Stantec Consulting Services Inc.
6800 College Boulevard Suite 750,
Overland Park KS 66211

December 12, 2017
File: 2017 Aurora Wind Project Acoustic Bat Summary

Attention: Jennifer Dean
Aurora Wind Project, LLC
16105 West 113th Street, Suite 105
Lenexa, KS 66219-2305

Reference: 2017 Acoustic Bat Monitoring Survey Summary for the Aurora Wind Project, Williams and Mountrail Counties, North Dakota

Dear Ms. Dean,

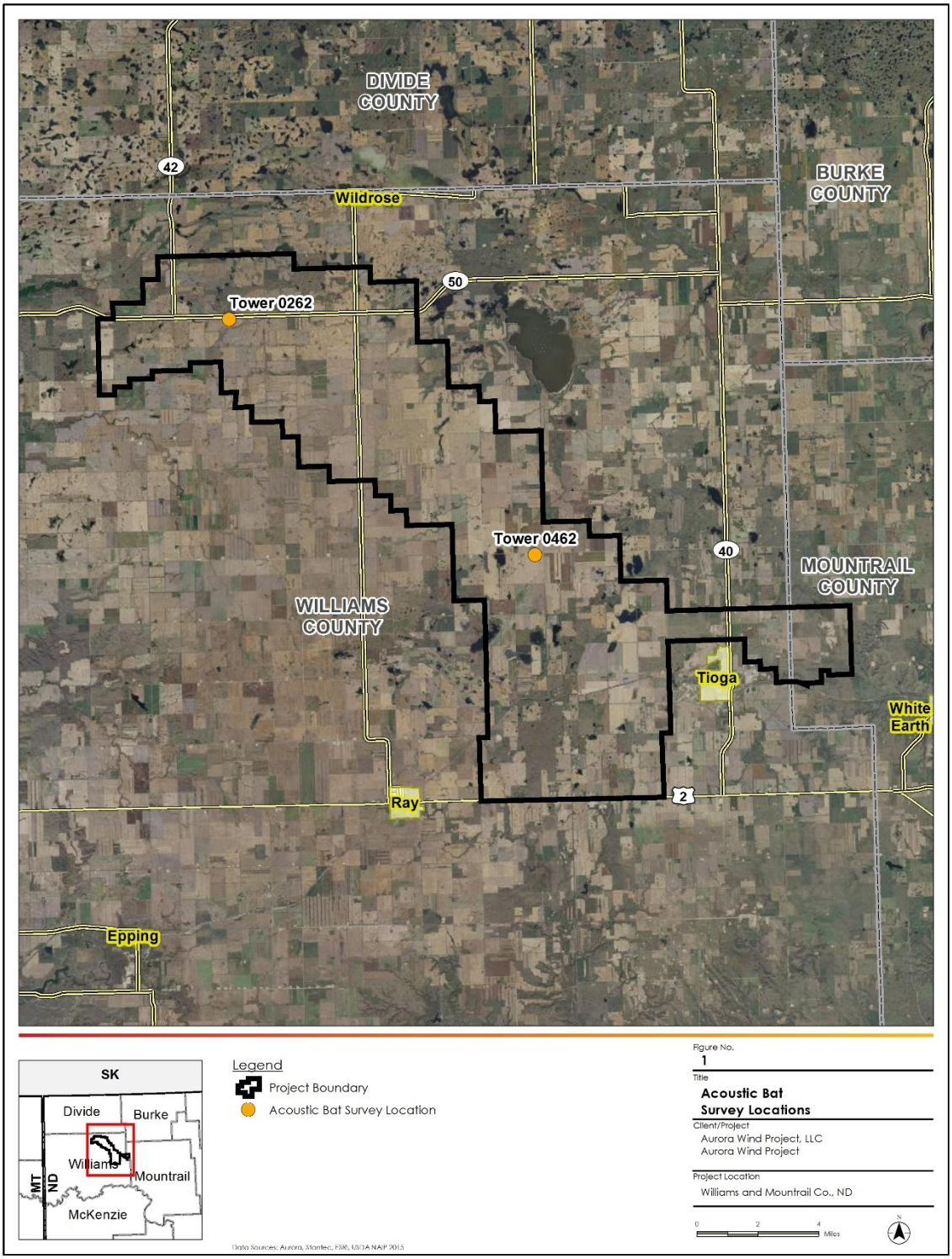
Aurora Wind Project, LLC (Aurora) contracted Stantec Consulting Services Inc. (Stantec) to conduct an acoustic survey utilizing meteorological (met) towers to document bat activity at the Aurora Wind Project (Project) in Williams and Mountrail counties, North Dakota, from April 18 through October 31, 2017. This memo summarizes the bat activity data recorded during the 2017 survey.

