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

January 16, 2019

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

Reference: 2018 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 June 4 through October 16, 2018. This letter summarizes the bat activity data recorded during the 2018 survey and is supplemental to the letter summary for the 2017 acoustic bat survey (Stantec 2017).

Acoustic bat monitoring equipment (Wildlife Acoustics SM3BAT full spectrum, dual-channel bat detectors with U1 ultrasonic microphones) was installed 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. Photos of each met tower with surrounding landscape are provided in Attachment A. All equipment used in this survey was calibrated to factory specifications before and after each survey year, and prior to fall migration activity, to ensure equipment was functioning properly. Since microphones were hard-mounted to the tower, pre-migration calibration was performed using an ultrasonic calibrator mounted on an Unmanned Aerial System to measure the maximum distance a microphone recorded the calibrator emitting sounds. During the calibration activities, photos were taken of each met tower with surrounding landscape and are provided in Attachment A.

The detectors were configured to monitor bat activity near ground level (3 meters [m] above ground level [agl]; “Low Microphone”) and at a height 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 0262 was installed on June 4, 2018. The detector on Tower 0462 was installed on June 8, 2017. Both detectors were demobilized on October 16, 2018. There was a potential for 134 detector nights at each microphone on Tower 0262 and 130 detector nights at each microphone on Tower 0462; therefore, the Project had 528 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.

33 PU-18-352 Filed 01/24/2019 Pages: 13
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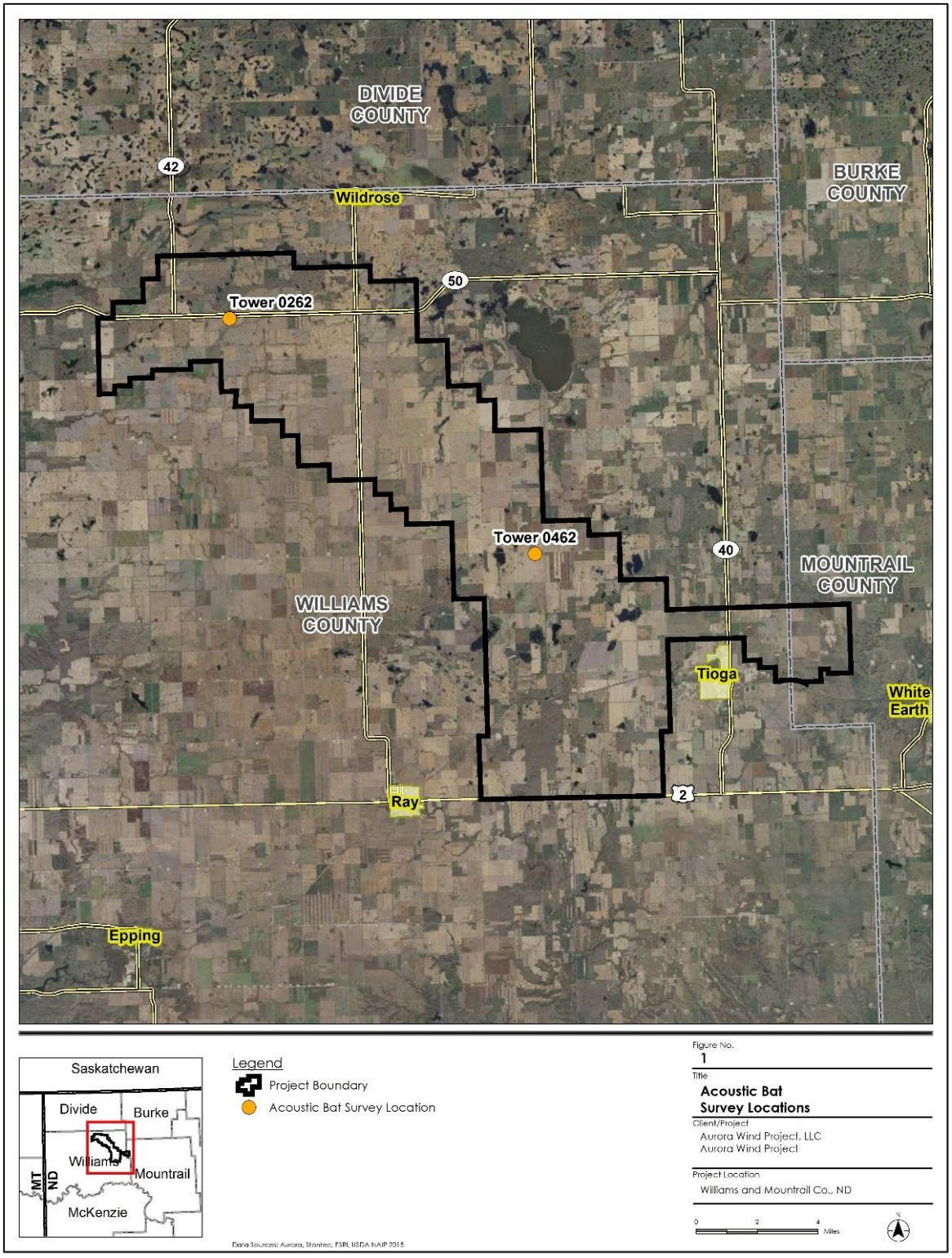

