%
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	4.32
Total hours estimate for Spring (Sh)	March 15 - May 30 = 76 days x 12hrs flight time / day	912

Characteristic	Notes	Value
Total hours estimate for Fall (Fh)	Sept 1 - October 15 = 45 days x 12 hrs flight time / day	540
Total hours estimate for Summer (Su)	June 1 - August 31 = 92 days x 12hrs flight time / day	1,104
Number of bird flights in risk window (n)	bch*(Sh+Fh)	11,046
Area presented by wind farm rotors (A) m2	N x ?R2	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds in Risk Area		1,613
Weighted Average within RSA	Wrsa	0.43
Number of birds through rotors	n x Wrsa	700
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.066
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	46
Collisions during study period with 75% operation and no avoidance	75% x above number	35
SNH recommended avoidance rate	98.00%	0.020
Collisions during study period with 75% operational rate and 98% avoidance		0.69
<b>Bird Mortality / Turbine / Year</b>		<b>0.038</b>

The estimated mortality for other landbirds associated with the Project at 98% avoidance is 0.684 other landbirds per year (or approximately 0.038 birds/turbine/year).

### 1.3.1.6 Total Mortality Estimates for Point Count Data

The above point count plot data estimates that total mortality associated with the Project on an annual basis will be approximately 15.12 birds, or 0.84 birds/turbine/year (Table 1.17). Note that the avian PC data captures wooded areas within the Project Area, where bird abundance and diversity was higher when compared to open areas. The radar data for the Project reflects open areas, therefore a higher number of birds in forested areas within the Project Area does not reflect higher risk since these areas are not within the rotor swept area (i.e., the risk window).

**Table 1.17: Summary of Collision and Mortality Estimates**

Species Group	Total Collision Estimates	Estimated mortality Birds/Turbine/Year
Waterfowl	0.18	0.01
Shorebirds	0.054	0.003
Passerines	14.13	0.785
Raptors	0.072	0.004
Other landbirds	0.684	0.038
<b>Total</b>	<b>15.12</b>	<b>0.84</b>

### 1.3.2 Radar Tracking Data

As per the methods of analysis previously provided, the following mortality estimates were determined for all nocturnal migrant bird passes using radar tracking data.

Due to radar limitations, radar captures 'target' signals. There is a broad assumption in the results that the targets are birds. In addition, targets (assuming they are birds), cannot be broken down easily by size, and there is no method to determine species. Therefore, the below estimate includes all radar targets and applies the 98% avoidance rate. The below estimate would then represent total estimated mortality.

**Table 1.18: Estimated Mortality for Total Nocturnal Migrant Bird Passes using Radar Tracking Data**

Characteristic	Notes	Value
Rotor Diameter (m)		160
Hub Height (m)		120
Maximum Rotor Height (m)		200
Minimum Rotor Height (m)		40
Rotor swept area (?R2)		20106
Number of Turbines (N)		18
Length of wind farm (m)	Lateral distance from boundaries	12,390
Survey Time (hrs)		3,850
<b>STAGE 1</b>		
Risk Window (W)	length of wind farm x max turbine height	2,478,000
Birds Flights per hour (bch)	Tn / hrs	32.93
Number of bird flights in risk window (n)	bch*(Sh+Fh)	126,781
Area presented by wind farm rotors (A) m2	N x ?R2	361,911
Total rotor area (TRA)	proportion A / W	0.146
Birds in Risk Area		18,516
Weighted Average within RSA	Wrsa	0.69
Number of birds through rotors	n x Wrsa	12,823
<b>STAGE 2</b>		
Probability of Collision (Band Model)		0.060
Collisions during study period with 100% operation and no avoidance	Number of birds through rotors x Probability of Collision	769
Collisions during study period with 75% operation and no avoidance	75% x above number	577
SNH recommended avoidance rate	98.00%	0.020
Collisions during study period with 75% operational rate and 98% avoidance		11.54
<b>Bird Mortality / Turbine / Year</b>		<b>0.641</b>

The estimated mortality for all nocturnal migrant bird passes associated with the Project as detected from radar and using a 98% avoidance is 11.53 birds per year (or approximately 0.641 birds/turbine/year).

Note that the avian PC data captures wooded areas within the Project Area, where bird abundance and diversity was higher when compared to open areas. The radar data for the Project reflects open areas, therefore a higher number of birds in forested areas within the Project Area does not reflect higher risk since these areas are not within the rotor swept area (i.e., the risk window).



