F BAT INVENTORY REPORT

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WISOKOLAMSON ENERGY PROJECT

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APRIL 2018

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WSP PROJECT NO.: 161-08790-00
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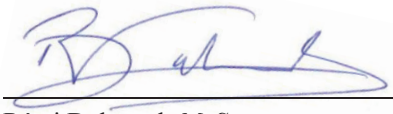

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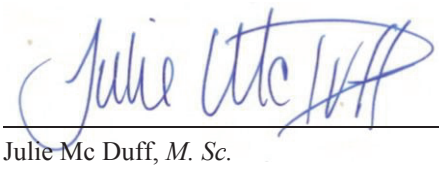

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1 INTRODUCTION

In Canada, wind energy development in a commercial context is one of the fastest growing sectors. New Brunswick alone is striving to meet an aggressive target of 40% of the province's electricity needs to be met by renewable energy by the year 2020 (Government of New Brunswick, 2018). Today, there is 294 MW of wind energy on the grid. New Brunswick currently has three operating wind farms but they represent some of the largest such projects in Atlantic Canada (The Maritimes Energy Association, 2018).

Even though electrical generation from wind turbines has many environmental benefits, the rapid growth has raised concerns on impacts of migratory and resident wildlife populations. Wind farm projects are subject to impact studies, the same as other major development projects. Since large numbers of bat fatalities at wind energy facilities is a relatively recent issue (Johnson, 2005), bats have become a primary environmental concern associated with wind energy development. Mortality is known to be caused by either direct strike by the rotating turbine blades, collision with the turbine towers, and/or barotrauma (Burns and Broders, 2013). Barotrauma is caused by a quick loss of air pressure near moving wind turbines and involves tissue damage in the bats lungs, and is still under discussion on its impact on the bat populations (Rollins et al. 2012). Due to these fatalities, provincial governments are now requiring risk avoidance surveys prior to the construction of the wind turbines.

In New Brunswick, seven species of bat occurrences have been documented: the Little Brown Myotis or Little Brown Bat (*Myotis lucifugus*), the Northern Myotis or Northern Long-Eared Bat (*Myotis septentrionalis*), the Big Brown Bat (*Eptesicus fuscus*), the Hoary Bat (*Lasiurus cinereus*), the Red Bat (*Lasiurus borealis*), the Silver-haired Bat (*Lasionycteris noctivagans*), and the Eastern Pipistrelle or Tri-colored Bat (*Pipistrellus subflavus*) (Government of New Brunswick, n.d.). Four species overwinter locally (Little Brown Bat, Northern Long-Eared Bat, Tri-colored Bat, and Big Brown Bat) and three (Hoary Bat, Silver-haired Bat, and Red Bat) are considered to be migratory species because they spend the winter in the south. It should be noted that at fall, even resident bat species migrate, although the distances are much smaller, and less important than in the case of migratory species. Each of these species has been documented to have experienced fatalities at wind turbine sites (Broders, 2011). In North America, large bat fatalities mainly occur in late summer and early fall and the most affected species are long distant migrant species. Nevertheless, bat mortalities have also been documented, in smaller numbers for short-distant migrant (or "resident") bat species (Broders, 2011). Even though some fatalities have been reported during spring migrations, it is thought that spring migration behavior is less structured and occurs by different routes compared to fall migration (Broders, 2011).

Of these seven species found in New Brunswick, three (Little Brown bat, Northern Long-eared Bat, and Tri-colored bat) were emergency listed as Endangered on Schedule 1 of the federal *Species at Risk Act* (SARA) in 2014 because of sudden and dramatic declines across the eastern portions of the ranges of Little Brown Bat and Northern Long-Eared Bat, and throughout the entire Canadian range of Tri-colored Bat. These declines are the direct result of White-Nose Syndrome (WNS), which is responsible for large numbers of mortality in hibernating bats through much of eastern North America (Blehert et al., 2009; CBC News, 2014; Burns and Broders, 2013, Environment Canada, 2015). In Canada, the total number of *Myotis* sp. bats recorded in New Brunswick, Nova Scotia, Ontario, and Quebec hibernacula declined by approximately 94% between 2010 and 2012 (Environment Canada, 2015). In Quebec, New Brunswick, and Nova Scotia, some hibernacula no longer have any individuals of these bat species present (Environment Canada, 2015). In March of 2011 White-nose-syndrome was first detected in a cave in Albert County, the province's most important bat hibernaculum (overwintering site) (Government of New Brunswick, n.d.).

