

Appendix 3: Avian Surveys Report

Assessment of Migratory and Breeding Birds at the Spicer Quarry, Annapolis County, Nova Scotia

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Background

The proposed expansion of the Spicer Quarry has triggered an Environmental Assessment under the Environment Act. The surveys conducted for this report were the avian component of the assessment. In ECA's consultation with the Nova Scotia Department of Lands and Forestry, six survey dates were agreed upon to assess bird use of the property. Surveys were designed to detect breeding raptors (March), breeding owls (April), early spring migrants and breeders (late April), late spring migrants and breeders (late May), early fall migrants (early September), and late fall migrants (late September). Exact dates for the surveys were selected to ensure favorable weather for migration and bird detection, and to maximize chances of detecting Species at Risk.

Study Site

The Spicer Quarry is situated between Bridgetown and Granville Ferry, NS, and the property extends from the floor of the Annapolis Valley up a steep slope to the top of North Mountain. Figure 1 depicts the study area, including all areas within 100m of the road, the existing quarry, future quarry, and stockpile/crusher area. The habitat along the road in the valley floor consists of several fields and primarily young conifer-dominated forest, with some patches of hardwoods and birch and alder thickets. The stockpile/crusher area is at the base of the slope of the North Mountain, and the forest to the west of the stockpile/crusher area is more mature. The part of the slope of the north mountain along the road is mature mixed forest, consisting of primarily of hemlock, spruce, maple, and birch. The habitat on top of the slope surrounding the existing quarry and within the future quarry site is mature hardwood-dominated forest, with some larger spruce, giving way to younger hardwood-dominated forest in the north edge of the future quarry site. The part of the future quarry site west of the road has been recently cleared and is now young regenerating forest. Sandwiched between the existing quarry and future quarry is a small stream drainage referred to in other components of the assessment as Wetland 1. Mature conifers are found in this location, which appears suitable for nesting raptors. To the north of the future quarry is a larger wetland denoted as Wetland 3 in other components of the study. The topography and wetlands on top of North Mountain are depicted in Figure 2.

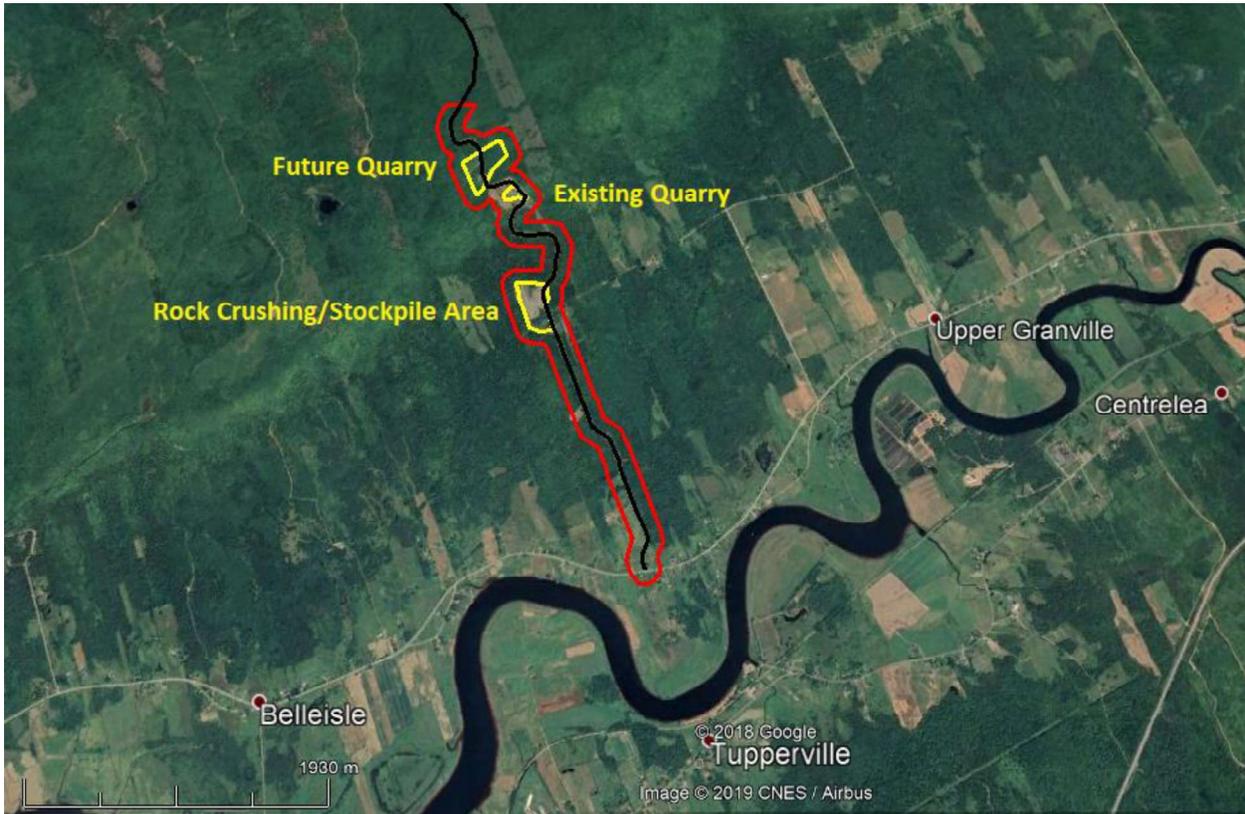


Figure 1. The study area at the Spicer Quarry, in Granville, NS. The road is depicted in black, project areas in yellow, and 100m buffer in red.