Acoustic bat monitoring equipment (Wildlife Acoustics SM3BAT full spectrum, dual-channel bat detectors) was installed on April 18 and 19, 2017 at two met towers (Tower 0262 and Tower 0462) within the Project. A map of the Project area with the locations of the two met towers outfitted with acoustic monitoring equipment is shown in Figure 1. The detectors were configured to monitor bat activity near ground level (3 meters [m] above ground level [agl]; "Low Microphone") and at heights within the proposed rotor-swept area (55 meters agl; "High Microphone"). Recording locations were named according to the tower number and the detector height (e.g., "0262 High" refers to the High Microphone at Tower 0262). The microphones were connected to a detector installed at the base of each tower and were programmed to record bat activity from 30 minutes prior to sunset to 30 minutes after sunrise each night of the survey. A detector night (DN) was defined as one microphone recording location sampled for an entire night.

The detector at Tower 0462 was installed on April 18, 2017. The detector on Tower 0262 was installed on April 19, 2017. Both detectors were demobilized on October 31, 2017. There was a potential for 195 detector nights at each microphone on Tower 0262 and 196 detector nights at each microphone on Tower 0462; therefore, the Project had 782 potential detector nights. All attempted detector nights were successful at both towers. A summary of survey effort at each monitoring location is presented in Table 1.

Table 1. Survey Effort

Microphone Location	Attempted Detector Nights	Successful Detector Nights	Success Rate
0262 High	195	195	**100%**
0262 Low	195	195	**100%**
0462 High	196	196	**100%**
0462 Low	196	196	**100%**
TOTAL	**782**	**782**	**100%**


DIVIDE COUNTY
BURKE COUNTY
MOUNTRAIL COUNTY
WILLIAMS COUNTY
Wildrose
Tower 0262
Tower 0462
Tioga
White Earth
Ray
Epping
42
50
40
2
SK
Divide
Burke
Williams
Mountrail
McKenzie
MT
ND
Legend
Project Boundary
Acoustic Bat Survey Location
Figure No.
1
Title
Acoustic Bat Survey Locations
Client/Project
Aurora Wind Project, LLC
Aurora Wind Project
Project Location
Williams and Mountrail Co., ND
0
2
4
Miles
N
Data Sources: Aurora, Stantec, ESRI, USDA NAIP 2015

Stantec conducted an analysis of the 2017 acoustic bat data collected at the Project. After the acoustic data files were downloaded, all files were filtered using Kaleidoscope Pro 4.3.2 (Wildlife Acoustics, Inc.) to eliminate noise (e.g., insects, rain, wind). The program parameters used when filtering data through Kaleidoscope Pro are available in Appendix A. A trained bat biologist visually reviewed the files in AnalookW (version 4.2n) to confirm they contained a Bat Pass (BP; i.e., at least 2 bat echolocation call pulses). Files that did not contain a BP were manually removed and not analyzed further.

Once each file was reviewed to verify it contained bat passes, files were assigned auto-identifications by Kaleidoscope Pro based on species potentially occurring in the Project (Table 2). Ten bat species could potentially occur within the Project based on historical ranges and North Dakota county records (Dyke et al. 2015, Harvey et al. 2011, Reid 2006). Of these species, four are state-listed Species of Conservation Priority (SCP) Level 1 (considered to be of declining status or the core of the species breeding range is in North Dakota) and three are SCP Level 3 (believed to be in the peripheral of the distribution or non-breeding in the state). These species are listed in the State Wildlife Action Plan which does not provide any regulatory protection, but identifies them for state conservation efforts. One of these SCP, the Northern Long-eared Bat (*Myotis septentrionalis*), is also federally-listed as threatened. Auto-identifications assigned by Kaleidoscope Pro were then sorted into species groups (defined below) by a trained bat biologist.