Table 1. Survey Effort

Microphone Location	Attempted Detector Nights	Successful Detector Nights	Success Rate
0262 High	134	134	**100%**
0262 Low	134	134	**100%**
0462 High	130	130	**100%**
0462 Low	130	130	**100%**
TOTAL	**528**	**528**	**100%**

Stantec conducted an analysis of the 2018 acoustic bat data collected at the Project. After the acoustic data files were downloaded, all files were filtered using Kaleidoscope Pro 4.2.0 (K Pro; Wildlife Acoustics, Inc.) to eliminate noise (e.g., insects, rain, wind). The program parameters used when filtering data through K Pro are available in Attachment B. A bat biologist with acoustic analysis expertise visually reviewed the files in AnalookW (version 4.2n, Chris Corben) to confirm they contained a bat pass (BP; i.e., at least 2 bat echolocation call pulses). Files that did not contain a bat pass were manually removed and not analyzed further.

Once each file was reviewed to verify it contained a bat pass, files were assigned auto-identifications by K 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 geographic 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 (Dyke et al. 2015). One of these SCP, the Northern Long-eared Bat (*Myotis septentrionalis*), is also federally-listed as threatened. Auto-identifications assigned by K Pro were then sorted into species groups (defined below). Passes not identified to species by K Pro were sorted into groups using AnalookW Filters (see Attachment B) by an experienced acoustic 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	Federal	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 noctivagans*	LFSG	-	-
Townsend's Big-eared Bat	*Corynorhinus townsendii*	LFSG	-	SCP Level 1
Western Small-footed Bat	*Myotis ciliolabrum*	HFSG	-	SCP Level 3
Sources: Dyke et al. 2015, Harvey et al. 2011, Reid 2006			SCP: Species of Conservation Priority	

A total of 1,688 bat passes was recorded at the 2 met towers, with 851 passes recorded at Tower 0262 (average of 3.2 BP/DN) and 831 bat passes recorded at Tower 0462 (average of 3.2 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 3.2 BP/DN. Activity was higher at the low microphones (1,178 bat passes; 4.5 BP/DN) than the high microphones (510 bat passes; 1.9 BP/DN). The Project's overall passage rate is lower than the average number of bat passes per detector night (4.2 BP/DN) for the Great Plains Region (Hein et al. 2013)[1]. Bat activity for each microphone at Tower 0262 and Tower 0462 was graphed for the survey period and is 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	228	134	1.7
0262 Low	623	134	4.7
0262 Total	**851**	**268**	**3.2**
0462 High	282	130	2.2
0462 Low	555	130	4.3
0462 Total	**837**	**260**	**3.2**
High Microphones Total	**510**	**264**	**1.9**
Low Microphones Total	**1,178**	**264**	**4.5**
Grand Total	**1,688**	**528**	**3.2**

[1] While passive long-term acoustic surveys are an acceptable method for documenting bat activity over time, there are important caveats that should be considered when comparing these results to other studies. Survey methodologies, including the timing of surveys, detector placement and type of equipment used are important when comparing results since each can greatly affect the passage rate reported (Kunz et al. 2007). For example, surveys completed only in the fall typically show higher bat passage rates than surveys conducted during only the spring or summer months or for the entire active bat season due to increased activity typically associated with fall migration. The type of bat detector, quality and calibration of microphones, and mode of data recording (full spectrum versus zero-crossing) also affect bat call recordings. Additionally, bat passes recorded on detectors can vary due to several biological and environmental variables. The bat's orientation, speed, and distance from the microphone all can influence how their echolocation calls are recorded (Limpens and McCracken 2002). Environmental variables such as temperature, humidity, wind speed, environmental clutter, insect noise, and proximity to other bats also affect how calls are produced and recorded. These factors yield natural variation in a species' echolocation call repertoire.