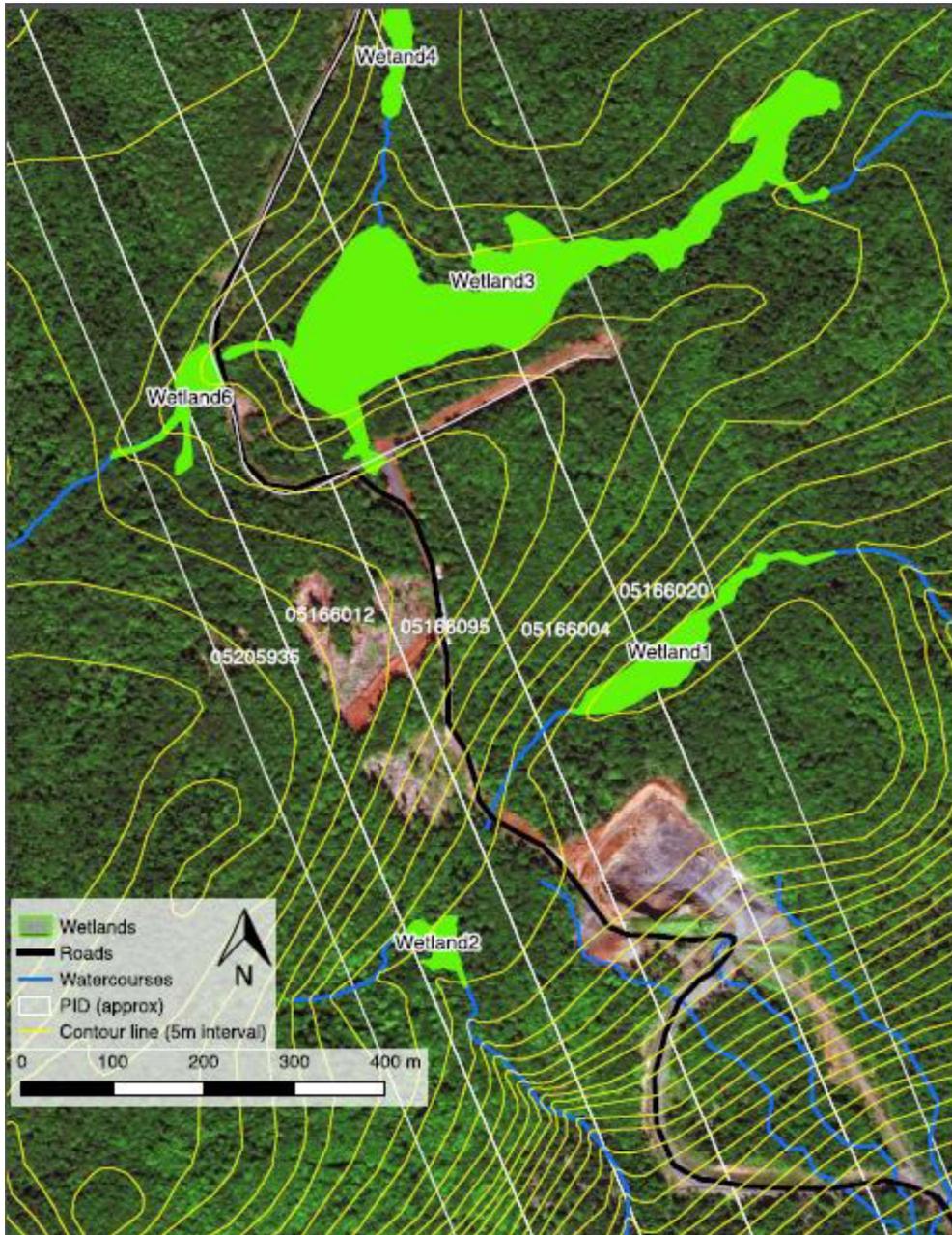


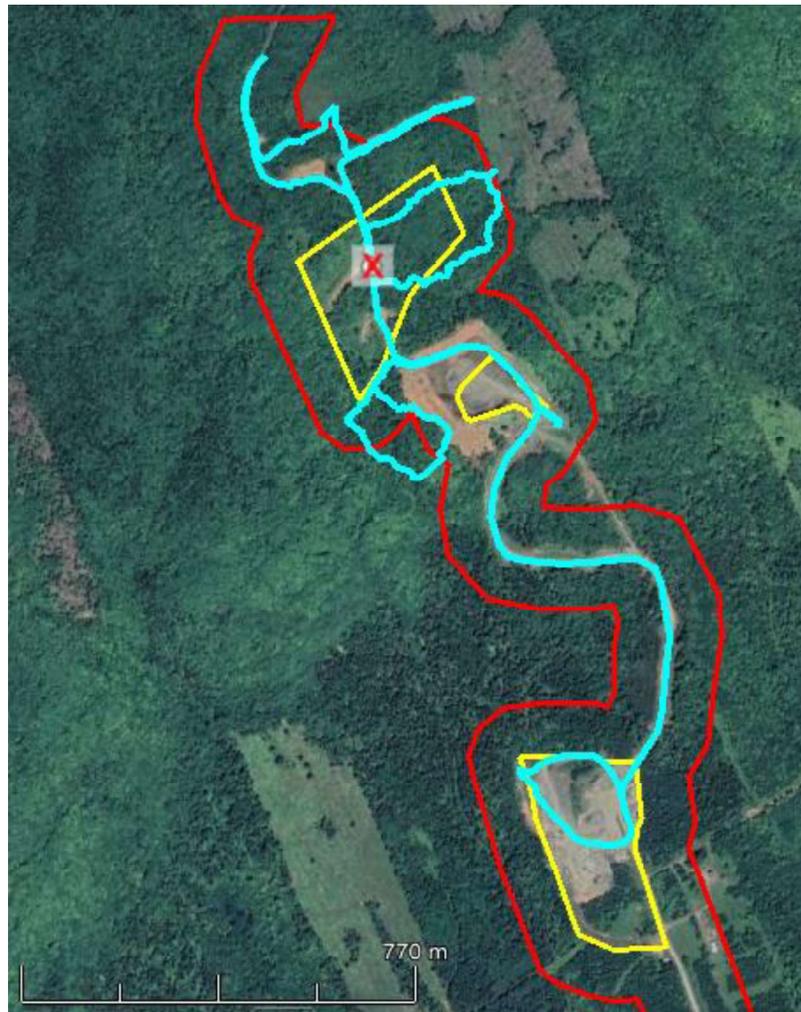
Figure 2. Imagery of the portion of the study area with the slope and top of North Mountain, including the road (black), drainages (blue), contours (yellow), wetlands (green).

Breeding Raptor Survey

Survey Methods

The breeding raptor survey was conducted in March to coincide with peak breeding display activity of Northern Goshawks. The active quarry, future quarry site, and roads north of future quarry were surveyed on foot, with periodic scans of the sky for soaring raptors. Playback of Northern Goshawk from the Sibley eGuide to Birds phone application was broadcast using a Samsung Galaxy S7 at maximum volume periodically throughout the survey. The stockpile/crusher area was also surveyed on foot, with careful attention paid for raptors soaring along the edge of North Mountain. Periodic stops were made along the entrance road to scan for soaring raptors. Figure 3 depicts a map of the track covered.

Figure 3. Map depicting the project areas (yellow), 100m buffer (red), and track covered during the raptor survey (turquoise).



Survey Date and Weather

The breeding raptor survey was conducted on March 14, 2019. The date was selected based on weather forecasts of a warm sunny day, which would be ideal for soaring raptors. The survey was initiated at 9:42AM, and completed at 12:55PM. The temperature was 0°C at the start and 5°C at the end of the survey, under clear skies. There was no wind at the beginning of the survey, and a SW breeze picked up to around 10kph by the end of the survey.

Results

Several raptors were detected during the survey. A Red-tailed Hawk and a Turkey Vulture were seen soaring over the entrance road of the property from a vantage point at the edge of the quarry on top of North Mountain. Neither species landed on the property, and there was no evidence that they were nesting on the property. Two Bald Eagles were seen soaring along the edge of North Mountain, but did not land or show any evidence of nesting on the property. There was no indication of raptors nesting in the future quarry area or active quarry. Since the area was covered by foot and Goshawk playback used, I am confident that no raptors of any species were nesting in this area, or they would have responded to the playback.

23 individuals of 12 species of birds were detected during the survey (Table 1). The most unusual detection was that of a Northern Shrike, that appeared along the edge of the active quarry in response to Goshawk playback. A Barred Owl was detected at the base of the slope of North Mountain just west of the stockpile/crusher area. A Canada Jay was seen and heard along the road just west of Wetland 3, at the northern edge of the survey area.

Table 1. Species of birds seen during the Breeding Raptor Survey on March 14, 2019

Species	Count
Turkey Vulture (<i>Cathartes aura</i>)	1
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	2
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	1
Barred Owl (<i>Strix varia</i>)	1
Hairy Woodpecker (<i>Dryobates villosus</i>)	1
Northern Shrike (<i>Lanius borealis</i>)	1
Canada Jay (<i>Perisoreus canadensis</i>)	1
American Crow (<i>Corvus brachyrhynchos</i>)	3
Common Raven (<i>Corvus corax</i>)	2
Black-capped Chickadee (<i>Poecile atricapillus</i>)	8
Red-breasted Nuthatch (<i>Sitta canadensis</i>)	1
White-winged Crossbill (<i>Loxia leucoptera</i>)	1

Nocturnal Owl Survey

Survey Methods

The survey protocol was modified from the protocol used by the Nocturnal Owl Survey (Takats et al. 2001) and American Woodcock Singing Ground Survey (USFWS 2018). Nine owl survey point counts were conducted on April 18, 2019, preceded by seven brief point counts to detect American Woodcocks. On the owl survey, Stop 1 was selected to monitor owls in the immediate vicinity of the active quarry. Stops 2 and 3 were positioned to detect owls within the planned expansions area, and stop 4 was positioned to detect owls near the wetland designated “Wetland 3” in the other documents for the overall assessment. The remaining stops (5-9) were conducted every 400 meters along the access road (reached by vehicle), starting with a point 400 meters to the south of stop 1 and continuing towards the entrance (Figure 4). I initiated the owl survey at the active quarry site at 8:58 PM, and proceeded on foot between stops 1 and 4, in order to maximize the chances of detecting owls in the quarry expansion site. Stops 5-9 were then conducted by driving between points and stopping every 400m. Stop 9 was completed at 10:22PM. The points were conducted closer together in distance than points in the Nocturnal Owl Survey, to maximize coverage of the site and chances of detecting Northern Saw Whet, Boreal, and Long-eared Owls. However, since Barred and Great Horned Owls are very loud and can be heard at multiple points, they were not recorded separately for each point, but rather the location of each territory was estimated based on the detections from multiple points.

The owl stop listening and playback protocol used was adapted from protocols used in the Nocturnal Owl Survey. Stops started with 2 minutes of silent listening, followed by a series of broadcasted calls interspersed with 1 minute listening periods. The order used for the playback was: Northern Saw Whet Owl, Boreal Owl, Long-eared Owl, and then Barred Owl. However,

since Barred Owls were calling consistently on the first half of the survey, their calls were not broadcast at those stops in the hope that territories could more easily be estimated without coaxing them to fly in towards the broadcasted calls. The Nocturnal Owl Survey protocol in NS only uses broadcast calls of Boreal Owl followed by two sessions of Barred Owls.

For the American Woodcock survey, I arrived at the entrance road at 8:22 PM, right as the woodcocks were beginning to display. I stopped every 400m along the entrance road until reaching the base of the slope, spaced out so as to not detect the same woodcocks at multiple spots, for a total of seven stops. Stops were short (<2 minutes) to maximize the number of territories that could be surveyed, since woodcocks typically call or perform flight displays without pause for the duration of their brief evening display (Duke 1966). The woodcock survey was completed by 8:50, and I then continued up North Mountain to begin the owl survey.

Survey Date and Weather

The owl survey was conducted on the evening of April 18, 2019. The date was selected to coincide with peak vocalizations of most breeding owl species in NS, lunar cycle (near full), and optimal weather conditions (clear, warm, and low wind). These conditions (with the exception of lunar cycle) are a requirement based on the survey protocol of the Nocturnal Owl Survey (Takats et al. 2001) and the date fell within the middle of the survey date window for that survey. While lunar cycle has not been scientifically shown to have an effect on owl calling frequency, anecdotal evidence from experienced owl surveyors in NS suggests that nights with bright moons are optimal for some species of owls, in particular Northern Saw Whet Owls (personal communications Bernard Forsythe, Richard Stern). The date was selected 3 days in advance, based on the most up to date weather forecasts, to schedule the night with optimal weather conditions during that particular week.