All of the seven bat species found in New Brunswick could be potentially present within the study area. According to the Atlantic Canada Conservation Data Centre (ACCDC) ranking, based on occurrence records from New Brunswick and Nova Scotia, three of the seven bat species present in New Brunswick, namely the Little Brown Bat, the Northern Long-Eared Bat, and the Tri-colored Bat are listed as S1 (Critically Imperiled—Critically imperiled in the province because of extreme rarity [often 5 or fewer occurrences] or because of some factor[s] such as very steep declines making it especially vulnerable to extirpation from the state/province).

This report presents acoustical inventory data collected during the reproduction and the fall bat migration periods in 2016, and during the reproduction period in 2017.

2 METHODS

2.1 EXISTING INFORMATION

A request has been made to the Atlantic Canada Conservation Data Centre (ACCDC) in February 2018, regarding the presence of rare and endangered species or special areas into the Study Area and in a 100 km buffer around it. Additional bat survey data from other studies in New Brunswick were also considered to evaluate the potential of presence of the different bat species in the vicinity.

2.2 ACOUSTIC SURVEY

The bat inventory has been conducted using the stationary acoustic inventory technique. In this method, automated stations, each composed of a waterproof box containing an *AnaBat® II* ultrasound detector, *AnaBat® CF Storage ZCAIM*) and a set of long-lasting batteries, were installed at various points in the Study Area.

The system's operating principle is relatively simple. During the after-dark hours, the *AnaBat® II Bat Detector* is active, waiting to receive ultrasound. When a signal is received, sounds are transmitted to an interface (*AnaBat® CF Storage ZCAIM*) which process and stores the information on a *Compact Flash* format memory card. At the time of analysis, the recordings on the memory cards are transferred to a computer. Sound analysis software (*AnaBat®6, version 6.3 and Batview*) is used to produce sonograms which can be used to view and analyze the recorded calls. The bats are then identified by comparing the sonograms with the known characteristics of particular species echolocation calls (sound signatures). Bat call sonograms which could not be attributed to species (or genus) are labelled "Undetermined". This technique has certain limitations. Due to the similarity of their sound signatures, it is difficult to discriminate the two most common species in the genus *Myotis* (Little Brown Bat and Northern Long-Eared Bat). In most cases, the identification is limited to the genus level.

Detectors were installed, taking into account the topography of the Study Area, habitat, presence of potential travel and/or migration corridors, and site availability for the installation of the *AnaBat® II Bat Detector*.

In 2016, two detectors were deployed July 6th and deactivated July 18th (stations AB1 and AB2-3). Three detectors were deployed August 8th and deactivated August 18th (stations AB1, AB2-3 and AB4). Finally, two detectors were deployed in two locations on September 15th and the cards and batteries were swapped on October 8th (stations AB5 and AB6). These last detectors were officially taken down on October 20th.

In 2017, two additional detectors were deployed on June 8th (AB7 and AB8). One of these detectors (AB8) had a technical problem and was replaced with a new detector on June 14th. Those detectors were deactivated on June 29th.