## **2.0 STATEMENT OF QUALIFICATIONS AND LIMITATIONS**

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This Report (the “Report”) has been prepared by Strum Consulting (“Consultant”) for the benefit of Natural Forces (“Client”) in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations, and conclusions contained in the Report (collectively, the “Information”):

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- represents Consultant’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports
- may be based on information provided to Consultant which has not been independently verified
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued
- must be read as a whole and sections thereof should not be read out of such context
- was prepared for the specific purposes described in the Report and the Agreement
- in the case of subsurface, environmental, or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time

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This Statement of Qualifications and Limitations forms part of the Report and any use of the Report is subject to the terms hereof.

Should additional information become available, Strum requests that this information be brought to our attention immediately so that we can reassess the conclusions presented in this report. This report was prepared by Mark MacDonald, MEM, Senior Environmental Scientist, and was reviewed by Melanie Juurlink, MREM, Senior Environmental Scientist.

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APPENDIX K  
WESP-AC SUMMARY TABLE

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WL ID	Hydrological Group		WATER Quality Group		AQUATIC SUPPORT Group		AQUATIC Habitat Group		TRANSITIONAL Habitat Group		WETLAND CONDITION		WETLAND RISK		Functional WSS
	Function	Benefits	Function	Benefits	Function	Benefits	Function	Benefits	Function	Benefits	Benefit Score	Benefit Rating	Benefit Score	Benefit Rating	
1	0.67	10.00	2.93	4.10	6.42	5.75	4.91	5.21	8.57	9.44	4.35	Moderate	8.77	Higher	No
2	7.63	8.12	7.37	4.78	5.91	0.69	1.82	2.63	7.00	9.60	1.88	Lower	8.83	Higher	No
3	0.65	8.87	2.46	3.29	7.17	3.83	6.07	7.66	7.51	9.62	5.36	Moderate	6.64	Moderate	No
4	1.58	8.87	2.54	4.68	9.33	8.29	8.22	8.57	8.06	9.67	10.00	Higher	8.81	Higher	No
5	1.51	8.18	2.06	4.29	8.96	5.76	4.35	2.73	8.63	9.72	8.84	Higher	9.27	Higher	No
6	1.35	8.23	1.89	5.14	7.86	5.44	4.42	7.67	7.50	9.68	5.56	Moderate	8.41	Higher	No
7	2.83	9.42	2.99	9.53	7.34	5.85	2.42	2.42	6.66	9.50	8.26	Higher	5.85	Moderate	No
8	2.11	9.76	3.90	9.53	7.50	6.71	4.37	7.57	7.34	9.61	7.39	Higher	6.68	Moderate	No
9	0.77	8.40	2.83	4.68	7.45	6.77	4.66	8.15	8.12	9.74	4.49	Moderate	7.26	Higher	No
10	7.88	4	7.71	3.79	4.76	0.55	1.72	2.48	6.4	9.53	5.65	Moderate	8.7	Higher	No
11	4.45	4.17	3.40	7.09	7.26	4.88	1.72	1.60	6.27	6.55	4.78	Moderate	7.96	Higher	No
12	5.85	4.46	8.95	3.94	3.95	2.29	4.09	7.61	7.32	9.63	4.49	Moderate	7.19	Higher	No
13	1.28	4.51	3.26	3.81	7.62	6.32	5.27	7.62	6.79	9.59	4.78	Moderate	6.19	Moderate	No
14	5.47	4.62	9.06	3.74	4.37	2.07	3.24	5.14	7.66	6.85	5.65	Moderate	6.80	Higher	No
15	9.30	5.19	8.62	2.76	5.73	0.60	1.94	1.68	6.68	6.57	8.26	Higher	7.99	Higher	No