The woodcock survey was initiated at 8:22PM under overcast skies with light (<10kph) south wind and a temperature of 8°C, and the owl survey commenced at 8:58PM under the same conditions. Sunset was at 8:10PM. The night was forecast to be clear, but a low pressure system from the southwest arrived ahead of schedule. Initial stops along the entrance road and the first two owl stops were conducted under good conditions (low wind, and no precipitation), but a period of drizzle interrupted the survey following the second point. The next three points were conducted under moderate conditions, with a moderate breeze ~10 kph from the South, and patchy drizzle. Survey listening stops were conducted as soon as drizzle let up, since the light rain precluded detection of quieter owls such as Northern Saw Whet. The last 5 points were conducted under sub-par conditions, with a breeze of ~15 kph that would have inhibited detection of quiet owl species, but the intermittent drizzle had ended.

Results

A single Great Horned Owl (*Bubo virginianus*) was observed perched on top of a dead tree in a small wetland along the entrance road before the formal owl points were conducted (Figure 4). Two Barred Owls (*Strix nebula*) were detected on the first point. One was calling from the base of the slope in the woods NW of the stockpile/crusher area, while the other was to the NW of the active quarry (Figure 4). The Barred Owl at the base of the slope was in the same general area as where one was heard calling during the raptor survey on March 14, 2019. The Barred Owl near the active quarry could be heard on owl stops 1-4, and was heard dueting with a second owl (presumably its mate) during points 2 and 3, yielding a total of three Barred Owls on the survey (Figure 4). Owls were not heard at points 5-10. Since none of the owls detected were found in response to playback, the approximate locations of the birds should reflect the locations of their territories. All are presumed to be nesting on or near the property, but apparently not within the future quarry area. Eleven American Woodcocks (*Scolopax minor*) were heard displaying along the entrance road (7 ~2 minute stops), along the valley floor. Table 2 shows numbers of each species detected during the owl and woodcock surveys.

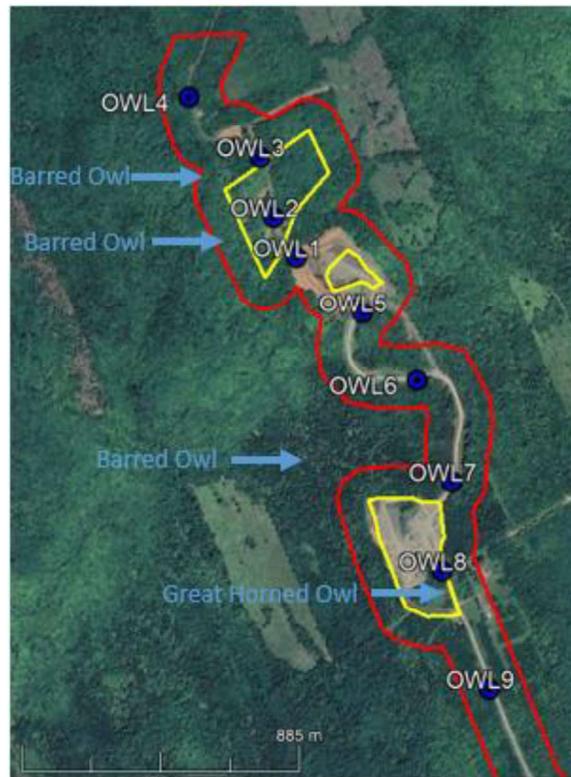


Figure 4. Map of owl point count locations and owl detections. Owls were located approximately at the tips of the arrows.

Table 2. Numbers of each species detected during the owl survey.

Species	Count
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	1
American Woodcock (<i>Scolopax minor</i>)	11
Wilson's Snipe (<i>Gallinago delicata</i>)	1
Great Horned Owl (<i>Bubo virginianus</i>)	1

Barred Owl (<i>Strix varia</i>)	3
American Robin (<i>Turdus migratorius</i>)	8
Song Sparrow (<i>Melospiza melodia</i>)	1

Migration and Breeding Bird Surveys

Survey Methods

An area search methodology was employed to cover as much territory as possible in the early hours of the morning when migrant and breeding birds are most detectable. Since the site was to be visited only twice and was small enough to be covered on foot in one morning, this method was desirable over point counts. The overall objective was to obtain an inventory of the birds within the future quarry site, the existing quarry, the stockpile/crusher area, wetland 3, and the forest within 100m of these sites and the road. Surveys were initiated at sunrise, and endured until the focal areas had been covered. Surveys were conducted on foot, though vehicles were used to reposition between focal sites. The stockpile/crusher area was surveyed first before work activities at the site became busy and noisy. The next area surveyed was the future quarry site, followed by the area north of the future quarry including Wetland 3. The active quarry, slope, and entrance road were surveyed on the return trip, unless a vehicle was not driven up the slope. In that case (June 1 and September 30), the slope and active quarry were surveyed on the walk up to the future quarry. Birds detected were recorded separately in each focal area (stockpile/crusher, active quarry, future quarry, and the vicinity of wetland 3), as well as along the road up the slope of North Mountain between the Active Quarry and Future Quarry, and along the entrance road between the stockpile/crusher area and the entrance from Route 1. The headings in Tables 3-6 of the birds detected by sector refer to these six areas.

Survey Dates and Weather

The spring migration/breeding surveys were conducted on April 26, 2019 and June 1, 2019. A date in late April was selected to maximize detections of early migrants, migratory breeding birds, and breeding resident birds that were most vocal early in the season. The second survey was scheduled for the last week of May or first few days of June. This timing coincided with peak movements of migrants and allowed for the return of migratory Species at Risk that could potentially breed at the site such as Common Nighthawk (*Chordeiles minor*), Olive-sided Flycatcher (*Contopus cooperi*), Eastern Wood-pewee (*Contopus virens*), and Canada Warbler (*Cardellina canadensis*), all of which return in the last week of May or early June. The exact dates were selected based on short-range weather forecasts, for clear mornings with light winds following southerly winds. The April 26 survey was initiated at 6:47 AM and finished at 10:31AM. The weather was clear, but there was a dense layer of fog in the valley. The top of North Mountain was above the fog. The temperature at the start of the survey was -2°C with no wind, and 8°C by the end of the survey and still without wind. The gps track of the survey is depicted in Figure 5. The June 1 survey was initiated 6:00AM at and finished at 9:52AM. The sky was clear but there was fog in the valley. The temperature at the start was 3°C with no wind, and 18°C with a West wind of 8 kph at the end of the survey. The gps track of the survey is depicted in Figure 6.

The fall migration surveys were conducted on September 6, 2019 and September 30, 2019. A date in early September was selected to coincide with peak movements of migratory warblers,

vireos and flycatchers, and a date in late September was selected to coincide with peak movements of migratory raptors, thrushes, and sparrows. The exact dates were selected based on short-range weather forecasts of clear mornings with light winds following northerly winds. The September 6 survey was initiated at 6:41AM and finished at 11:41AM. The temperature at the start was 8°C with no wind, and there was fog in the valley. The temperature at the end was 17°C, and it became clear with a light north wind. The track for the September 6 survey is shown in Figure 7. The September 30 survey was initiated at 7:26AM and finished at 11:12AM. The weather started with clear skies, no wind, and a temperature of 7°C. The temperature rose to 12°C by the end of the survey and the wind picked up to ~10kph out of the northeast. The track for the September 30 survey is shown in Figure 8.