The first bat pass recorded at the Project occurred on June 5, 2018. 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 8.8 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 at the low microphone at Tower 0262 on August 19, 2018 with 51 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 seasonal onset of cooler temperatures at more northerly latitudes, the early decrease in bat activity at the Project is expected. The last bat pass recorded for the Project occurred on October 15, 2018.

Of the 1,688 bat passes recorded, 1,599 (94.7%) were identified to a Species Group (LFSG or HFSG). The majority (58.1%) of classifiable bat passes for the Project 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 2 microphone heights. Bat passes attributed to the LFSG were more prevalent at high microphone locations throughout the survey, contributing 84.9% of the bat passes identified at that height. Bat passes attributed to the HFSG were more prevalent at low microphone locations, contributing 52.8% of the identified bats at that height (Figure 5).

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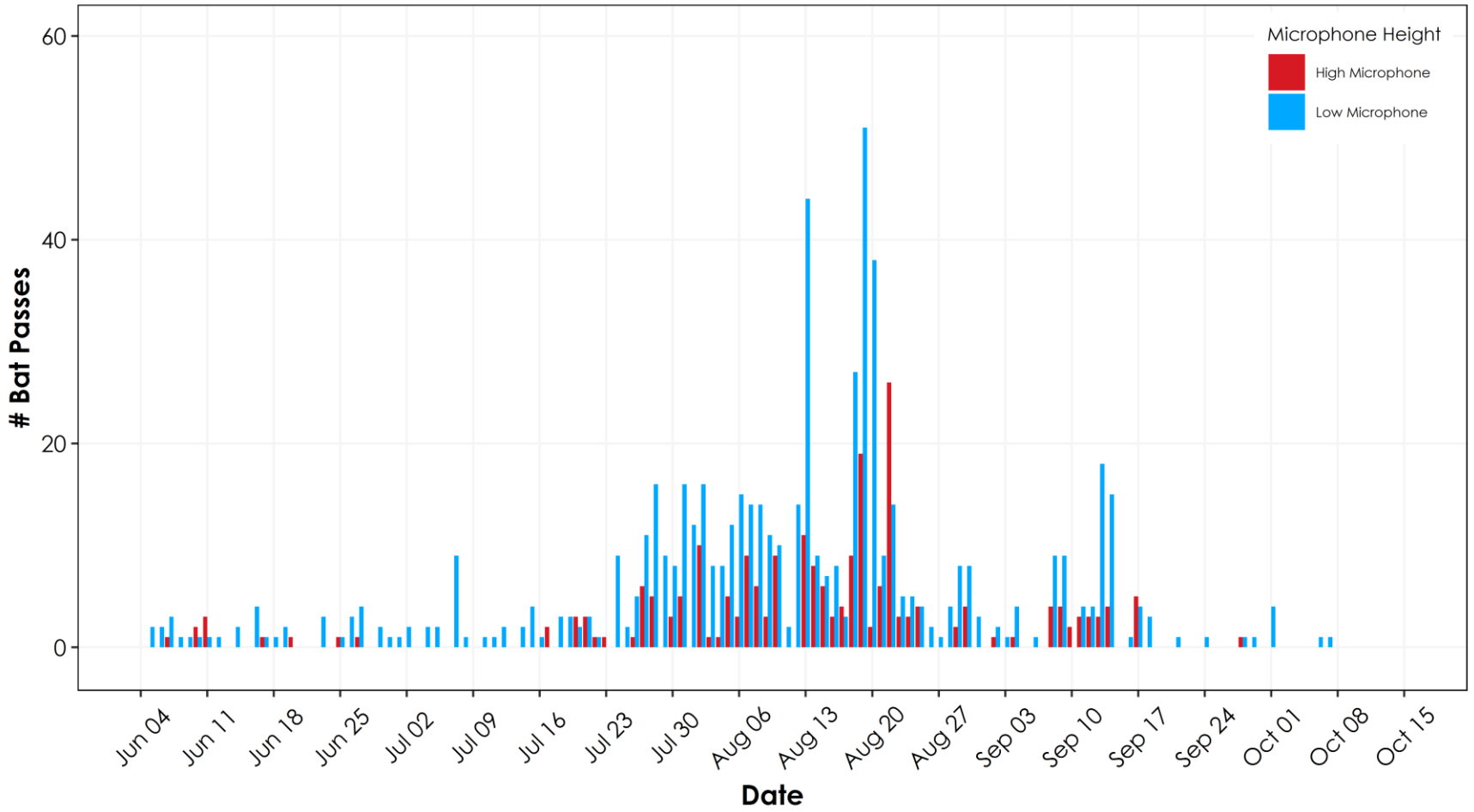