16	6.74	5.02	9.35	1.80	4.78	2.89	4.76	5.18	8.00	7.02	8.26	Higher	5.86	Moderate	No
17	6.43	4.23	9.18	3.74	4.77	3.53	6.31	5.45	7.36	6.83	1.88	Lower	5.62	Moderate	No
18	2.88	5.24	3.68	2.43	6.13	6.55	4.88	7.66	7.46	8.93	3.62	Lower	7.00	Higher	No
19	2.48	5.02	2.76	3.81	6.82	6.44	5.43	5.38	8.46	9.75	7.10	Higher	7.21	Higher	No
20	2.68	4.91	2.51	3.68	5.77	5.92	3.50	5.30	7.53	9.66	1.88	Lower	4.97	Moderate	No
21	1.99	5.21	3.40	2.16	7.47	7.00	4.61	7.65	7.88	9.71	7.10	Higher	7.72	Higher	No
22	1.22	5.19	3.22	3.81	7.88	7.07	4.93	7.67	7.97	9.71	8.26	Higher	6.86	Higher	No
23	1.57	5.30	3.59	3.85	7.00	7.83	6.53	5.73	5.63	9.45	1.88	Lower	7.05	Higher	No
24	1.94	5.19	3.65	3.16	7.44	7.02	6.04	5.29	6.38	9.51	1.88	Lower	5.07	Moderate	No
25	2.56	5.19	3.26	3.81	6.25	6.27	4.16	5.39	7.94	9.71	3.04	Lower	7.21	Higher	No
26	3.51	4.74	3.59	3.81	4.40	5.78	4.55	5.49	8.52	9.76	7.10	Higher	7.24	Higher	No
27	2.86	3.55	3.31	3.85	6.99	5.04	5.21	7.64	7.42	9.64	4.78	Moderate	5.84	Moderate	No
28	1.82	3.27	3.07	2.74	7.39	5.15	5.17	7.59	6.63	9.52	8.26	Higher	6.97	Higher	No
29	6.41	5.08	8.85	0.88	4.80	2.60	4.36	7.65	8.03	8.99	5.36	Moderate	8.07	Higher	No
30	7.38	5.02	7.42	2.66	6.64	0.44	1.60	2.37	5.75	8.73	6.52	Higher	7.18	Higher	No
31	8.66	5.17	8.04	3.77	5.91	0.41	1.52	2.35	5.89	8.74	5.65	Moderate	7.47	Higher	No
32	6.72	5.36	8.30	3.74	5.07	1.97	2.96	7.60	6.87	8.88	3.04	Lower	6.13	Higher	No
33	0.13	5.19	2.05	2.05	5.06	7.40	5.20	5.50	7.21	6.85	5.65	Moderate	4.84	Moderate	No
34	7.63	5.19	7.61	2.66	4.36	0.53	1.91	1.61	6.42	6.57	5.36	Moderate	7.62	Moderate	No
35	6.22	5.14	8.96	3.74	3.93	2.62	4.35	7.66	7.54	8.96	5.36	Moderate	6.13	Moderate	No
36	6.44	5.36	9.38	2.63	4.80	2.64	4.24	7.63	7.19	8.91	3.04	Lower	7.24	Higher	No
37	6.91	5.30	7.05	4.85	5.42	0.43	1.49	2.38	5.11	8.70	3.04	Lower	9.32	Higher	No
38	4.69	5.30	3.56	3.81	5.43	3.30	5.81	7.65	7.07	8.91	3.04	Lower	4.42	Moderate	No
39	0.84	5.24	3.37	9.28	6.94	7.77	5.47	7.97	8.35	8.97	8.26	Higher	6.83	Higher	No
40	8.05	5.13	7.37	3.75	5.17	0.62	2.48	2.40	5.97	8.76	3.04	Lower	7.31	Higher	No
41	6.70	5.47	8.89	3.74	4.12	2.89	6.66	5.10	5.36	6.49	4.78	Moderate	4.84	Moderate	No
42	6.20	5.19	9.34	3.74	5.22	2.92	5.63	5.14	5.99	6.52	6.52	Higher	6.50	Moderate	No
43	2.49	5.08	3.56	3.81	6.51	6.41	4.60	5.20	7.85	6.98	8.26	Higher	4.57	Moderate	No
44	0.15	4.96	2.63	1.75	6.36	7.14	4.16	5.45	7.90	7.00	8.26	Higher	4.80	Moderate	No
45	1.01	4.74	3.67	9.35	8.57	6.84	5.00	5.25	8.73	7.21	8.26	Higher	6.35	Moderate	No
46	0.16	4.51	2.95	3.74	8.54	6.64	4.38	5.21	7.83	6.91	8.26	Higher	5.51	Moderate	No
47	7.63	4.85	7.46	3.52	4.47	0.50	1.69	1.62	4.98	6.48	0.00	Lower	7.03	Higher	No
48	5.96	3.78	9.21	3.88	4.55	2.67	3.82	5.18	7.20	6.74	0.00	Lower	7.87	Higher	No
49	7.80	3.50	7.54	1.78	6.12	0.42	1.48	2.38	6.99	8.82	6.52	Higher	7.14	Higher	No
50	8.66	5.16	7.92	2.79	4.67	0.29	1.25	2.28	6.41	8.76	3.91	Moderate	7.95	Higher	No
51	2.45	4.96	2.99	3.88	7.42	2.48	3.49	7.64	7.63	8.95	2.46	Lower	5.95	Moderate	No
52	8.66	5.02	7.74	4.35	4.49	0.30	1.24	2.28	5.84	8.72	2.46	Lower	7.18	Higher	No
53	8.08	5.02	7.74	3.85	5.72	0.39	1.37	2.36	5.92	8.74	3.62	Lower	8.50	Higher	No
54	3.09	5.02	3.03	4.81	6.47	2.32	3.49	7.60	7.21	8.91	2.46	Lower	7.38	Higher	No