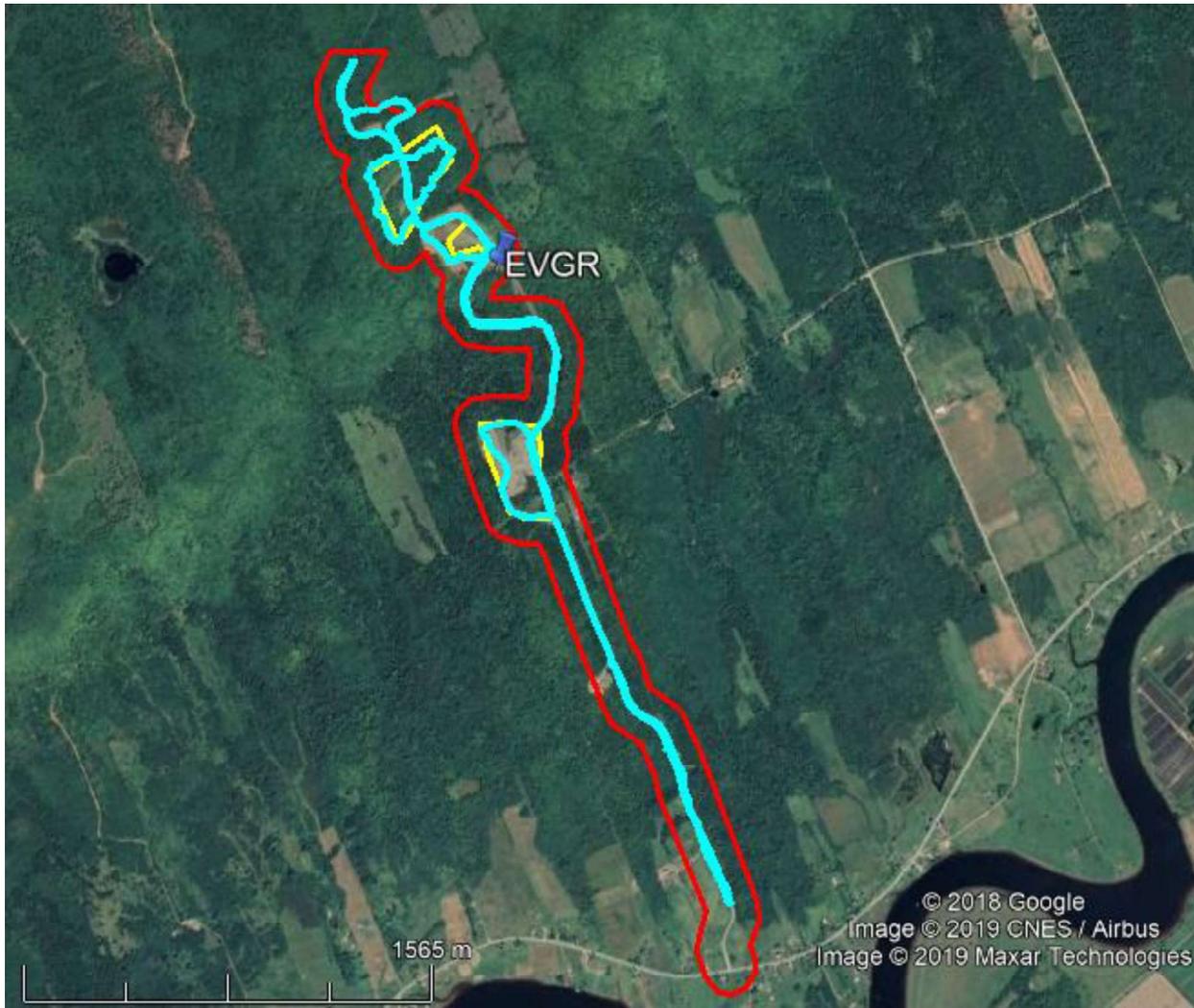


Figure 6. Track of the survey conducted on April 26, 2019, showing the track (light blue), project areas (yellow), 100m buffer (red), and location of an Evening Grosbeak sighting (EVGR).

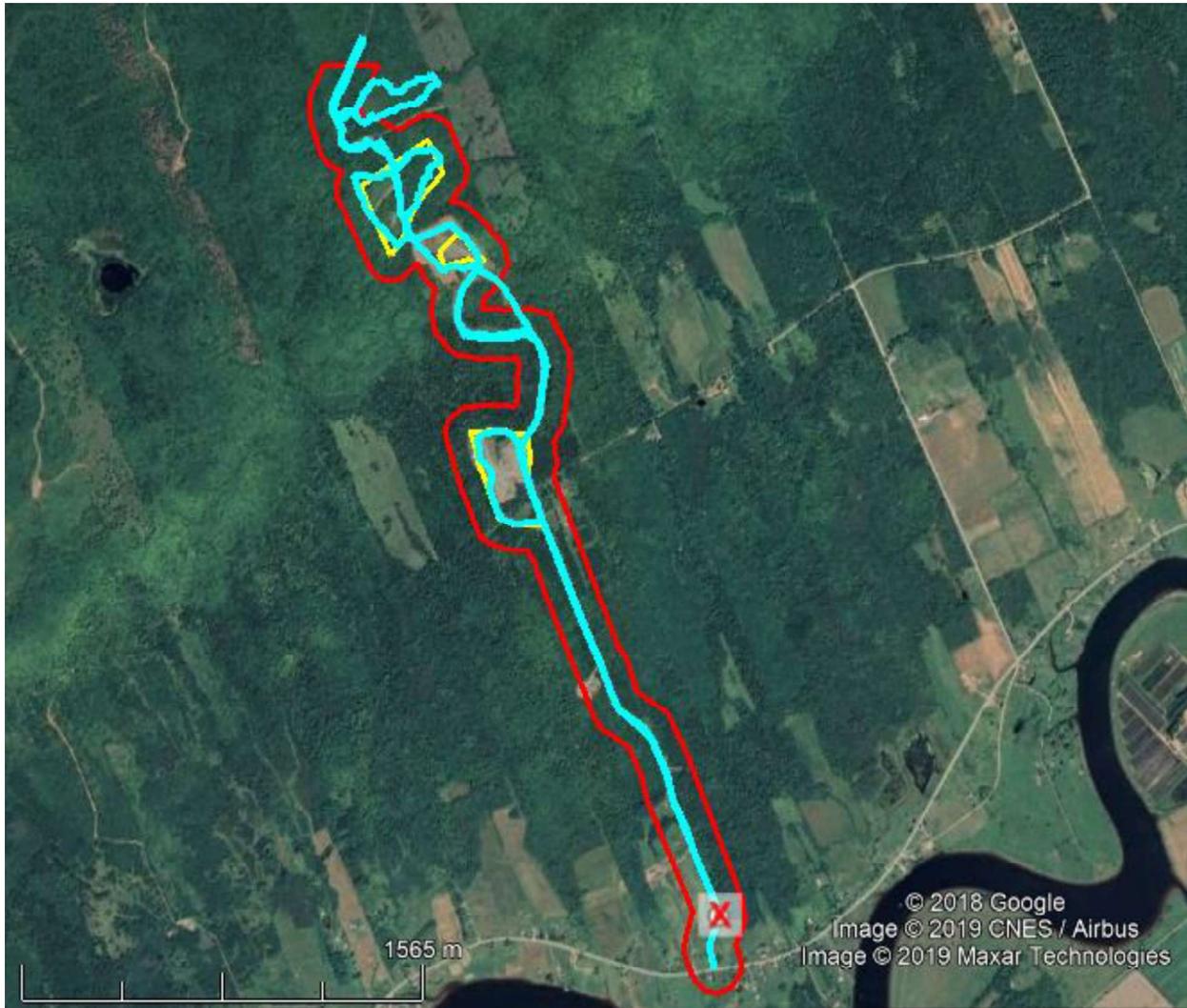


Figure 7. Track of the survey conducted on June 1, 2019, showing the track (light blue), project areas (yellow), and 100m buffer (red).



Figure 8. Track of the survey conducted on September 6, 2019, showing the track (light blue), project areas (yellow), and 100m buffer (red).

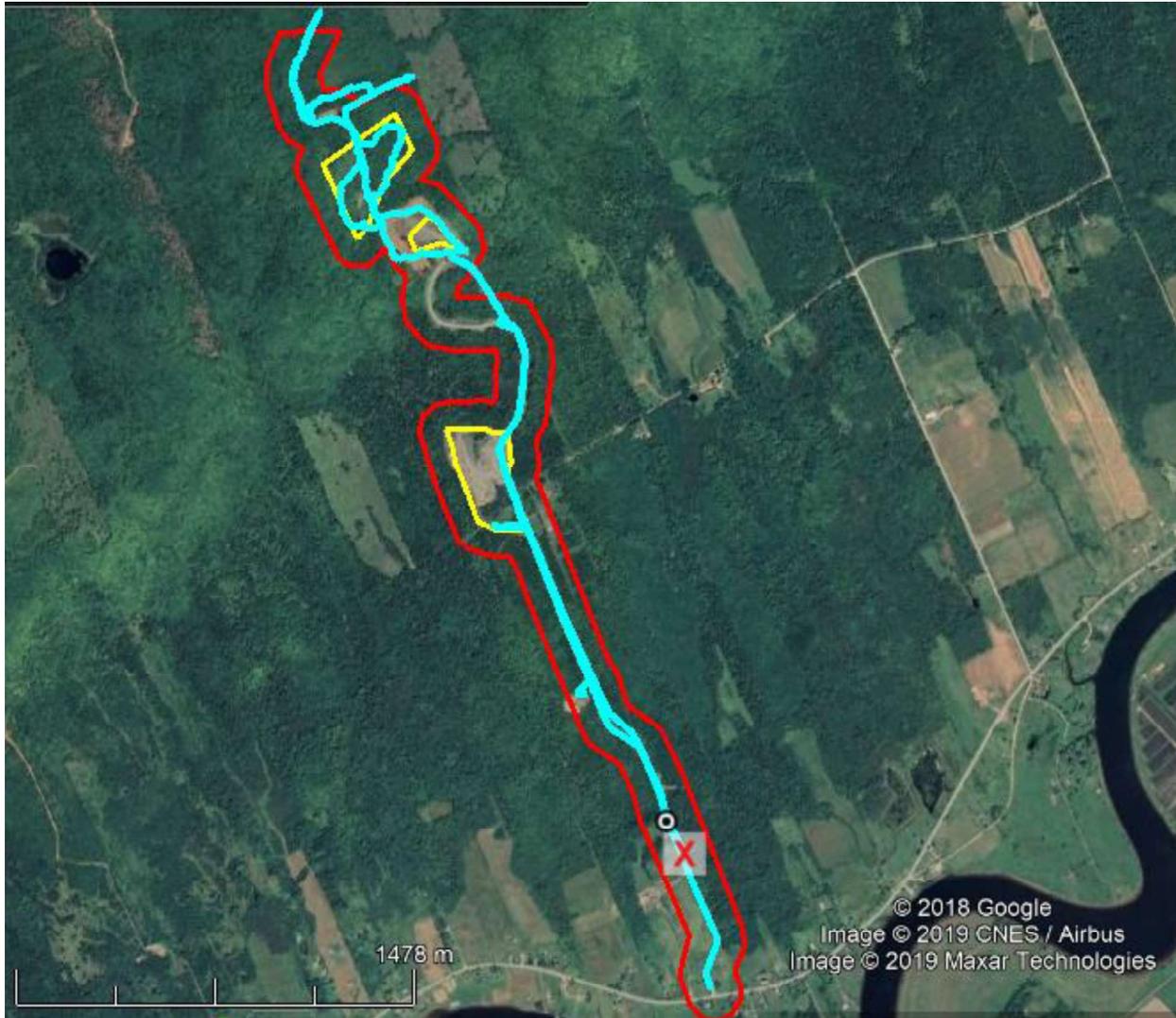


Figure 9. Track of the survey conducted on September 30, 2019, showing the track (light blue), project areas (yellow), and 100m buffer (red).