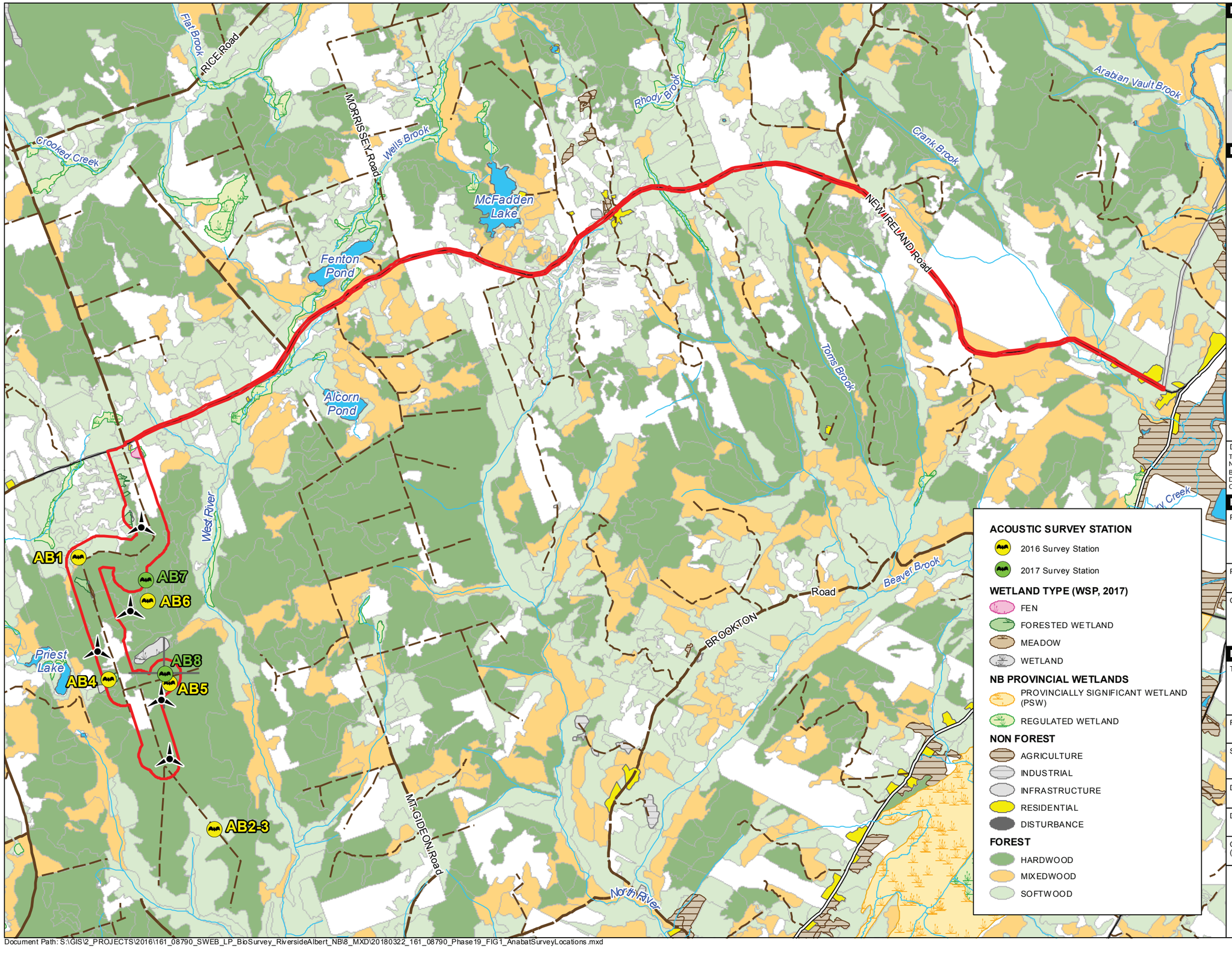
Sound signatures were collected from a total of six stations. Stations were equipped with an automated system and were set to record between 8:00 pm and 6:00 am. All the stations were placed in trees approximately 4 to 6 meters above ground, except for station AB8 which was placed on a meteorological tower, approximately 30 meters high.

The location of the acoustic inventory stations is illustrated on Figure 2.1. Table 2.1 presents a general habitat description for each station location. Photographs of the habitat adjacent to each station are included in Appendix A.

Table 2.1: Survey Stations Locations and Habitats

STATION	COORDINATES	DEPLOYED	RETRIEVED	RECORDING PERIOD	HABITAT DESCRIPTION
AB1	E 352558 N 5064557	7/6/2016 8/8/2016	7/18/2016 8/18/2016	7/6/2016 to 7/15/2016 (10 nights) 8/9/2016 to 8/18/2016 (10 nights)	Placed in a mature conifer tree on the edge of a clearing. The clearing is surrounded by mature conifer trees and 10–15 years old hardwood.
AB2-3	E 353764 N 5061860	7/6/2016 8/8/2016	7/18/2016 8/18/2016	N/A*	On the edge of the clearing next to the road. The clearing is surrounded by mature mixed forest.
AB4	E 352799 N 5063357	8/8/2016	8/18/2016	8/9/2016 to 8/17/2016 (9 nights)	Placed in a mature conifer tree on the edge of a mixed-tree swamp pointing in the north/northeast direction.
AB5	E 353389 N 5063294	9/15/2016	10/20/2016	9/15/2016 to 10/19/2016 (35 nights)	On the edge of a southern edge of a cleared opposite the lot of the met tower. Partially commercially thinned (PCT) and some clear cutting.
AB6	E 353218 N 5064100	9/15/2016	10/20/2016	9/15/2016 to 10/19/2016 (35 nights)	Along the road of T6. PCT area/clearcutting.
AB7	E 353205 N 5064307	6/14/2017	6/29/2017	6/14/2017 to 6/28/2017 (15 nights)	On the edge of a clearing surrounded by sparse forest, on a slope.
AB8 (Met Tower)	E 353349 N 5063389	6/8/2017	6/29/2017	6/8/2017 to 6/28/2017 (21 nights)	Placed on a Met Tower, about 30 m high. Clear cutting surrounded by mixed forest with some very mature trees.