Bat species can often be identified by the differences in the frequencies of their echolocation calls. The minimum frequency of a bat pass (measured in kilohertz [kHz]) is a characteristic typically used to differentiate species or groups of species from one another. Bats with minimum echolocation pulse frequencies typically less than or equal to 30 kHz were placed into the Low Frequency Species Group (LFSG). Bats with minimum echolocation pulse frequencies typically higher than 30 kHz were sorted into the High Frequency Species Group (HFSG). These groups are also presented in Table 2.

Table 2. Bat Species Potentially Occurring in the Project Vicinity

Species	Scientific Name	Species Group	Federal Rank	State Rank
Big Brown Bat	*Eptesicus fuscus*	LFSG	-	SCP Level 1
Eastern Red Bat	*Lasiurus borealis*	HFSG	-	-
Hoary Bat	*Lasiurus cinereus*	LFSG	-	-
Little Brown Bat	*Myotis lucifugus*	HFSG	-	SCP Level 1
Long-eared Bat	*Myotis evotis*	HFSG	-	SCP Level 3
Long-legged Bat	*Myotis volans*	HFSG	-	SCP Level 3
Northern Long-eared Bat	*Myotis septentrionalis*	HFSG	Threatened	SCP Level 1
Silver-haired Bat	*Lasionycteris noctivigans*	LFSG	-	-
Townsend's Big-eared Bat	*Corynorhinus townsendii*	LFSG	-	SCP Level 1
Western Small-footed Bat	*Myotis ciliolabrum*	HFSG	-	SCP Level 3

Sources: Harvey et al. 2011, Dyke et al. 2015, Reid 2006 SCP: Species of Conservation Priority

A total of 1,836 BPs was recorded at the 2 met towers, with 912 BPs recorded at Tower 0262 (average of 2.3 BP/DN) and 924 bat passes recorded at Tower 0462 (average of 2.4 BP/DN). The average bat passage rate for each microphone and met tower location is presented in Table 3. The average bat passage rate for the Project was 2.3 BP/DN. Activity was nearly two times higher at the low microphones (1,228 bat passes; 3.1 BP/DN) than the high microphones (608 bat passes; 1.6 BP/DN). These passage rates are lower than the average number of bat passes per detector night (4.2 BP/DN) for the Great Plains Region (Hein et al. 2013). Bat activity for each microphone at Tower 0262 and Tower 0462 was graphed for the survey period and are shown in Figure 2 and Figure 3, respectively. Bat activity trends for the entire Project, based on microphone height, are shown in Figure 4.

Table 3. Summary of Bat Passes

Microphone Location	Bat Passes	Detector Nights	Average BP/DN
0262 High	303	195	1.6
0262 Low	609	195	3.1
0262 Total	**912**	**390**	**2.3**
0462 High	305	196	1.6
0462 Low	619	196	3.2
0462 Total	**924**	**392**	**2.4**
High Microphones Total	**608**	**391**	**1.6**
Low Microphones Total	**1228**	**391**	**3.1**
Grand Total	**1,836**	**782**	**2.3**

The first bat pass recorded at the Project occurred on April 20, 2017. Both towers experienced relatively low activity until mid-July. Activity at the Project peaked between late-July and mid-September with the highest monthly bat passage rate being in August (average of 7.9 BP/DN). This period coincides with timing of fall migration, known to occur from August to November (Cryan 2003). The highest bat activity night at the Project occurred on August 10, 2017 with 94 bat passes. From peak activity in early August, bat activity gradually decreased until early October. The increase in high microphone activity observed in early September may have resulted from a later migratory push. Bat activity decreased to an average of 0.1 BP/DN in October. Given the relatively high latitude of the Project, the early decrease in bat activity is expected. The last bat pass recorded for the Project occurred on October 17, 2017.

Of the 1,836 bat passes recorded, 1,409 (76.7%) were identified to a Species Group (LFSG or HFSG). The majority (59.2%) of classifiable bat passes were classified as LFSG (Figure 5). To compare bat frequency-group composition at ground level and in the rotor-swept zone, bat passes identified to species groups were totaled among the two microphone heights. Bat passes attributed to the LFSG were more prevalent at high microphone locations throughout the survey, contributing 86.3% of the bat passes identified. Bat passes attributed to the HFSG were more prevalent at low microphone locations, contributing 54.5% of the identified bats (Figure 5).