Figure 2. Nightly Bat Activity at Tower 0262

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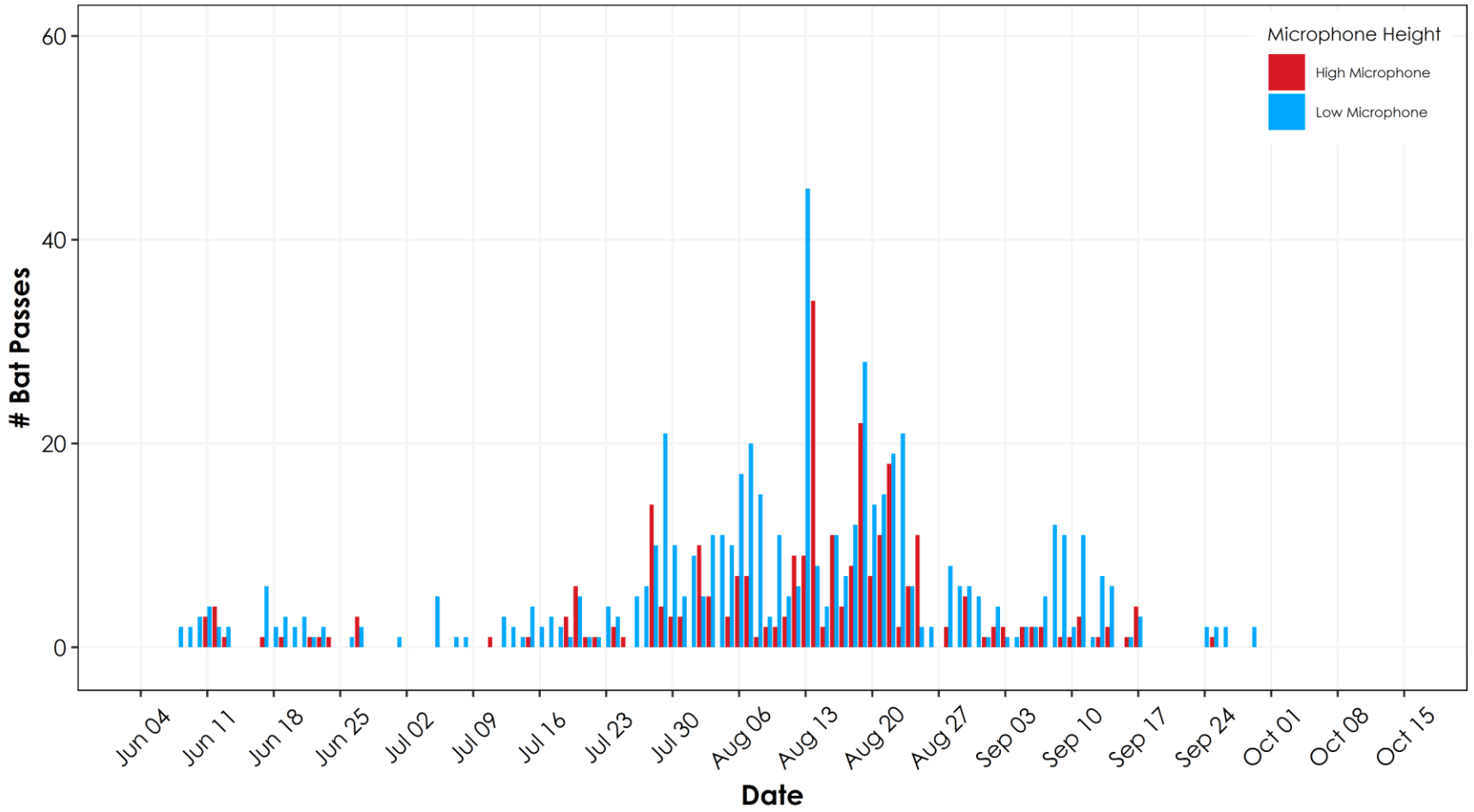