Results

Spring Migration and Breeding

April 26, 2019

The early spring migration and breeding survey on April 26, 2019 detected 212 individuals of 34 species of birds (Table 3). The most active areas of the site for migrants were the entrance road and stockpile/crusher area, where there were flocks of Yellow-rumped and Palm Warblers. Northern Flickers were also migrating, as individuals were seen moving over the site in long flights. Two Tree Swallows seen heading north high over the future quarry area were surely migrants. The only Species at Risk observed during the survey were two flocks of Evening Grosbeaks that flew over the quarry site, but did not land in the forest nearby.

In the future quarry site, 35 individuals of 15 species were found in the survey (Table 3). The birds observed were mostly resident breeding species, with a few migratory breeders that included one Hermit Thrush, two Winter Wrens, and one Yellow-rumped Warbler. The Ruffed

Grouse, Song and White-throated Sparrows, and Dark-eyed Juncos were found in the regenerating clearcut on the west side of the road, while the other birds were in the forested part of the future quarry site. All of the species detected, with the exception of Tree Swallow, were presumed to be breeding birds rather than migrants, as they were singing and were not observed in flocks.

At the active quarry site, no birds were observed in the quarry itself, but were detected along the forested edge or flying over. Similarly, at the stockpile/crusher area, no birds were observed using the interior of the area but were observed along the edge or flying over. The edges of the stockpile/crusher were particularly active with both migratory and breeding birds, with most activity on the north and west sides of the cleared area.

June 1, 2019

The peak migration and breeding bird survey conducted on June 1, 2019 detected 322 individuals of 52 species (Table 4). There was some evidence that migrants were moving through the area, as Blackpoll and Tennessee Warblers (which breed elsewhere) were observed, as were large numbers of American Redstarts and Red-eyed Vireos that could represent a combination of breeding and migratory individuals. Otherwise, most of the birds detected were likely species breeding at the site.

Species at Risk found during the survey include eight Canada Warblers using the edge of Wetland 3, and six Eastern Wood-Pewees at locations throughout the site. Five singing male Canada Warblers were found in wet shrubby areas adjacent to Wetland 3, at least three of which were accompanied by females (Figure 10). The Eastern Wood-Pewees were distributed across the property at five locations, and two were heard from the woods on the slope of North Mountain (Figure 11). One of the Eastern Wood-Pewees was found using the southernmost tip of the future quarry area, and one was heard near the southern edge of the stockpile/crusher area. The other pewees were in areas not likely to be disturbed by the quarry operation.

In the future quarry area, 66 individuals of 26 species were found using the site (Table 4). These were a mix of resident breeding and migratory breeding species, and all birds observed were presumed to be on territory, since none were observed in flocks or flying over. The most abundant species were Red-eyed Vireos, Ovenbirds, and American Redstarts. Two somewhat uncommon species using the site were Pileated Woodpecker and Black-throated Blue Warbler. The Eastern Wood-Pewee was observed in a patch of forest just north of the active quarry in an area to be part of the future quarry, though likely uses the more extensive mature forest on the west edge of the active and future quarry. Otherwise, the other birds at the site were typical breeding species of medium-aged mixed-wood forest and small clearcuts.

At the active quarry, the birds detected were in the forest around the edge of the site, except for a Belted Kingfisher that was seen exiting a nest burrow on the bank north of the road on the north side of the quarry. The forest on the margin of the stockpile/crusher area was diverse, and was represented by typical forest species plus some shrub/alder associated species such as Rose-breasted Grosbeak, Alder Flycatcher, and Veery, though no birds were observed using the interior of the stockpile area.

In addition to the Canada Warblers mentioned above, some locally uncommon species were seen in the vicinity of Wetland 3 to the north of the future quarry site. These include two Northern Waterthrushes, three Yellow-bellied Flycatchers, one Nashville Warbler, and six Black-throated Blue Warblers. There was no evidence of other forested-wetland associated Species at Risk using the site, such as Olive-sided Flycatcher or Rusty Blackbird. The slope of the North Mountain below the active quarry site was an interesting mixture of Hemlock associated species such as Black-throated Green Warbler, Blackburnian Warbler, and Winter Wren, conifer affiliated species such as Swainson's Thrush, Red-breasted Nuthatch and Golden-crowned Kinglet, and hardwood associated species such as Eastern Wood-Pewee, Least Flycatcher, and Veery.

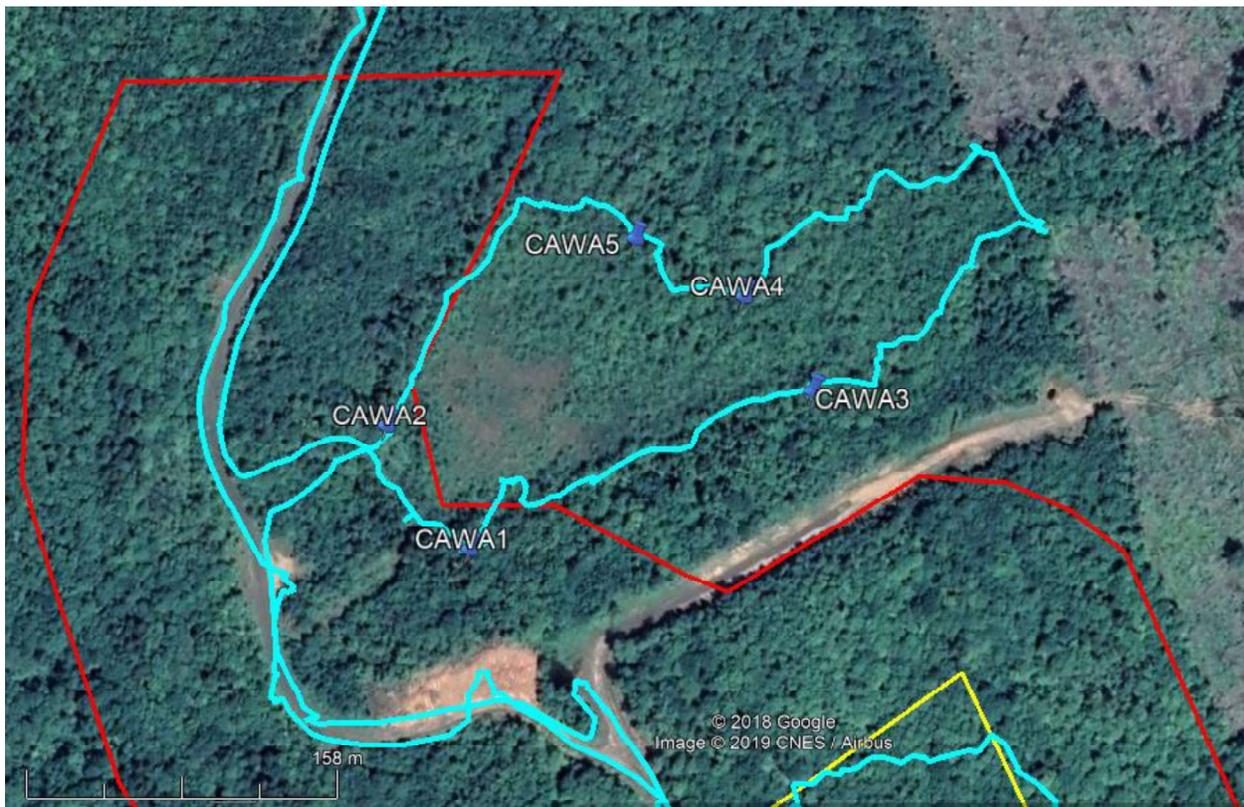


Figure 10. Locations where singing male Canada Warblers (CAWA) were detected in Wetland 3.