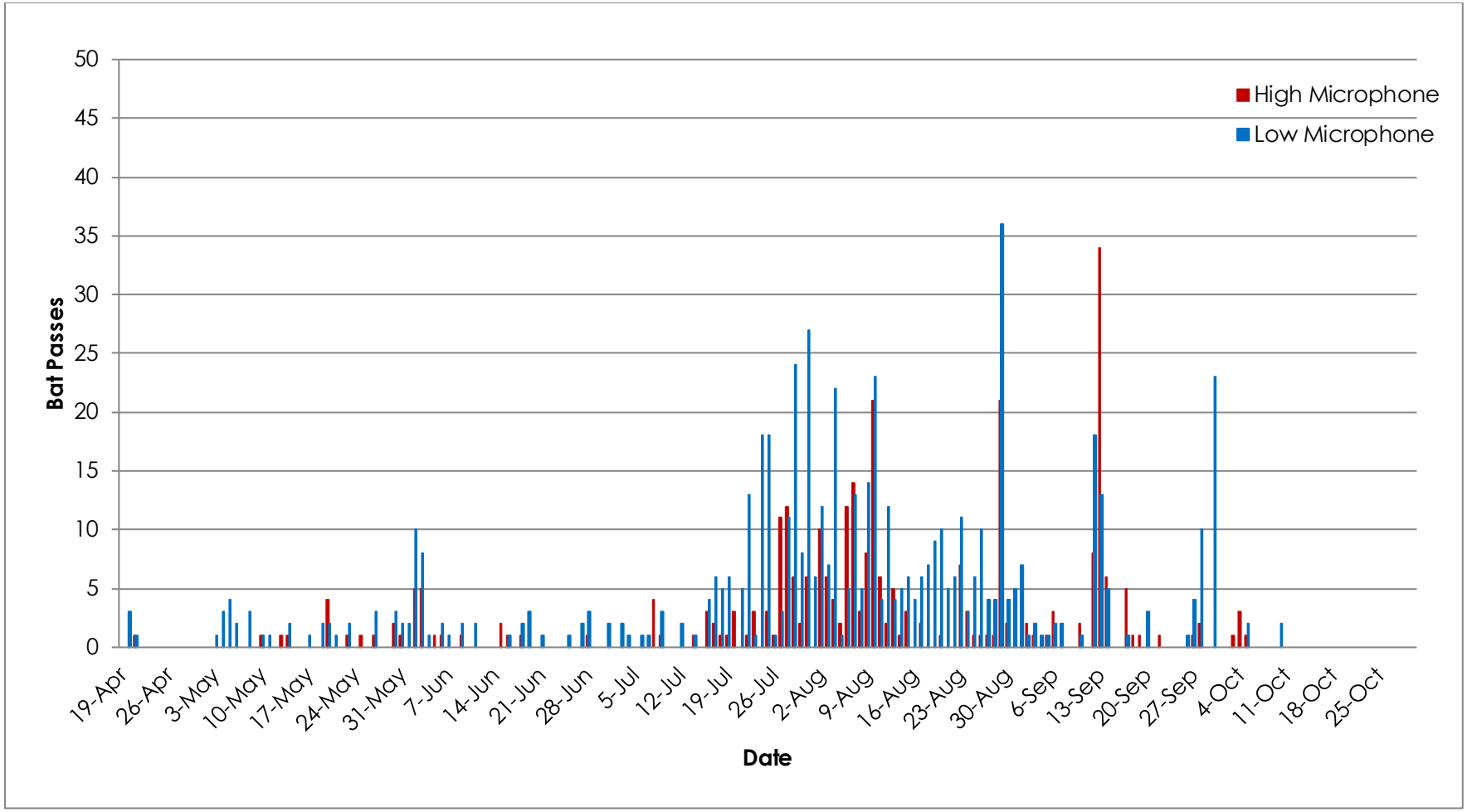


Figure 2. Nightly Bat Activity at Tower 0262

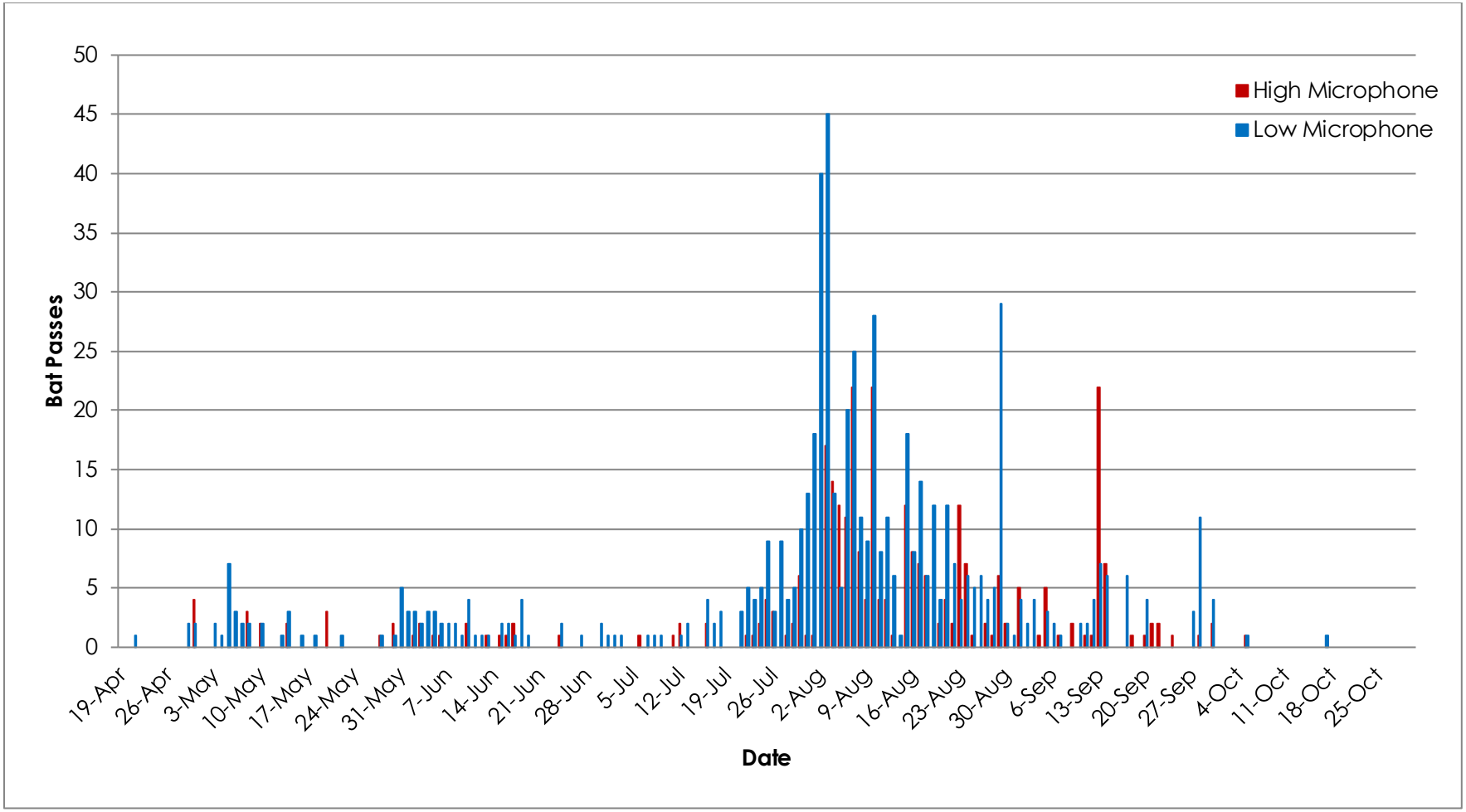