Figure 3. Nightly Bat Activity at Tower 0462

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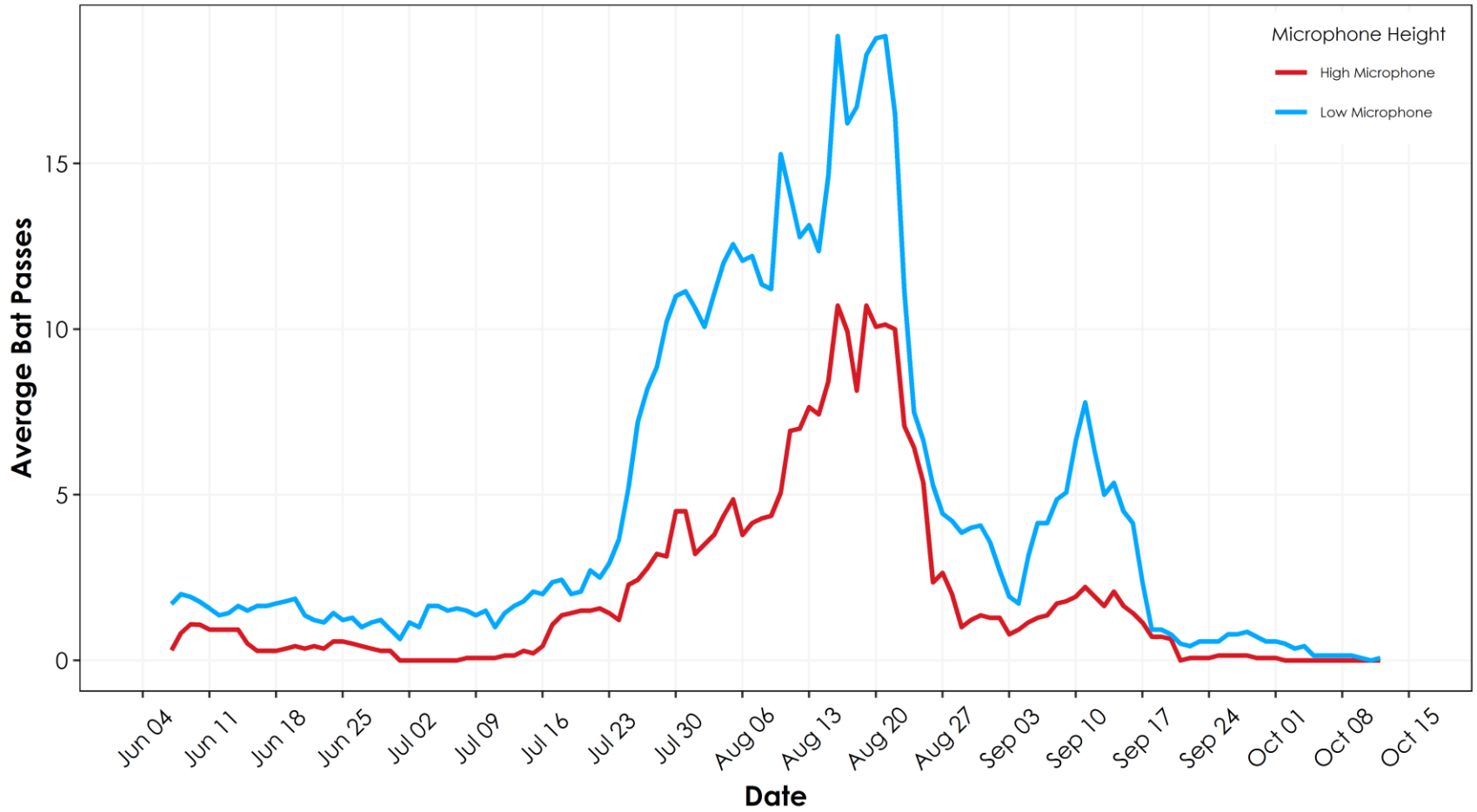

Figure 4. Average Nightly Bat Activity at High and Low Microphones
Values are the 7-day moving average of both towers averaged.

