APPENDIX E BAT WHITE PAPER

The Proponent has undertaken a number of pre-construction bat studies to document the occurrence of resident and migrating bats near the Project site so that existing, pre-construction conditions may be determined and serve as a baseline against which to evaluate potential impacts of the Proposed Action. The following studies were conducted between 2004 and 2006, and are included in the Project Record.

- *Arrowwood Environmental. 2005. Searsburg Wind Power Expansion Project Bat Habitat Assessment and Mapping Final Report, prepared for enXco, Inc./Deerfield Wind, LLC, May 2005.*
- *USDA Forest Service. 2005. Final Report for Myotis leibii (Eastern Small Footed Bat Survey), Deerfield Wind Project, Prepared by Joe Torres, USDA Forest Service, Green Mountain National Forest Biologist, Manchester Ranger District, December 19, 2005.*
- *Tyburec J. 2005. Analysis and Report for AnaBat Detection Files Collected on 22 June 2005 in Searsburg, Vermont and on 28 June 2005 in Salisbury., August 2005*
- *Woodlot Alternatives. 2005a. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont, November 2005.*
- *Woodlot Alternatives. 2005b. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont, November 2005.*
- *Woodlot Alternatives. 2006. Spring 2006 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont, December 2006.*
- *Woodlot Alternatives. 2007. Summer-Fall Bat Detector Survey and Two-year Summary at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont, January 2007.*

As of October 2007, Woodlot Alternatives, Inc. (Woodlot) has joined with Stantec Consulting (Stantec).

Bat Habitat Assessment and Mapping

Arrowwood Environmental (Arrowwood) assessed bat habitat as part of a pre-construction wildlife survey for the Project. In accordance with the U.S. Fish and Wildlife Service protocols, a habitat suitability index (HSI) methodology was utilized. Specifically, the survey focused on determining the availability of habitat for two listed bat species—the Indiana bat, a state and federally-listed endangered species, and the eastern small-footed bat, which is listed as Threatened by the Vermont Natural Heritage Program (NHP), and as a Sensitive Species by the USDA Forest Service.

The study area for this inventory consisted of a three-mile radius centered along the ridges of the Project site. Arrowwood used remote mapping to identify potential Indiana bat and eastern small-footed bat habitats. Resources for the mapping included 1:40,000 color infrared photographs, 2003 National Agriculture Imagery Program true color orthophotograghs, 1995–1998 black and white orthophotograghs, and USGS topographic maps.

Habitat suitability for the Indiana bat was assessed using food suitability (cover type diversity), and landscape suitability (forest cover). Indiana bats use large diameter deciduous trees (dead and alive) with loose and peeling bark as maternity colony roost sites. These trees often occur in floodplains and wetlands and are typically, subjected to full sunlight (Kurta et al. 1993, Kurta et al. 1996 in Degraff and Yamasaki 2001). Indiana bats forage in the foliage of tree crowns 2 to 30 meters (7 to 98 feet) tall along the shores of rivers and lakes and over fields and floodplains (Humphrey et al. 1977 in Degraff and Yamasaki 2001). Two known Indiana bat hibernacula, including the largest known Indiana bat hibernaculum in Vermont, are located near Manchester, Vermont, 20 to 25 miles north of the Project site (USDA Forest Service 2006).

Habitat suitability for the eastern small-footed bat was assessed by the presence or absence of cliffs and talus areas, which are utilized as maternal roosting areas. Female eastern small-footed bats form small maternity colonies on rocky crevices on cliffs and sometimes crevice-like places on buildings (Hitchcock 1955 and Kurta 1995 in Degraaff and Yamasaki 2001).

Arrowwood determined that the area within a three-mile radius of the Project site does not include suitable habitat for Indiana bat, owing primarily to the homogeneous nature of the dense forest cover of the region. Most areas assessed had only two cover types (hardwoods forest and conifer forest), and forest cover ranged from 90 to 100%. Indiana bats are typically found in areas with a "moderate" amount of forest cover. While less than 5% forest is unsuitable, the ideal range is a landscape with 20-60% forest (Arrowwood 2005). Arrowwood concluded that the landscape surrounding the Project site lacks the cover type diversity necessary for the Indiana bat because the landscape near the Project is dominated by densely forested areas and the Indiana bats prefer “moderate” forested areas (Arrowwood 2005).