WL ID	Hydrological Group		WATER Quality Group		AQUATIC SUPPORT Group		AQUATIC Habitat Group		TRANSITIONAL Habitat Group		WETLAND CONDITION		WETLAND RISK		Functional WSS
	Function	Benefits	Function	Benefits	Function	Benefits	Function	Benefits	Function	Benefits	Benefit Score	Benefit Rating	Benefit Score	Benefit Rating	
55	0.60	4.91	3.99	9.14	7.82	6.96	5.55	7.74	8.85	9.72	6.52	Higher	7.16	Higher	No
56	1.94	4.51	3.90	9.30	8.00	6.34	3.90	5.57	8.56	7.14	8.26	Higher	8.29	Higher	No
57	7.32	4.51	7.24	3.36	5.44	0.59	1.77	2.51	6.58	9.55	5.65	Moderate	8.72	Higher	No
58	2.45	4.46	2.89	9.36	6.55	6.08	4.16	8.00	7.12	8.85	3.62	Lower	8.40	Higher	No
59	1.29	4.51	2.61	9.53	7.61	6.79	5.76	8.11	7.07	9.59	3.62	Lower	6.71	Higher	No
60	7.61	5.64	9.29	2.80	5.38	2.30	4.15	3.36	8.48	7.15	8.26	Higher	7.07	Higher	No
61	3.55	4.64	3.63	2.97	6.14	2.58	4.19	7.63	8.26	8.99	7.68	Higher	7.63	Higher	No
62	2.83	3.55	2.87	4.45	6.15	2.11	3.77	7.58	7.63	8.95	5.65	Moderate	6.42	Moderate	No
63	2.62	3.55	2.55	3.74	5.73	2.76	4.51	5.56	7.73	6.95	7.10	Higher	6.50	Moderate	No
64	8.08	3.95	7.61	4.01	5.69	0.52	1.67	1.64	6.91	6.60	5.65	Moderate	7.99	Higher	No
65	4.98	4.96	3.98	4.01	6.43	5.58	1.39	2.35	6.22	8.75	5.65	Moderate	6.72	Higher	No
66	6.91	4.51	8.80	3.22	4.07	2.48	5.37	5.26	6.15	9.54	3.62	Lower	6.55	Moderate	No
67	8.35	4.79	7.90	3.52	5.91	0.53	1.71	1.65	5.81	6.52	3.62	Lower	7.95	Higher	No
68	6.03	3.72	9.30	3.74	3.60	2.04	3.29	5.17	7.71	6.97	8.26	Higher	5.39	Moderate	No
69	3.16	3.33	3.11	3.81	4.92	4.51	4.19	5.12	7.17	6.68	5.65	Moderate	6.67	Moderate	No
70	8.92	3.55	8.29	3.77	6.67	0.96	3.17	1.84	6.60	6.59	5.65	Moderate	7.94	Higher	No
71	6.81	4.40	9.05	2.24	4.32	2.76	4.21	7.64	8.15	8.25	4.78	Moderate	7.17	Higher	No
72	1.50	4.06	2.08	2.17	4.21	5.03	4.19	7.62	7.49	8.91	6.52	Higher	4.92	Moderate	No
73	1.27	3.55	3.28	9.08	8.37	6.83	7.16	8.04	9.04	9.04	8.26	Higher	7.35	Higher	No
74	8.53	3.72	8.16	3.43	4.82	0.02	0.00	2.27	5.51	9.46	0.43	Lower	7.11	Higher	No
75	8.94	4.68	8.46	0.89	5.10	0.24	0.15	2.45	5.56	9.46	3.04	Lower	6.26	Moderate	No
76	8.49	8.69	8.19	2.51	5.13	0.36	1.35	2.34	5.49	8.70	6.52	Higher	7.38	Higher	No
77	6.11	4.34	9.20	1.80	4.48	2.38	3.48	7.61	7.67	8.95	5.65	Moderate	7.20	Higher	No
78	8.02	4.68	8.15	1.78	4.45	0.18	0.24	2.36	6.72	9.54	8.26	Higher	6.21	Moderate	No
79	0.13	4.34	1.78	2.76	6.58	6.23	4.59	5.51	7.91	7.03	5.65	Moderate	6.11	Moderate	No
80	1.51	10.00	2.66	9.90	5.94	5.20	4.42	5.12	6.30	6.61	0.00	Lower	6.49	Moderate	No
81	7.16	5.41	7.04	4.87	6.62	0.68	2.83	2.40	6.97	9.54	8.26	Higher	8.34	Higher	No
82	3.25	1.93	5.27	2.56	4.94	3.69	5.15	7.47	6.94	7.44	6.95	Lower	2.51	Lower	No
83	4.29	3.83	5.81	4.03	5.58	4.16	4.34	3.50	7.39	3.84	8.06	Moderate	3.95	Higher	No
84	3.03	2.08	4.47	2.60	4.73	3.99	4.39	7.72	7.15	7.50	9.17	Higher	3.88	Higher	No
85	3.06	2.10	4.83	3.10	4.43	4.03	4.25	7.73	7.20	7.50	8.61	Higher	4.36	Higher	No
86	3.02	1.98	4.76	3.67	5.53	4.02	4.55	2.53	7.22	3.21	7.78	Moderate	4.04	Higher	No
87	3.33	2.00	4.95	8.35	5.77	4.97	5.60	2.58	7.36	3.39	7.78	Moderate	3.10	Moderate	No
88	6.21	1.88	9.48	2.67	3.43	2.26	4.09	8.28	7.04	7.50	8.06	Moderate	4.30	Higher	No
89	4.03	1.93	5.67	2.49	4.66	3.09	5.70	4.54	6.58	4.07	9.17	Higher	4.12	Higher	No
<b>Average Score</b>	4.45	4.98	5.53	4.14	5.92	3.69	3.87	5.20	7.14	8.23	5.57		6.69		
<b>Average Rating*</b>	Moderate	Moderate	Higher	Moderate	Higher	Lower	Moderate	Higher	Higher	Moderate	Moderate		Moderate		