Figure 3. Nightly Bat Activity at Tower 0462

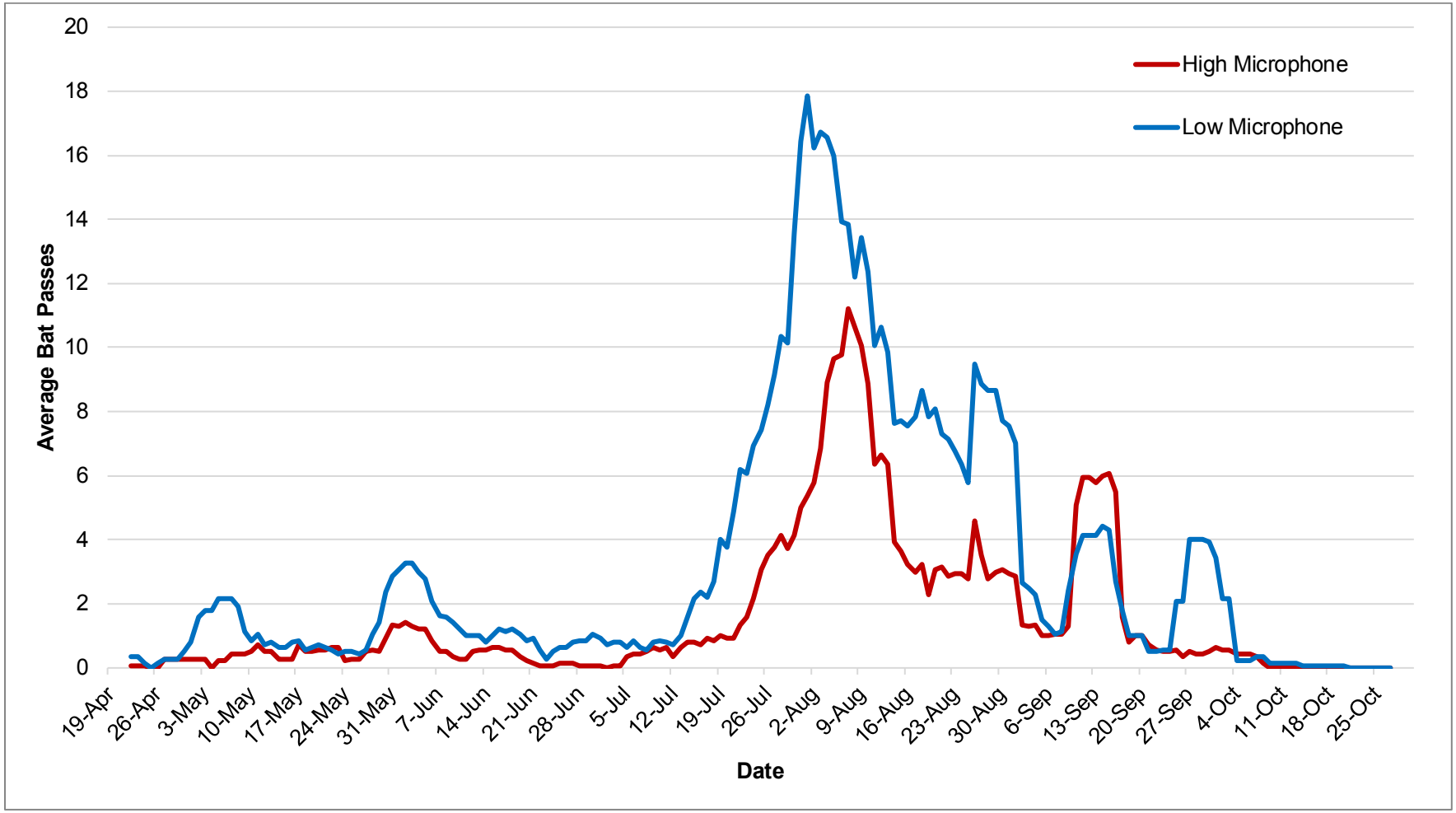


Figure 4. Average Nightly Bat Activity at High and Low Microphones
Values are the 7-day moving average of both towers averaged.