* Technical failure prevents the recording of bat calls



KEY MAP:

LEGEND:

- WTG
- MET TOWER
- WATERCOURSE
- WATERBODY
- STUDY AREA BOUNDARY

TRANSPORTATION

Dept. of Transportation & Infrastructure (DTI)

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY

Dept. of Energy & Resouce Development (DERD)

- PRIMARY FOREST ROAD
- TERTIARY/LIMITED ACCESS FOREST ROAD
- LOGGING ROAD (Within Harvest Block)

ACOUSTIC SURVEY STATION

- 2016 Survey Station
- 2017 Survey Station

WETLAND TYPE (WSP, 2017)

- FEN
- FORESTED WETLAND
- MEADOW
- WETLAND

NB PROVINCIAL WETLANDS

- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- REGULATED WETLAND

NON FOREST

- AGRICULTURE
- INDUSTRIAL
- INFRASTRUCTURE
- RESIDENTIAL
- DISTURBANCE

FOREST

- HARDWOOD
- MIXEDWOOD
- SOFTWOOD

PROJECT:

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT RIVERSIDE-ALBERT, NEW BRUNSWICK

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY**

FIGURE:

TITLE:
LOCATION OF ACOUSTIC SURVEY STATIONS

FIGURE NO.:	REVISION NO.:
1	0

SCALE: 1:35,000
0 500 1,000 2,000 Metres

DATUM:	PROJECTION:
NAD 83 CSRS	NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: R. DUHAMEL
CREATED DATE: (YYYY-MM-DD) 2018-03-28	REVISION DATE: (YYYY-MM-DD) 2018/03/28

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3 RESULTS

3.1 EXISTING INFORMATION

According to the ACCDC report, no known bat hibernaculum is present within 5 km of the Project study area. To our knowledge, the closest known bat hibernaculum is located about 18 km north from the Study Area (Vanderwolf et al., 2012). ACCDC reports the presence of the Little Brown Bat, the Northern Long-Eared Bat, and the Tri-colored Bat about 15.5 km from the Study Area. The Big Brown Bat is also reported about 18 km from the Study Area.

Furthermore, a bat survey conducted in 2017 for the Richibucto Wind Power Project (Natural Forces, 2017), located about 100 km north of the Study Area, confirm the presence of all the 7 species reported in New Brunswick, namely the Little Brown Bat, the Northern Long-Eared Bat, the Big Brown Bat, the Hoary Bat, the Red Bat, the Silver-haired Bat, and the Tri-colored Bat.

3.2 ACOUSTIC SURVEY—SUMMER AND FALL 2016

Echolocation surveys were conducted south off of New Ireland Road within the study area from July 6th to October 20th, 2016. In total, there were 973 separate sound files recorded and of these only 19 files were determined to be ultrasound generated by bats. All the remaining files were extraneous noise. Weather conditions (raindrops and wind), some insects like the cicada, and vehicle traffic on the dirt road are among the potential sources of extraneous noise recordings.

Three bat species and a genus were identified during this survey among the 19 bat sonograms recorded, including:

- Hoary Bat;
- Species in the genus *Myotis*;
- Big Brown Bat; and
- Tri-colored Bat.

Table 3.1 shows the results obtained at the different survey stations. The species encountered, the number of identified recordings for each species, as well as the total number of recordings per station are included. For each station, the relative percentage of each bat species is calculated (% per Station), and for each species the percentage sonograms collected at each station is also given (% per Species). Information concerning endangered species in New Brunswick is highlighted in red.