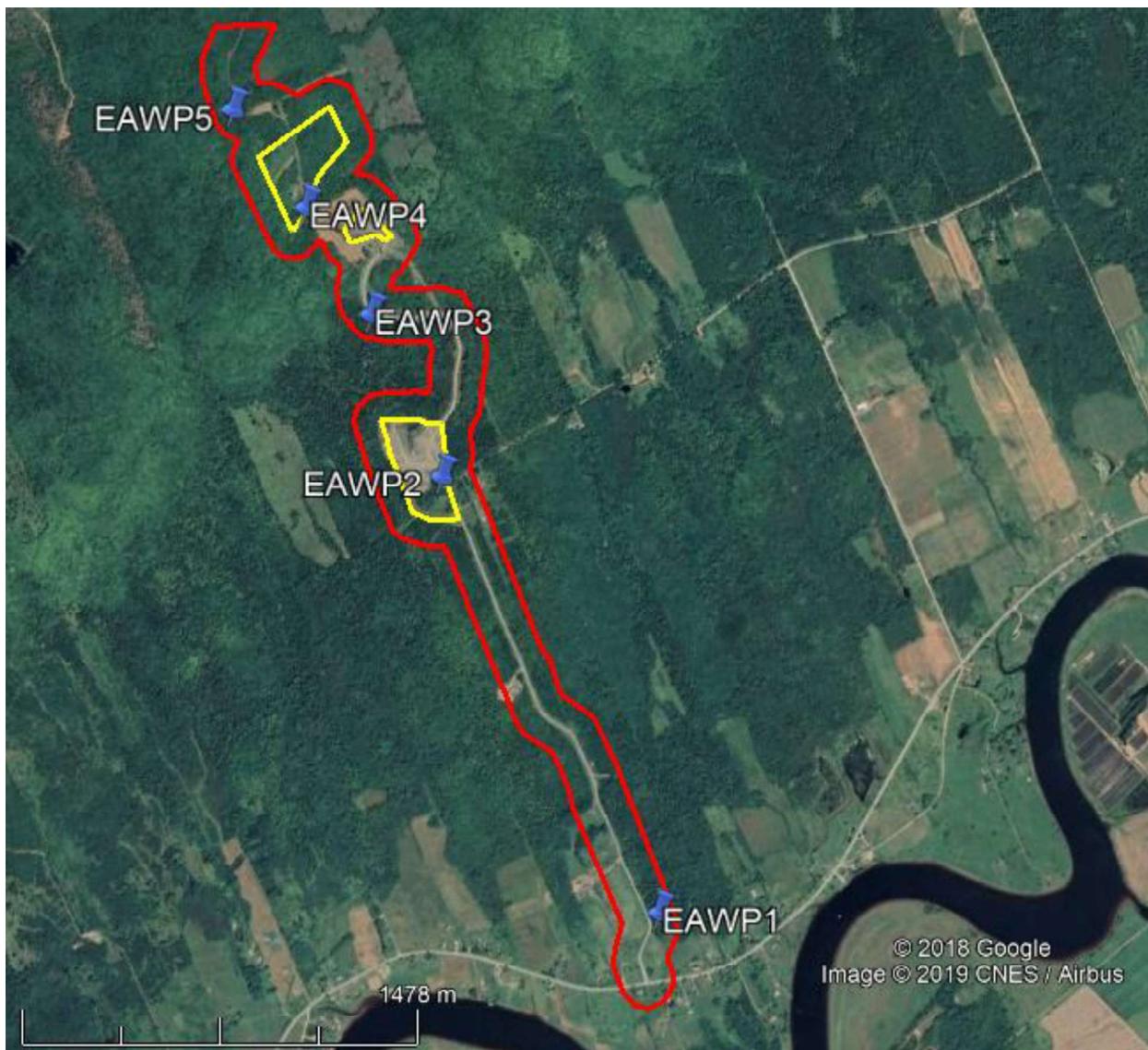


Figure 11. Locations where Eastern Wood-Pewees (EAWP) were detected at the site.

Fall Migration

September 6, 2019

The early fall migration survey coincided with a large migratory flight, based on numbers of migrants seen at the site. Three large flocks of warblers and vireos were found, one along the edge of the stockpile/crusher area, one at the edge of the clearcut in the future quarry area, and one along the road near western edge of Wetland 3. In all, 372 individuals were found of 47 species of birds (Table 5). These flocks were clearly migratory considering that a number of the species present that do not breed locally, such as 15 Bay-breasted Warblers, one Cape May Warbler, two Tennessee Warblers, and one Wilson’s Warbler. Of the other warblers and vireos, it is impossible to know what proportion of the counts might have been local breeders, but most of the birds present were associated with these large flocks. The largest flock, approximately 110 birds, was using the sunlit edge of the clearcut in the future quarry site, from the road to the corner of the clearcut. In particular, the birds were using the strip of forest within the clearcut on the west side of the road. The flock was dominated by Magnolia, Black-and-white, Bay-breasted, and Black-throated Green Warblers, and 15 species of warblers were represented.

Two Species at Risk were detected on the surveys, Canada Warbler and Eastern Wood-Pewee, the same two that were detected in the breeding season. One Canada Warbler was low in the saplings with the large flock in the regenerating clearcut. The other was near one of the territories along the southern edge of Wetland 3. It was not clear whether these were locally breeding birds or migrants. Two Eastern Wood-Pewees were seen feeding with the large flock of warblers at the edge of the clearcut in the future quarry site, in the same location as where one was observed in June. These may have been locally breeding birds. An additional pewee was heard along the eastern edge of the active quarry.

The edge of the stockpile/crusher area had numerous migrants, but the species composition was different from that on top of North Mountain. Five Ovenbirds and one Cape May Warbler were present in the flock in this area, neither of which were present on top of North Mountain. Additionally, there were far fewer Magnolia Warblers considering the size of the flock. A flock of 70 Red-winged Blackbirds flew over the stockpile site, but did not stop in the area.

September 30, 2019

The late fall migration survey coincided with a period of heavy movement by sparrows and thrushes, yet no large flocks of migrants were found on the site. One flock of warblers, vireos, kinglets, chickadees, juncos, and goldfinches was found in the future quarry area along the eastern edge of the road. The flock included two Blackpoll Warblers, which do not breed in the area, so could have been comprised of migrants. Another small flock of warblers was present near Wetland 3 and contained an Orange-crowned Warbler, another species that does not breed locally. In all, 143 individuals of 28 species were found on the survey (Table 6), a marked decrease from the September 6 survey. The most abundant species were American Goldfinch, Dark-eyed Junco, Blue Jay, Golden-crowned Kinglet, Ruby-crowned Kinglet, and Black-capped Chickadee. No Species at Risk were detected on the survey. Two Sharp-shinned Hawks and a Red-tailed Hawk were seen migrating along the face of North Mountain. Nine species of migratory warbler and two species of vireo were detected. The stockpile/crusher area was not surveyed entirely on this date since work activity commenced at the site before my arrival, and there was steady dump truck traffic and persistent noise from the rock crusher.

Table 3. Number of each species detected during the April 26, 2019 survey, and areas in which they were detected.

Species	Stockpile	Active Quarry	Future Quarry	North	Slope	Road	Total
Ring-necked Pheasant (<i>Phasianus colchicus</i>)		1				1	2
Ruffed Grouse (<i>Bonasa umbellus</i>)	1		2	2			5
Mourning Dove (<i>Zenaidura macroura</i>)	1	1				1	3
Turkey Vulture (<i>Cathartes aura</i>)						2	2
Belted Kingfisher (<i>Megasceryle alcyon</i>)						2	2
Yellow-bellied Sapsucker (<i>Sphyrapicus varius</i>)						1	1
Downy Woodpecker (<i>Dryobates pubescens</i>)		1				1	2
Hairy Woodpecker (<i>Dryobates villosus</i>)		1					1
Northern Flicker (<i>Colaptes auratus</i>)	1	3	1	2		2	9
Blue Jay (<i>Cyanocitta cristata</i>)	1			1		4	6
American Crow (<i>Corvus brachyrhynchos</i>)						2	2
Common Raven (<i>Corvus corax</i>)	1			1			2
Black-capped Chickadee (<i>Poecile atricapillus</i>)	2	4	6		1	6	19
Tree Swallow (<i>Tachycineta bicolor</i>)			2				2
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	3		4		3		10
Ruby-crowned Kinglet (<i>Regulus calendula</i>)				1		1	2
Red-breasted Nuthatch (<i>Sitta canadensis</i>)	3	1					4
White-breasted Nuthatch (<i>Sitta carolinensis</i>)			2				2
Brown Creeper (<i>Certhia americana</i>)			2				2
Winter Wren (<i>Troglodytes hiemalis</i>)	1	1	2		2		6
European Starling (<i>Sturnus vulgaris</i>)	3					1	4
Hermit Thrush (<i>Catharus guttatus</i>)	1	1	1	2			5
American Robin (<i>Turdus migratorius</i>)	8	4	3	3	2	3	23
Evening Grosbeak (<i>Coccothraustes vespertinus</i>)		13		4			17
Purple Finch (<i>Haemorhous purpureus</i>)	1	1	1	2	1	1	7
Pine Siskin (<i>Spinus pinus</i>)	1						1
American Goldfinch (<i>Spinus tristis</i>)	3					8	11
Dark-eyed Junco (<i>Junco hyemalis</i>)	3	2	4	1	5		15
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	2	1	2	1	1		7
Song Sparrow (<i>Melospiza melodia</i>)	5		2		2	7	16
Common Grackle (<i>Quiscalus quiscula</i>)		3					3
Palm Warbler (Yellow) (<i>Setophaga palmarum</i>)						1	1
Yellow-rumped Warbler (Myrtle) (<i>Setophaga coronata</i>)	3	2	1	3		7	16
Northern Cardinal (<i>Cardinalis cardinalis</i>)	2						2
Total individuals	46	40	35	23	17	51	212
Total species	20	16	15	12	8	18	34
Survey duration (min)	17	28	77	39	11	18	190
Survey distance (km)	0.70	1.23	1.50	1.36	0.80	1.00	6.59

Table 4. Number of each species detected during the June 1, 2019 survey, and areas in which they were detected.