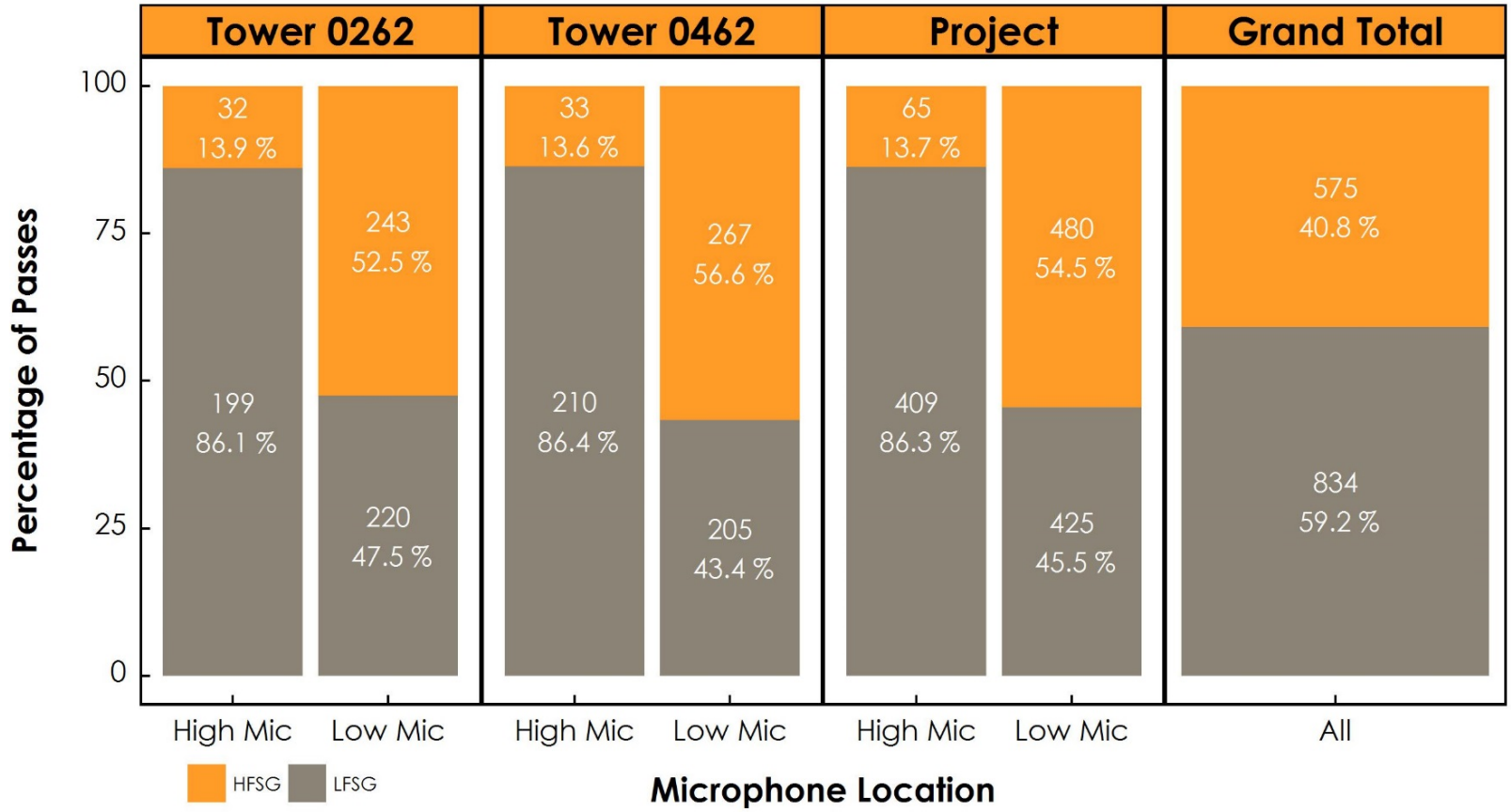


Figure 5. Bat Pass Frequency Group Percentage by Location

Passive long-term acoustic surveys are an acceptable method for documenting bat activity over time. Bat calls recorded on detectors can vary due to several biological and environmental factors. The bat's orientation, speed, and distance from the microphone all can influence how their calls are recorded (Limpens and McCracken 2002). Additionally, temperature, humidity, wind speed, environmental clutter, insect noise, and proximity to other bats also affect how echolocation calls are produced and recorded. These factors yield natural variation in a species' echolocation call repertoire. The type of bat detector, quality and calibration of microphones, and mode of data recording (full spectrum versus zero-crossing) also affect bat call recording. All equipment used in this survey was calibrated to factory specifications before and after the survey to ensure equipment was functioning properly. It is important to consider these factors when comparing activity rates across projects.

This survey documented the resident bat population at the Project during the spring migratory season, the summer maternity season, and fall migratory season. Based on the results of this survey, bat activity at the Project is lower than expected for the Great Plains region. Bat activity patterns are consistent with bat activity seen elsewhere in the United States with peak activity occurring between late July and mid-September, which coincides with fall migration (Hein et al. 2013). Finally, the low frequency species group represents most of the bats detected at the Project in 2017. Acoustic data are scheduled to be collected at the Project from spring through fall for the 2018 survey season.

Regards,

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cc. Ryan Hrabe, Stantec Consulting Services Inc.

REFERENCES

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APPENDIX A: KALEIDOSCOPE PARAMETERS

Parameter	Setting
Frequency Range	16 – 120 kHz
Pulse Length Range	1.5 – 35 milliseconds
Maximum Inter-Syllable Gap	500 milliseconds
Minimum Pulse Number	3
Advanced Signal Processing	Yes
Classifier Sensitivity	Balanced (Neutral)