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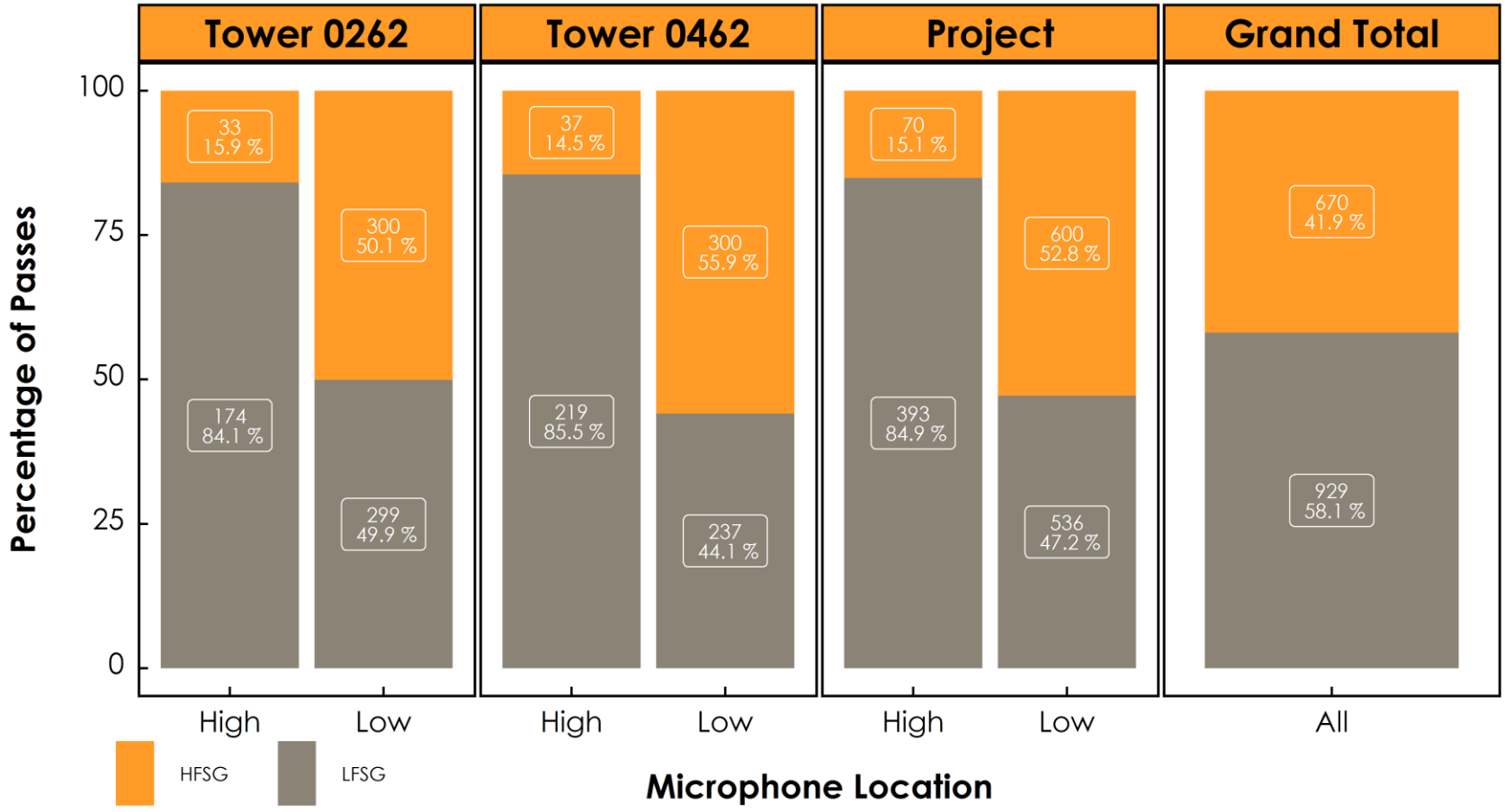