Species	Stockpile	Active Quarry	Future Quarry	North	Slope	Road	Total
Ring-necked Pheasant (<i>Phasianus colchicus</i>)						2	2
Ruffed Grouse (<i>Bonasa umbellus</i>)	2		1	1			4
Mourning Dove (<i>Zenaida macroura</i>)	4	1	1	1	1	1	9
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)				1			1
Belted Kingfisher (<i>Megaceryle alcyon</i>)		1			1		2
Yellow-bellied Sapsucker (<i>Sphyrapicus varius</i>)	1					1	2
Downy Woodpecker (<i>Dryobates pubescens</i>)		1	2	1			4
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	1	2	1				4
Northern Flicker (Yellow-shafted) (<i>Colaptes auratus</i>)		1	2	1			4
Eastern Wood-Pewee (<i>Contopus virens</i>)	1		1	1	2	1	6
Yellow-bellied Flycatcher (<i>Empidonax flaviventris</i>)				3			3
Alder Flycatcher (<i>Empidonax alnorum</i>)	1			1		2	4
Least Flycatcher (<i>Empidonax minimus</i>)	2	1	1		2		6
Blue-headed Vireo (<i>Vireo solitarius</i>)			1		1		2
Red-eyed Vireo (<i>Vireo olivaceus</i>)	1	1	9	12	3	1	27
Blue Jay (<i>Cyanocitta cristata</i>)				1			1
American Crow (<i>Corvus brachyrhynchos</i>)						3	3
Common Raven (<i>Corvus corax</i>)						1	1
Black-capped Chickadee (<i>Poecile atricapillus</i>)			2		2	1	5
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	1				1		2
Red-breasted Nuthatch (<i>Sitta canadensis</i>)					1		1
White-breasted Nuthatch (<i>Sitta carolinensis</i>)			1				1
Brown Creeper (<i>Certhia americana</i>)				1			1
Winter Wren (<i>Troglodytes hiemalis</i>)	1		1				2
European Starling (<i>Sturnus vulgaris</i>)	2						2
Veery (<i>Catharus fuscescens</i>)	3				1		4
Swainson's Thrush (<i>Catharus ustulatus</i>)				1	3		4
Hermit Thrush (<i>Catharus guttatus</i>)		1	2	3		1	7
American Robin (<i>Turdus migratorius</i>)	5	2	1		1	3	12
Cedar Waxwing (<i>Bombycilla cedrorum</i>)					1		1
Purple Finch (<i>Haemorhous purpureus</i>)	1			1	3		5
American Goldfinch (<i>Spinus tristis</i>)	6	3	5	4	6	2	26
Dark-eyed Junco (Slate-colored) (<i>Junco hyemalis</i>)	1		1	3	1		6
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	4	1	1			1	7
Song Sparrow (<i>Melospiza melodia</i>)	5					2	7
Ovenbird (<i>Seiurus aurocapilla</i>)	5	2	7	5	1	3	23

Species	Stockpile	Active Quarry	Future Quarry	North	Slope	Road	Total
Northern Waterthrush (<i>Parkesia noveboracensis</i>)				2			2
Black-and-white Warbler (<i>Mniotilta varia</i>)		1	2	3		1	7
Tennessee Warbler (<i>Leiothlypis peregrina</i>)				1	1		2
Nashville Warbler (<i>Leiothlypis ruficapilla</i>)	1			1			2
Common Yellowthroat (<i>Geothlypis trichas</i>)	4	1	2	3	2	3	15
American Redstart (<i>Setophaga ruticilla</i>)	2	1	9	10	2	1	25
Northern Parula (<i>Setophaga americana</i>)	2	1	2	1	3		9
Magnolia Warbler (<i>Setophaga magnolia</i>)	2		2	3	1		8
Blackburnian Warbler (<i>Setophaga fusca</i>)	1			2	2		5
Chestnut-sided Warbler (<i>Setophaga pensylvanica</i>)		1	2	2			5
Blackpoll Warbler (<i>Setophaga striata</i>)				1			1
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)			3	6	1		10
Yellow-rumped Warbler (Myrtle) (<i>Setophaga coronata</i>)	3					2	5
Black-throated Green Warbler (<i>Setophaga virens</i>)	1	1	4	7	2		15
Canada Warbler (<i>Cardellina canadensis</i>)				8			8
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	2						2
Total individuals	65	23	66	91	45	32	322
Total species	28	18	26	31	25	19	52
Survey duration (min)	22	10	69	104	9	7	221
Survey distance (km)	1.15	0.37	1.63	2.80	0.24	2.04	8.23

Table 5. Number of each species detected during the September 6, 2019 survey, and areas in which they were detected.

Species	Stockpile	Active Quarry	Future Quarry	North	Road	Total
Mourning Dove (<i>Zenaida macroura</i>)	1				4	5
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)			1			1
Turkey Vulture (<i>Cathartes aura</i>)					1	1
Red-tailed Hawk (<i>Buteo jamaicensis</i>)		1			1	2
Downy Woodpecker (<i>Dryobates pubescens</i>)				1		1
Hairy Woodpecker (<i>Dryobates villosus</i>)			1			1
Northern Flicker (Yellow-shafted) (<i>Colaptes auratus</i>)	1		2			3
Eastern Wood-Pewee (<i>Contopus virens</i>)		1	2			3
Blue-headed Vireo (<i>Vireo solitarius</i>)	1	1	6	3		11
Red-eyed Vireo (<i>Vireo olivaceus</i>)	1		12	5	2	20
Blue Jay (<i>Cyanocitta cristata</i>)	1		1	2	3	7
American Crow (<i>Corvus brachyrhynchos</i>)					1	1
Common Raven (<i>Corvus corax</i>)		2	1			3
Black-capped Chickadee (<i>Poecile atricapillus</i>)	2		3	3	3	11
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	2		3	1		6
Ruby-crowned Kinglet (<i>Regulus calendula</i>)	1		1			2
Red-breasted Nuthatch (<i>Sitta canadensis</i>)			2			2
White-breasted Nuthatch (<i>Sitta carolinensis</i>)			1			1
Brown Creeper (<i>Certhia americana</i>)			1			1
Gray Catbird (<i>Dumetella carolinensis</i>)	1			1		2
Swainson's Thrush (<i>Catharus ustulatus</i>)				1		1
Hermit Thrush (<i>Catharus guttatus</i>)			3	5		8
American Robin (<i>Turdus migratorius</i>)	1					1
Cedar Waxwing (<i>Bombycilla cedrorum</i>)				1		1
Purple Finch (<i>Haemorhous purpureus</i>)	2		4	1		7
American Goldfinch (<i>Spinus tristis</i>)	8	1	5	6	1	21
Dark-eyed Junco (Slate-colored) (<i>Junco hyemalis</i>)			1	3		4
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	2		3			5
Song Sparrow (<i>Melospiza melodia</i>)	5			3	1	9
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	70					70
Ovenbird (<i>Seiurus aurocapilla</i>)	5					5
Black-and-white Warbler (<i>Mniotilta varia</i>)	5		13	3		21
Tennessee Warbler (<i>Leiothlypis peregrina</i>)			2			2
Common Yellowthroat (<i>Geothlypis trichas</i>)	3		8	7	2	20
American Redstart (<i>Setophaga ruticilla</i>)	1		1			2
Cape May Warbler (<i>Setophaga tigrina</i>)	1					1
Northern Parula (<i>Setophaga americana</i>)	3		2	1		6

Species	Stockpile	Active Quarry	Future Quarry	North	Road	Total
Magnolia Warbler (<i>Setophaga magnolia</i>)	3		17	13	1	34
Bay-breasted Warbler (<i>Setophaga castanea</i>)	2		11	2		15
Blackburnian Warbler (<i>Setophaga fusca</i>)	1		4	1		6
Chestnut-sided Warbler (<i>Setophaga pensylvanica</i>)			3	3		6
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)			7	1		8
Palm Warbler (Yellow) (<i>Setophaga palmarum</i>)	1		1			2
Yellow-rumped Warbler (Myrtle) (<i>Setophaga coronata</i>)	2		5	4	2	13
Black-throated Green Warbler (<i>Setophaga virens</i>)	4		10	3		17
Canada Warbler (<i>Cardellina canadensis</i>)			1	1		2
Wilson's Warbler (<i>Cardellina pusilla</i>)			1			1
Total individuals	130	6	139	75	22	372
Total species	27	5	34	25	12	47
Survey duration (min)	40	8	127	63	15	253
Survey distance (km)	1.09	0.40	1.64	1.77	1.83	6.73

Table 6. Number of each species detected during the September 30, 2019 survey, and areas in which they were detected.