\*Average group rating calculated based on the Nova Scotia normalized reference values in the WESP-AC tool.



APPENDIX L  
VISUAL AND SHADOW FLICKER ASSESSMENT

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# VISUAL AND SHADOW FLICKER ASSESSMENT

14.06.2024

Clydesdale Ridge Wind Project

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# 1 Introduction

The Clydesdale Ridge Wind Project (the Project) is being developed by Clydesdale Holdings Ltd. (the Proponent). The Proponent represents a partnership between Natural Forces Developments Limited Partnership (Natural Forces) and Dalhousie Mountain Wind Energy Inc. The Proponent is further partnering with Mi'kmaq bands in Nova Scotia to ultimately develop, construct, own, and operate the Project.

The Project consists of up to 18 wind turbine generators (WTGs) and is situated adjacent to the operational Dalhousie Mountain Wind Farm, which is owned and operated by an affiliate of Dalhousie Mountain Wind Energy Inc. The Project is located near Mount Thom, Earltown, Loganville, and Berichan in both Colchester County and Pictou County. The proposed WTG locations and associated infrastructure are predominantly on privately-owned lands owned by multiple landowners, with a portion of the access road and collector lines traversing provincial Crown land. The private lands are secured under Lease, Option to Lease, and Easement. The Proponent has an active application for an Easement over the provincial Crown land.

On behalf of the Proponent, Natural Forces has undertaken a visual impact assessment. This assessment details the perceived visual impacts from the proposed project on the surrounding community. A distance of 2 km from each turbine location has been used to determine an area of influence for shadow flicker impacts at receptors in the area. In addition to a shadow flicker assessment, this report includes a Zone of Visual Influence (ZVI) assessment as well as a photomontage of the Project.