Table 3.1: Results Obtained at the Different Survey Stations – 2016 season

STATION	SPECIES	COMMON NAME	# OF BAT SONOGRAMS	% PER STATION	% PER SPECIES
AB1	None		0		
	Total		**0**		
AB2-3	None		N/A*		
	Total		**N/A**		
AB4	*Lasiurus cinereus*	Hoary Bat	8	72.7	100
	Myotis sp.	Species in the genus Myotis	1	9.1	25.0
	No ID	No ID	2	18.2	100
	Total		**11**	**100**	**N/A**
AB5	None		0		
	Total		**0**		
AB6	*Eptesicus fuscus*	Big Brown Bat	1	0.1	100
	Myotis sp.	Species in the genus Myotis	3	0.4	75.0
	Perimyotis subflavus	Tri-colored Bat	4	0.5	100
	Total		**8**	**100**	**N/A**
	Grand Total		**19 bat sonograms**		

* Technical failure prevents the recording of bat calls

3.3 ACOUSTIC SURVEY—SPRING 2017

Additional echolocation surveys were conducted south of New Ireland Road within the study area from June 8th to 28th, 2017. In total, there were 799 separate sound files recorded and of these only one file was determined to be ultrasound generated by bat. All the remaining files were extraneous noise. Weather conditions (raindrops and wind), some insects like the cicada, and vehicle traffic on the dirt road are among the potential sources of extraneous noise recordings.

The only bat sonogram collected in spring 2017 was from Hoary Bat. The call was recorded at the AB7 station, on June 27th at 00:45 am. No bat activity was recorded at the 30 m high station.

3.4 GENERAL DISCUSSION

The Hoary Bat represented approximately 45% of the sonograms, and had the highest percent of sonograms out of all the species identified. The Tri-colored Bat represents approximately 20% of the sonograms. Species in the genus Myotis represent approximately 20% of the sonograms but, due to limitations of methodology, the relative proportion of the sonograms belonging to each species of Myotis cannot be determined. However, the presence of the species in the genus Myotis was assessed during sonogram identification.

Only one sonogram of the Big Brown Bat has been collected, representing approximately 5% of the recordings.

Furthermore, 10% of the recordings couldn't be identified to any species (no ID). Those calls are mostly recordings that are too short to recognize key characteristics. This may happen when bats fly near the limits of the detection zone. Considering this type of event is independent of the species, the distribution of the ''unidentified", between bat species would, in principle, follow the same pattern as the recordings specific to the species.

According to their seasonal movements, bat species are divided into two categories, residents or migratory. In fall, even resident species can travel hundreds of kilometers to reach their winter habitat, usually a cave or a mine

opening. These hibernacula can be found at the latitude of the study area. Concerning migratory species, they migrate south, wintering in the southern part of the United States to the Gulf of Mexico.

Both resident and migratory species were encountered during this survey, but most of the sonograms were collected during early migration (August 9th to 14th 2016) and migration (September 17th to 21st 2016), with 11 and 8 sonograms respectively. Early migration peak time bat activity is mostly due to Hoary Bat, which represents 8 out of 11 sonograms collected in August (all the recordings for this species). September peak time bat activity is mostly due to species of the Myotis genus (3 out of 8 sonograms) and Tri-colored Bat (4 out of 8 sonograms, all the recordings for this species). The only sonogram of Big Brown Bat was also collected in September. Only one sonogram, from Hoary Bat, was collected during 2017 summer survey (reproduction period) while no bat where recorded in the reproduction period in 2016. Indeed, bats exhibit nightly and seasonal activity patterns that vary among species and individuals (Johnson et al., 2011).

During this survey, all the recordings for Hoary Bat were collected between 11:30 pm and 02:40 am, those from species of the genus Myotis between 08:00 pm and 00:30 am, and those for Tri-colored Bat between 09:30 pm and 05:30 am. The sonogram from Big Brown Bat was collected around 01 00 pm. Bats typically forage in several different locations each night and display dynamic movements across the landscape (Kunz et al. 2007). However, the methodology does not control the action of whether several calls of a given species recorded during a single night or even different nights came from one or several individuals. Therefore, some of the recorded calls could originate from a single bat repeatedly calling near the same station during the night, or even for several nights. Indeed, 5 out of the 8 sonograms from Hoary Bat were recorded on August 9th between 11:44 pm and 11:52 pm