Species	Stockpile	Active Quarry	Future Quarry	North	Slope	Road	Total
Ruffed Grouse (<i>Bonasa umbellus</i>)				2			2
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)				7			7
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	1			1			2
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	1						1
Downy Woodpecker (<i>Dryobates pubescens</i>)			1				1
Blue-headed Vireo (<i>Vireo solitarius</i>)			1				1
Red-eyed Vireo (<i>Vireo olivaceus</i>)			1				1
Blue Jay (<i>Cyanocitta cristata</i>)		1	4	1	7		13
Common Raven (<i>Corvus corax</i>)				1	1		2
Black-capped Chickadee (<i>Poecile atricapillus</i>)			7	3		4	14
Golden-crowned Kinglet (<i>Regulus satrapa</i>)		1	11		1		13
Ruby-crowned Kinglet (<i>Regulus calendula</i>)	1		4	4			9
Red-breasted Nuthatch (<i>Sitta canadensis</i>)						1	1
Hermit Thrush (<i>Catharus guttatus</i>)				1			1
American Robin (<i>Turdus migratorius</i>)	2				2		4
Cedar Waxwing (<i>Bombycilla cedrorum</i>)					1		1
American Goldfinch (<i>Spinus tristis</i>)		5	21	1	1		28
Dark-eyed Junco (Slate-colored) (<i>Junco hyemalis</i>)			9	6			15
Song Sparrow (<i>Melospiza melodia</i>)	4					2	6
Ovenbird (<i>Seiurus aurocapilla</i>)				1			1
Orange-crowned Warbler (<i>Leiothlypis celata</i>)				1			1
Nashville Warbler (<i>Leiothlypis ruficapilla</i>)			1	1			2
Common Yellowthroat (<i>Geothlypis trichas</i>)			1	3			4
Magnolia Warbler (<i>Setophaga magnolia</i>)						1	1
Blackpoll Warbler (<i>Setophaga striata</i>)			2				2
Palm Warbler (Yellow) (<i>Setophaga palmarum</i>)				4			4
Yellow-rumped Warbler (Myrtle) (<i>Setophaga coronata</i>)	1		1		2	1	5
Black-throated Green Warbler (<i>Setophaga virens</i>)				1			1
Total individuals	10	7	64	38	15	9	143
Total Species	6	3	13	16	7	5	28
Survey duration (min)	6	17	73	65	15	4	180
Survey distance (km)	0.20	0.39	1.63	2.06	0.45	0.41	5.14

Conclusions

In the course of the various avian surveys at the Spicer quarry, a total of 1098 birds were detected of 78 species, though some of the individuals may have been detected on multiple surveys. The site has a variety of forest types, fields, and wetlands yielding a large diversity of breeding and migratory species. Results from the individual surveys are discussed below with respect to the expansion of the quarry and Species at Risk.

Expansion area

The six surveys detected 304 individuals of 46 species in the quarry expansion area, but ~110 individuals were detected in a single migratory flock on September 6, 2019. No raptors or owls were detected within the expansion area, however, suitable nest sites are present in the mature trees on the east side of the road in the expansion area near Wetland 1. Since playback was used for raptor and owl species, it is unlikely that raptors or owls were nesting in the expansion area and went undetected. Barred Owls were heard in the forest immediately to the west of the expansion area, and may use the expansion area as part of their hunting territory.

Breeding species in the expansion area were typical of mixed woods in the area, but no particularly rare species were found on territory in the footprint of the future quarry. One Eastern Wood-Pewee was singing from within the expansion area, but the mature hardwood habitat immediately west of the expansion area appears to be better nesting habitat than what was observed in the expansion area. Perhaps the pewee was taking advantage of foraging opportunities at the edge of the regenerating clearcut in the expansion area. Habitat within the expansion area was not suitable for other forest-dwelling Species at Risk (e.g. Canada Warbler, Rusty Blackbird, Olive-sided Flycatcher, Common Nighthawk), except perhaps Evening Grosbeaks which were observed flying over the active quarry but were not seen using the expansion area. Careful attention was paid for Boreal Chickadees which are not listed but are now scarce in this region of the province, however none were found. All individuals of the breeding species detected during the April 26 and June 1 surveys would be displaced by the expansion of the quarry, which would be a net loss of habitat for these species, considering that nothing was found using the interior of the active quarry.

The fall migration surveys, in particular the September 6 survey, yielded high numbers of migratory birds using the expansion area. The warbler flock encountered on that date in the survey area was as large and diverse as almost any other migratory flock a birdwatcher or surveyor might hope to find in the province. Increasingly, it appears that the North Mountain serves as a corridor or congregation area for migrating warblers, as large flocks are encountered at sites along the North Mountain (e.g. Blomidon Provincial Park, Cape Split, Black Rock, Digby Neck, Brier Island) more regularly than at other sites around the province. While this has not yet been shown unequivocally or scientifically, anecdotal evidence and eBird (www.ebird.org) data suggest that North Mountain is an important area for fall migrants. In the early morning, these flocks typically are found feeding along sunlit edges of the forest, especially in areas with a dense shrub layer. The regenerating clearcut in the expansion area provides just such habitat. If the forest in this area had been left intact, the flocks would likely feed at another forest clearing interface. Similarly, the edge of the future quarry could actually provide good foraging habitat for migrating flocks, however the interior of the quarry would not be suitable for any birds. The forested and clearcut habitat did not appear to be important for migratory

sparrows, as few were found in the area during the late fall survey. Migratory thrushes may use the woods here extensively, however thrushes are exceedingly difficult to detect in forested habitats during fall migration, and only one Hermit Thrush was encountered. Raptors also surely use North Mountain as a migratory corridor, though only two Sharp-shinned Hawks and one Red-tailed Hawk were seen migrating on the dates surveyed. While many raptors surely pass over the site on some days, there is no reason to suggest that the quarry expansion would adversely affect migrating raptors.

Species at Risk

Table 17: SAR confirmed during avian surveys of the Spicer Quarry study area.

Taxa Group	Scientific Name	Common Name	COSEWIC*	SARA*	NSESA*	Provincial Rarity Ranking
<i>Birds</i>	<i>Cardellina canadensis</i>	Canada Warbler	T	T	E	S3B
	<i>Contopus virens</i>	Eastern Wood-Pewee	SC	SC	V	S3S4B
	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	SC	-	V	S3S4B, S3N

E=Endangered, T=Threatened, SC=Special Concern, V=Vulnerable

Three Species at Risk (SAR) were found while surveying the Spicer Quarry (Table 7). The most sensitive species found using the area was Canada Warbler. Five territorial male Canada Warblers were found along the periphery of Wetland 3, at least three of which were seen paired with a female. Care should be taken to prevent alteration of the hydrology/drainage of wetland 3, which could render the habitat unsuitable for Canada Warblers. Additionally, an area adjacent to the road on the property at these coordinates (latitude 44.839460°, longitude -65.388980°) had been recently cleared, and the soil pushed into the edge of the wetland. One Canada Warbler pair was found immediately adjacent to this cleared area, and activities of this sort should be avoided adjacent to this wetland.

Eastern Wood-Pewees were found using mature stands of forest throughout the property, however this species is still relatively common in this region of Nova Scotia. One individual was found during the breeding season in the expansion area of the quarry, though the forest to be cleared for the expansion does not appear to be particularly good habitat for pewees at this time, as there were no stands of mature hardwoods.

Two flocks of Evening Grosbeaks were observed on the April 26 survey, but these birds were observed flying over the property and did not land. This species is highly nomadic and may use the property at times for feeding and/nesting, however there was no indication that they were using the property in 2019.

No other avian SAR were detected on the property. Wetland 3 is the largest bog, however it still appeared to be too small for Olive-sided Flycatchers, and none were found there. The clearcut to the east of the property was also checked for Olive-sided Flycatchers, but none were detected. Wetland 3 would also be the most suitable location for Rusty Blackbird on the property, but none were found. The wet forested area on the east side of the wetland seems ideal for this species, however they have become so rare in the province that many areas of suitable habitat are unoccupied.

Common Nighthawk seemed like a reasonable possibility considering the amount of bare rock and gravel at the site. None were found, perhaps because the operations at the quarry and stockpile/crusher area create too much disturbance for this species. The clearcut to the east of the expansion area was also surveyed for this species. Eastern Whip-poor-wills were also possible at the site, however they are so scarce in the Nova Scotia that they are not detected anywhere in the province most years. The steep rocky sides of the quarry and muddy banks above could provide suitable nesting habitat for Peregrine Falcon or Bank Swallow, however neither were using the site. Similarly, the fields along the entrance road could conceivably harbour Bobolinks, however none were detected on the surveys. There was no suitable habitat present for other avian Species at Risk.

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