This report outlines background information on the shadow flicker effect and relevant policy and guidelines, describes the source of shadows and the receptors (homes), provides the prediction methodology and results, and proposes mitigation methods.

## 1.1 Background

Prior to determining the predicted amount of shadow flicker effect of a project, careful site design is recommended, followed by industry accepted mitigation strategies. This assessment serves to demonstrate that shadow flicker is being assessed with careful planning and mitigation. The ZVI assessment and photomontage are additional tools in determining the cumulative visual impacts of the Project on the surrounding community.

Incident light rays on a moving object casts an intermittent shadow on a receptor. This intermittent shadow, perceived as a change in light intensity by an observer, as it pertains to WTGs, is referred to as shadow flicker. This is caused by incident sun rays on the rotor blades as they turn.

For shadow flicker to occur, the following criteria must be met:

1. The sun must be shining and not obscured by any cloud cover or fog;
2. The wind turbine must be located between the sun and the shadow receptor;

3. The line of sight between the turbine and the shadow receptor must be clear, as sight-impermeable obstacles, such as vegetation, buildings, awnings etc., will prevent shadow flicker from occurring at the receptor; and
4. The shadow receptor must be close enough to the WTG to be in the shadow of the turbine rotor.

A ZVI assessment creates polygons that show how many turbines will be visible from a given location on a map. This assessment, while relatively simple, is a reliable, conservative representation of the visual impacts to the broader area surrounding a project.

The Photomontage study demonstrates how the Project may be visible on the landscape from local viewpoints used by, or known to, community members. The resulting Photomontages serve as an example of how the Project may appear following construction, subject to minor adjustments to the layout further into the design process.

## 1.2 Policy and Guidelines

The *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia*, as provided by the Environmental Assessment Branch, states that shadow flicker perceived by a receptor must not exceed 30 hours or more per year, or exceed 30 minutes or more per day. This document is aligned with industry standards and other regulations in maritime provinces.

There are no policies or guidelines concerning ZVI or viewshed, as visual aesthetics are subjective to the observer.

## 1.3 Source of Shadow

This assessment is conducted using the Nordex N163, 7MW turbine model, with a hub height of 118m, a rotor diameter of 163m, and a total height of ~200 m. Of the turbine models considered for the Project, this model signifies the highest possible impact. This approach allows for the visual and shadow flicker assessment to evaluate a scenario of maximum potential impact. This assessment also assumes that all 18 turbine locations will be constructed, further demonstrating the highest possible impact.

Should another turbine model be selected for the Project, modelling will be re-run prior to construction to ensure compliance.

The geographical coordinates of the 18 proposed turbine locations are included in **Appendix B**.

## 1.4 Receptors

There are 26 receptors within the vicinity of the turbine locations. The receptors consist of year-long dwellings, seasonal dwellings, and local businesses. They have been identified based on online geographical data from the Nova Scotia Data Catalogue and cross referenced with aerial photography, as well as site visits. The geographical coordinates of these receptors are included in **Appendix B**. A map of the project area with the receptors is included in **Appendix A**.

## 2 Shadow Flicker Assessment

The shadow flicker impact was calculated for the proposed Project layout at each of the 26 receptors using the Shadow module of the software package WindPRO version 4.0. This was completed using methodologies, detailed below, to calculate the expected hours per year and maximum minutes per day of shadow flicker from the Project at each receptor.

### 2.1 Methods

The flicker assessment, conducted in WindPRO, uses monthly sunshine probabilities from the nearest data source (Charlottetown station database) (**Table 1**) and the turbine specifications to calculate the shadow levels at each receptor.

**TABLE 1: SUNLIGHT PROBABILITIES FOR CHARLOTTETOWN, PEI IN HOURS PER DAY**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.37	4.18	4.42	5.04	6.34	7.54	7.95	7.19	5.76	3.98	2.63	2.31

The position of the sun relative to the wind turbine rotor plane and the resulting shadow is calculated in steps of one-minute intervals throughout a complete year. If the rotor plane, assumed to be a solid disk equivalent in size to the swept area, indicated in **Table 2**, casts a shadow on a receptor window during one of these intervals, it is registered as one minute of potential shadow impact.