Bat activity was recorded at 3 of the 6 stations that were functional at a given period during 2016 and 2017 surveys, namely AB4, AB6, and AB7 stations. All Hoary Bat calls but one were recorded at the AB4 stations, along with 1 call from a species of the genus Myotis and 2 undetermined sonograms (total of 11 recordings). The other recordings from species of the genus Myotis, as well as all the recordings from Tri-colored Bat and Big Brown Bat, were collected at the AB6 station (total of 8 recordings). Finally, a single Hoary Bat call was collected during the 2017 summer survey (AB7). All the habitats selected for survey stations were suitable for bats: forest patches with some mature trees alternate with clearings, and sometimes wetlands, as for AB4 station, providing both resting and foraging sites for bats.

Indeed, most of inventoried bat species are arboreal. Hoary Bat prefers arboreal roosting habitats, while species of the genus Myotis and Tri-colored Bat use both buildings and trees (Tremblay and Jutras, 2010; Environment Canada, 2015). The Big Brown Bat, for its part, usually prefers buildings or rock structures (McAlpine et al., 2002; Tremblay and Jutras, 2010), but it also uses mature trees with cavities (peak holes, cracks, etc.) (Willis et al., 2006). Many bat species (including species of the genus Myotis) preferentially roost in older forest stands, compared to young forests (Barclay and Brigham, 1996). Furthermore, swamps, peat bogs, beaver ponds, lakes and streams are known to be drinking and foraging habitats used by bats (Taylor, 2006).

Although most of the survey stations are near forest patches, AB4 station is the only one located near a wetland, in the valley between Priest Lake and West River, which could be used by bats as a moving/migrating corridor. Indeed, when moving from one site to another, bats generally use linear forest structures to guide themselves (Grindal and Brigham 1998, Henderson and Broders 2008). Stream valleys, with their riparian strips of vegetation, as well as road and power lines, are therefore potential corridors for their movements. Bat activity at AB6 station, which is located along an access road, could also be explained by its use as a moving corridor by bats. East of the project footprint, the valley of the East River is probably the most suitable moving/migrating corridor for bats near the Study Area, since it is globally north—south oriented.

The Hoary Bat is a long distance migratory bat that is a solitary tree roosting species. It had the largest number of calls in this study. Scientific knowledge on the status of these bats is that they are common but occur in low population frequencies in Nova Scotia (van Zyll de Jong, 1985).

Myotis species in New Brunswick are the most widely distributed and abundant species (Vanderwolf et al., 2012). Both the Little Brown Bat and the Northern Long-Eared Bat were likely active in the site area, but generally their calls are not distinguishable from each other. The Little Brown Bat is mainly found foraging in open areas and over water, while the Northern Long-Eared Bat is known as an interior forest species (Henderson and Broders, 2008).

The Big Brown Bat is a resident species, and for long, was considered to have reached the northern limit of its eastern North American range in southern New Brunswick (van Zyll de Jong, 1985, McAlpine et al., 2002). However, recurrent annual surveys performed in Quebec since 2000 show that Big Brown Bat distribution is far more Nordic than it was previously thought (Jutras et al., 2012). Due to its rarity, Big Brown Bat does not seem to be a significant component of forested ecosystems in New Brunswick (McAlpine et al., 2002) nor in Nova Scotia (Broders et al., 2003). But considering the preference of this species for using buildings as roosting sites as well as hibernacula, it is possible that Big Brown Bat is more common in the province—and in Atlantic Canada—than it is usually thought (McAlpine et al., 2002; Broders et al., 2003).

Overall, with 20 bat calls recorded with an effort of 135 detector-nights from June to October, the average bat passes recorded is approximately 0.15 call per night. When comparing this result to bat acoustic survey of Richibucto Wind Project (Natural Forces, 2017), with an average bat passes of 1.4 calls per night, the bat activity within the Study Area appears to be low.

4 CONCLUSION

The acoustic inventory results confirm the use of the Study Area by bats, although the rate of bat activity seems to be low. Five species of bats were identified including; 9 recordings of Hoary bat, 4 recordings of species of the genus Myotis (Little Brown Bat, and the Northern Long-Eared Bat), 4 recordings of Tri-colored Bat, and 1 recording of Big Brown Bat. One of the species was identified as long distance migratory species (Hoary Bat), and the others as resident species (species of the genus Myotis, Tri-colored Bat, and Big Brown Bat). Recorded bat activity is relatively low in the Study Area.