Figure 5. Bat Pass Frequency Group Percentage by Location

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Stantec conducted the acoustic bat surveys as part of Project-specific voluntary Tier 3 pre-construction due diligence activities described in the United States Fish and Wildlife Service's Land-based Wind Energy Guidelines (2012). The data included in this report are intended to assess the use of the Project by bats, to document the timing of peak activity, to identify species frequency-group activity and composition, and to advise and inform Aurora of the status of bat activity at the Project. This survey documented the resident bat population at the Project during the summer maternity season and fall migration 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 (Cryan 2003). The low frequency species group represents most of the bats detected at the Project in 2018. Finally, based on the results of this survey, bat activity at the Project is lower than average for the Great Plains region. These results are consistent with the 2017 survey results.

Regards,

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Phone: (913) 202-6879
JT.Layne@stantec.com

Attachment: A – Site Photos
B – Bat Call Filtering Parameters

cc. Ryan Hrabe, Stantec Consulting Services Inc.

REFERENCES

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ATTACHMENT A: SITE PHOTOS

Photo 1: Tower 0262 and landscape. Photo taken with unmanned aerial system on August 16, 2018.

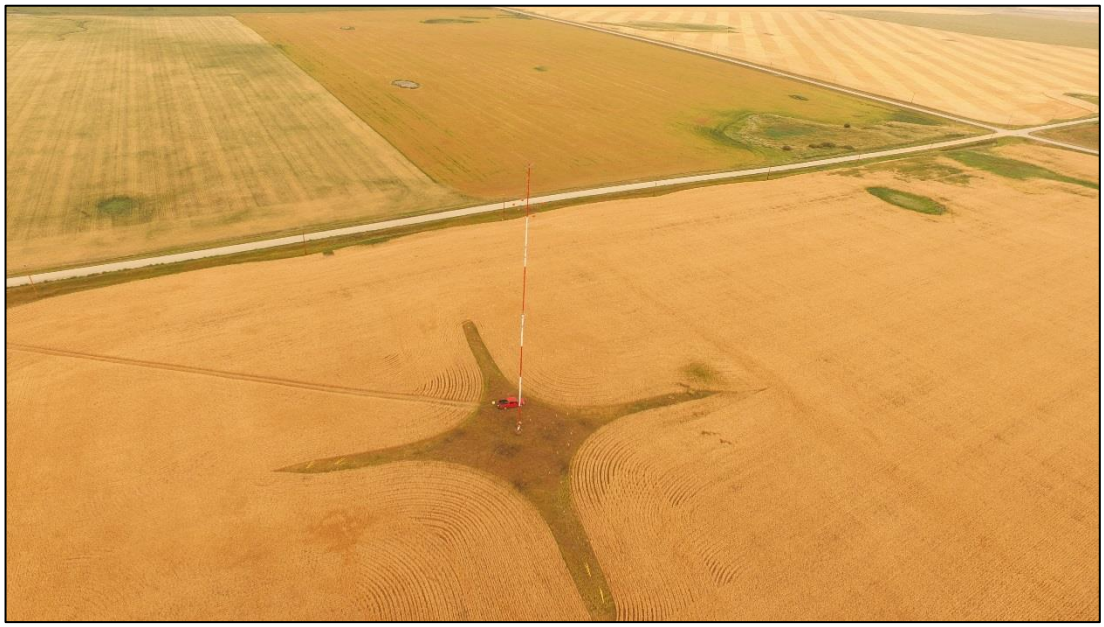

Photo 2: Tower 0462 and landscape. Photo taken with unmanned aerial system on August 16, 2018.

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ATTACHMENT B: BAT CALL FILTERING PARAMETERS

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)

ANALOOK LOW BAT FILTER

Parameter	Setting
Body: Fc (kHz)	12 – 29.9 kHz
Frequencies: Fmin (kHz)	12 – 29.9 kHz
Sequence: Minimum Number of Calls per Duration	3 calls per 15 seconds

ANALOOK HIGH BAT FILTER

Parameter	Setting
Body: Fc (kHz)	30 – 100 kHz
Frequencies: Fmin (kHz)	30 – 100 kHz
Sequence: Minimum Number of Calls per Duration	3 calls per 15 seconds