**TABLE 2: TURBINE CHARACTERISTICS**

Turbine Model	Nordex N163/6.X
Nameplate Capacity	7.0 MW
Hub Height	118 m
Rotor Diameter	163 m
Sweep Area	20,867 m <sup>2</sup>

The impact of shadow flicker on surrounding receptors is limited by two factors in the modeled scenario. The first factor is that the angle of the sun over the horizon must be greater than 3 degrees, due to optic conditions in the atmosphere that cause the shadow to dissipate before it could potentially reach a receptor. The second factor is that the blade of the wind turbine must cover at least 20% of the incident solar rays to have a noticeable effect.

To further ensure a conservative approach, each receptor is treated as a greenhouse with 1.5 m high by 1.5 m wide windows for 360° of the building. Furthermore, no topographical or ground cover shielding caused by buildings, barns, trees, awnings, etc. has been considered between the wind turbines and receptors. Finally, the model assumes that WTGs are constantly operational and always facing the receptor directly.

These assumptions result in a highly conservative prediction of the potential shadow flicker impacts, meaning that the actual shadow flicker impacts will likely be much less severe than those calculated in the predictive model.

## 2.2 Shadow Flicker Assessment Results

The results of the shadow flicker prediction model at each receptor demonstrate compliance with the selected requirements of no more than 30 hours per year of shadow, and no more than 30 minutes on the day of maximum shadow flicker.

The assessment demonstrates that all receptors located within 2 km of the 3 WTG Project layout are modelled to be subjected to less than 30 hr/year and less than 30 min/day of shadow flicker. The detailed results of the shadow assessment study for all receptors are included in **Appendix B**. A summary of the only receptors with any expected shadow flicker levels are detailed below in **Table 3**.

**TABLE 3: SHADOW FLICKER IMPACT ASSESSMENT SUMMARY FOR THE ONLY RECEPTORS IMPACTED**

Receptor ID	Expected Shadow Flicker from WTGs [hr/year]	Shadow Flicker from WTGs [minutes/day]	In Compliance
I	4:31	8	Yes
O	19:50	17	Yes
P	4:41	10	Yes
Q	6:53	12	Yes
R	4:46	11	Yes
S	5:23	10	Yes

## 3 Other Visual Assessments

### 3.1 Zone of Visual Influence

The software package WindPRO version 4.0 was used to complete the ZVI assessment, specifically, the module for ZVI within the package. The ZVI assessment shows the broader extent of visual impacts from the Project on the surrounding landscape. The ZVI assessment does not consider factors such as weather conditions, vegetation cover, existing buildings, or other screening objects, but exclusively considers the location of turbines with respect to topographical features. Therefore, this assessment represents a conservative approach.

For the ZVI assessment, an observation height of 150 cm was selected and a 50 x 50 km area was used. The assessment simulates if an individual would be able to perceive any of the WTGs from the location specified on the map. This includes WTGs that would be fully or partially visible.

A map showing the results of the assessment is included in **Appendix C**.



The resulting polygon shows that at least one of the turbines will be visible from much of the surrounding landscape. This is due to higher-elevated areas being favored for turbine locations, where wind resource is more available. The topography of the surrounding area results in some sections to the east and west of the Project where no turbines are visible.

### 3.2 Photomontage

A photomontage is a rendering of the proposed turbines on a georeferenced photograph of the existing landscape. The rendering is then adjusted to remove any turbines or sections of turbines that would be obscured by existing obstacles in reality. The photomontages were completed using the Photomontage module in WindPRO version 4.0.

The photomontage photos were taken from four locally known points where the Project may impact the view scape. Distributed around the Project to capture the WTGs from multiple angles, these locations include a point near the Earltown Community Centre along NS-311, a point along Loganville Road, a point along Balmoral Road, and at the entrance to the South of the Project on Glen Road. The geographical coordinates of the photomontage locations are indicated in **Table 4**.

In each photomontage, at least one proposed turbine is visible or partially visible from the selected location. The photomontages and a map of their locations are included in **Appendix D**.

**TABLE 4: PHOTOMONTAGE LOCATIONS**

Location	Latitude	Longitude
Earltown	-63.137	45.576
Loganville Road	-63.046	45.633
Balmoral Road	-63.132	45.654
Glen Rd	-63.001	45.521

## 4 Proposed Mitigation

The shadow flicker modelling demonstrates that the Project is in compliance with the industry standard thresholds. However, should the amount of shadow flicker experienced at nearby receptors become an issue, there are various mitigation measures that can be put in place, which are discussed below.