The bat surveys were carried out between Jul 6th, and October 19th, 2016, and from June 8th to 28th, 2017. Consequently, data analysis gives information about bat use of the Study Area during the reproduction and migration periods. No evidence of the presence of a “maternity” or potential hibernaculum was collected during this study. The nearest known hibernacula and/or maternity is located about 18 km north from the Study Area. Before the white-nose syndrome, this hibernaculum was considered as a major site for bats (> 1000 bats) (Vanderwolf et al., 2012).

5 REFERENCES

Barclay, R. R. and R. M. Brigham. 1996. Bats and Forests Symposium. British Columbia, Ministry of Forests Research Program. Victoria, BC.

Blehert, D. S., A. C. Hicks, M. Behr, C. U. Meteyer, B. M. Berlowski-Zeir, E. L. Buckles, J. T. H. Coleman, S. R. Darling, A. Gargas, R. Niver, J. C. Okoniewski, R. J. Rudd, and W. B. Stone. 2009. Bat White-Nose Syndrome: An emerging fungal pathogen? Science **323**:227-227.

Broders, H. G., 2011. Analysis of ultrasonic AnaBat recordings with inferences on bat species composition and activity at the site of the proposed wind turbine farm at Glen Dhu, Nova Scotia. Submitted as a component of the Glen Dhu South Wind Power Project Environmental Assessment.

Burns, L. and H. G. Broders. 2013. Bat Population Study. Submitted as a component of the Kemptown COMFIT Wind Project: Environmental Assessment Affinity Wind LP. Available at: http://www.novascotia.ca/nse/ea/kemptown-wind-farm/Kemptown-Appendix-I-L.pdf

CBC News. 2014. Bats nearly wiped out by white-nose syndrome in Eastern Canada. News release published on: October 27th, 2014, http://www.cbc.ca/news/technology/bats-nearly-wiped-out-by-whitenose-syndrome-in-eastern-canada-1.2814088

Environment Canada. 2015. Recovery Strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. ix + 110 pp.

Government of New Brunswick. 2018. Renewable Resources. Retrieved February 27, 2018, from Government of New Brunswick: http://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/renewable.html

Government of New Brunswick. N.d. Species and Status Databases. Retrieved February 2, 2018, from Government of New Brunswick: http://www1.gnb.ca/0078/WildlifeStatus/search-e.asp

Government of New Brunswick. N.d. White-Nose Syndrome. Retrieved February 2, 2018, from Government of New Brunswick: http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/Bats-WhiteNoseSyndrome.pdf

Grindal, S.D. and R.M. Brigham. 1998. Effects of small scale habitat fragmentation on activity by insectivorous bats. Journal of Wildlife Management 62: pp. 996-1003.

Henderson, L.E., and H.G. Broders. 2008. Movements and resource selection of the northern long-eared myotis (Myotis septentrionalis) in a forest-agriculture landscape. Journal of Mammalogy 89: pp. 952–963.

Johnson, G. D. 2005. A review of bat mortality at wind-energy developments in the United States. Bat Research News **46**: 45–50.

Johnson, J.B.; Edwards, J.W.; Ford, W.M. 2011. Nocturnal activity patterns of Northern Myotis (*Myotis septentrionalis*) during the maternity season in West Virginia (USA). Acta Chiropterologica. 13: 391–397.

Jutras, J., Delorme, M., Mc Duff, J. et C. Vasseur. 2012. Le suivi des chauves-souris du Québec. Le Naturaliste Canadien, 136 (1): 48-52.

Kunz, T. H., E. B. Arnett, W., P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers of Ecology and the Environment 5: 315–324.

McAlpine, Donald F., Frances Muldoon, Graham J. Forbes, Alexander I. Wandeler, Scott Makepeace, Hugh G. Broders, and James P. Goltz. 2002. Over-wintering and reproduction by the Big Brown Bat, *Eptesicus fuscus*, in New Brunswick. Canadian Field-Naturalist 116(4): 645–647.

Natural Forces. 2017. Richibucto Wind Project — Environmental Impact Assessment Registration. Final report, November 2017. 206 p + appendices.