The ZVI and photomontage assessments were carried out to provide additional information on how the Project will appear on the landscape. There are no particular requirements for these assessments, but the visual impact on the landscape is mitigated by the siting of the Project on agricultural land and the selection of paint for the WTGs that reduce contrast with the environment and minimizes blade glint.

## 4.1 Tracking the Shadow Flicker

Should receptors experience shadow flicker that becomes an issue, the complaint will be addressed following a Complaint Resolution Plan. The main steps to resolve the issue will be:

- 1) Conduct an investigation to understand the conditions under which shadow flicker issues are experienced. The specific date, time, location of observed shadow flicker, and local weather conditions (including wind direction and wind speed) will be noted for each incident of shadow flicker as well as the duration of the event.
- 2) If it is determined from the investigation that the shadow flicker was caused by the Project and exceeds thresholds, the Operations Team for the Project will work to identify the best mitigation based on the circumstances, such as screening, discussed below.
- 3) The Operations Team will track any such events along with the supporting data, and will track the success of any mitigation measures employed to inform future resolutions.

## 4.2 Screening

Screening efforts are a feasible and effective mitigation measure for reducing shadow flicker impact. If the investigation following the Complaint Resolution Plan reveals that a receptor experiences an exceedance of the modelled shadow flicker levels, the Proponent could use screening methods that will provide shade to buildings and windows, effectively reducing shadow flicker annoyance.

Screening can be accomplished with existing vegetation, revegetation, and planting additional vegetation to the area that is experiencing shadow flicker. Similar, and sometimes superior, results can be obtained by installing awnings and window coverings if it would be preferred by those experiencing the impact.

## 5 Discussion and Conclusions

Natural Forces has completed an assessment to evaluate the visual impacts of the Clydesdale Ridge Wind Project at receptor locations within 2 km of the proposed WTGs through the shadow flicker assessment. The broader surrounding area has been assessed through the photomontage and ZVI assessments.

Based on the parameters used in WindPRO shadow flicker prediction model, it has been shown that in a conservative scenario, shadow flicker emitted by the proposed WTG model in the 18-turbine layout is less than 30 hours per year and 30 minutes per day at all receptors. The maximum potential shadow flicker impact, as measured in hours per year at a receptor, is 19 hours and 50 minutes per year. The highest potential maximum daily shadow flicker time at a receptor is 17 minutes.

Various measures may be used to mitigate the effect of shadow flicker perceived at receptors if it becomes an issue, including screening using natural barriers, awnings, or other structures.

The model indicates that the receptors will not receive excessive amounts of shadow flicker. Natural Forces will work closely with the homeowners and businesses to observe occurrences of real-case shadow flicker impact during operation and apply mitigation as mentioned.

## 6 References

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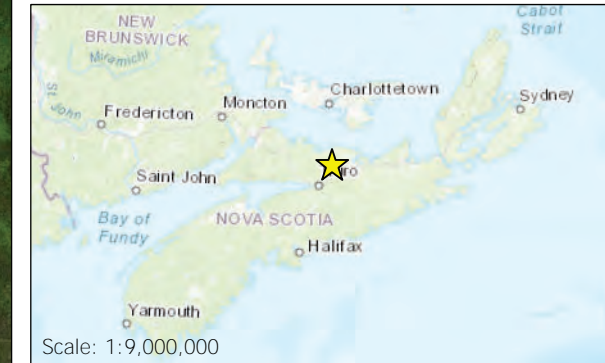
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## **Appendix A: Project Map with Shadow Flicker Assessment**

# Clydesdale Ridge Wind Project

## Shadow Flicker Assessment



### Legend

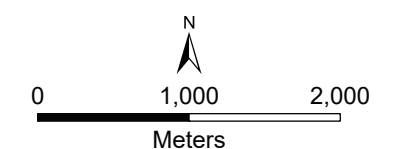
- Residences and Buildings
- Proposed Turbine Locations
- $\geq 30$  Shadow Flicker Hours per Year
- Shadow Flicker Maximum per Day:
  - $\geq 30$  Minutes

### Notes

1. Turbine markers not to scale.
2. The Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia states that shadow flicker perceived by a receptor must not exceed 30 hours or more per year, or exceed 30 minutes or more per day.

### Sources

Basemap: ESRI World Topo Map



Scale: 1:50,000

Spatial Reference: NAD 1983 UTM Zone 20N

Page Size: 11" x 17"

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Prepared by: Kellan Duke