New Brunswick Museum. 2017. White-nose Syndrome. Retrieved February 2, 2018, from New Brunswick Museum: http://www.nbm-mnb.ca/index.php?option=com_content&view=article&id=576&Itemid=1304

Rollins, K. E., D. K. Meyerholz, G. D. Johnson, A. P. Capparella, and S. S. Loew. 2012. A forensic investigation into the etiology of bat mortality at a wind farm: Barotrauma or injury? Veterinary Pathology Online: DOI: 10.1177/0300985812436745.

The Maritimes Energy Association. 2018. Wind Power — New Brunswick. Retrieved February 27, 2018, from The Maritimes Energy Association: http://www.maritimesenergy.com/page.asp?ID=64

Taylor, D.A.R. 2006. Forest management and bats. Bat Conservation International, 16 p.

Tremblay, J. A. et J. Jutras. 2010. Les chauves-souris arboricoles en situation précaire au Québec — Synthèse et perspectives. Le naturaliste canadien, 134-1: 29-40.

Vanderwolf, K.J., McAlpine, D.F., Forbes, G.J., and Malloch, D. 2012. Bat populations and cave microclimate prior to and at the outbreak of white-nose syndrome in New Brunswick. Can. Field-Nat. 126: 125–134.

van Zyll de Jong, C. G. 1985. Handbook of Canadian mammals. Volume 2: Bats. National Museums of Canada, National Museum of Natural Science, Ottawa.

Willis, C.K.R., C.M. Voss and R.M. Brigham. 2006. Roost selection by forest-living female big brown bats *(Eptesicus fuscus)*. J. Mammal., 87: pp. 250–345.

APPENDIX

A PHOTOGRAPHS

Picture 1 – AB1 Survey Station

Picture 2 – AB1 Survey Station

Picture 3 – AB2-3 Survey Station

Picture 4 – AB2-3 Survey Station

Picture 5 – AB4 Survey Station

Picture 6 – AB4 Survey Station

Picture 7 – AB5 Survey Station

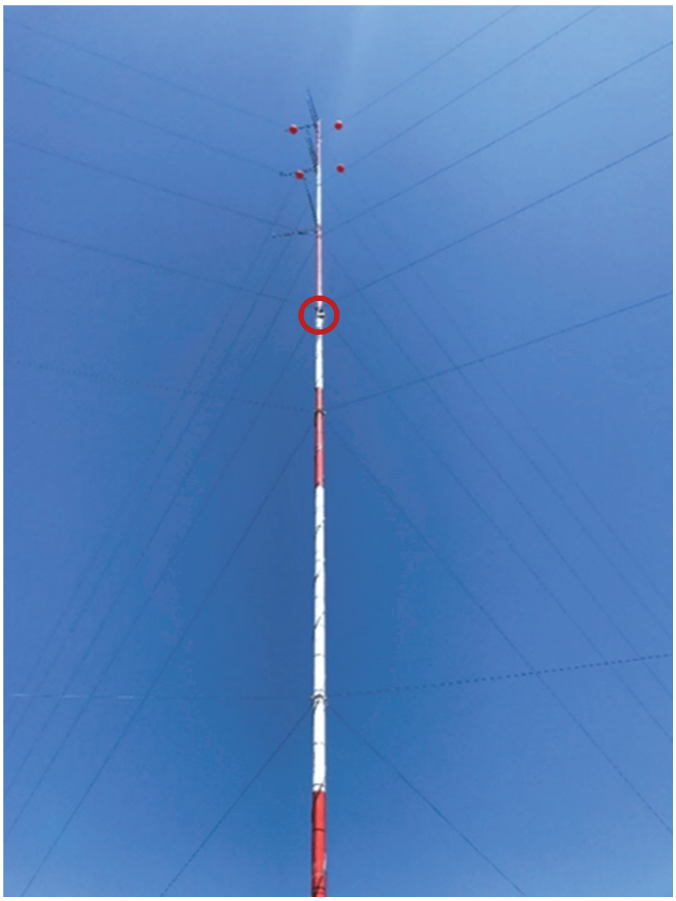
Picture 8 – AB5 Survey Station

Picture 5 – AB6 Survey Station

Picture 6 – AB6 Survey Station

Picture 7 – AB7 Survey Station

Picture 8 – AB8 Survey Station (installation)



Picture 9 – AB8 Survey Station (red circle: 30m high)