Arrowwood’s habitat assessment for the eastern small-footed bat maternity roost sites resulted in the identification of four ledge or talus areas that represented potential roosting locations. Because of the limitations of remote mapping, Arrowwood proposed ground-truthing of these sites to better assess their suitability as maternity roost sites.

Ground-Truthing Potential Eastern Small-footed Bat Maternity Roost Sites

A team of biologists from the USDA Forest Service and the Vermont State Fish and Wildlife Department conducted a survey of the four potential eastern small-footed bat maternity roost sites identified by Arrowwood in their bat habitat analysis and mapping. The team determined that only one site (Site 1) included suitable habitat, due to its southern facing rock cliff slope. Site 1 was also within two miles of the Project site (USDA Forest Service 2005).

Site 1 occurs within a mixed forest of northern hardwoods and softwoods consisting of Yellow birch (*Betula alleghaniensis*), Paper birch (*Betula papyrifera*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*). The site is located at the base of a 100-foot, south-facing cliff with multiple cracks and fissures. The cliffs are exposed along the south and east face of the ridge and approximately 25 feet below the top of the ridge. The exposed area is approximately 0.25 acre (USDA Forest Service 2005).

The team of biologists surveyed Site 1 using visual observations and Anabat® acoustic detectors to determine bat use and potential presence of eastern small-footed bats on June 22, 2005. Anabat detectors are frequency-division detectors that divide the frequency of ultrasonic calls made by bats so that they may be audible to humans (Woodlot 2005a). An Anabat detector was positioned on a boulder where the observers could view bats near the cliff face. Bats were observed during the dusk and bat calls were recorded on a computer software program. Ms. Janet Tyburec of Bat Conservation International analyzed the recorded frequencies (*Analysis and Report for Anabat Detection Files Collected on 22 June 2005 in Searsburg Vermont and on 28 June 2005 in Salisbury, Vermont*). Tyburec found that of the calls recorded, six calls were of sufficient quality for analysis. Of the six recordings, five of the call structures were consistent with that of the big brown bat and eastern red bat. None of the echolocation calls was typical of *Myotis* species, which includes eastern small-footed bat and Indiana bat. (Tyburec 2005 and USDA Forest Service 2005).

Based on habitat analysis and field survey results, the USDA Forest Service and Vermont Fish and Wildlife Department concluded that mist netting or other pre-construction surveys for eastern small-footed bats would not be necessary. This conclusion was based on generally poor site conditions (forested areas with few open areas), a minimal number of sites with suitable eastern small-footed bat maternity colony habitat, and the lack of any observed small-footed bats at the closest site with suitable habitat conditions. The USDA Forest Service and Vermont Fish and Wildlife Service concluded that if eastern small-footed bats occur within a three-mile radius of the Project area they are not likely to be present in large numbers.

Spring 2005 Acoustic Study

Woodlot Alternatives, Inc. conducted field surveys of bat migration activity at the Project site during spring 2005. The full study report is included in the Project Record. Woodlot monitored bat calls using Anabat II acoustic detectors between April 19 and June 15, 2005 to document bat occurrence in the Project area. Visual ceilometer observations were also made concurrently between April 26 and May 30, 2005.

Two Anabat II detectors were suspended from guy wires of the met tower just southeast of the Searsburg Wind Facility in the Eastern Project site. The detectors were suspended at heights of 7 meters and 15 meters (22 feet and 50 feet) above the ground. The acoustic surveys were designed to document the occurrence and detections rates of bats near the ground and at heights near the low end of the rotor-swept zone of the proposed turbines. Anabat II detectors are reported to have a range of 30—40 meters (Gardin 2007). The upper detector was deployed for 50 consecutive nights from April 19 to June 15. The lower detector was deployed for 43 nights from April 26 to June 15. The detectors were programmed to record data from 7:00 PM to 7:00 AM every night.

Data from the Anabat II detectors were downloaded to a computer for analysis. Potential call files were extracted from data files using CFCread© software, with default settings in place. This software screens all data recorded by the bat detector and extracts call files based on the number of pulses recorded within a certain time period. Every potential call file was visually inspected, with any distinct grouping of recognizable calls or call fragments being considered a bat call sequence. Call sequences were identified based on visual comparison of call sequences with reference libraries of known calls collected by Chris Corben (inventor of Anabat system) and Lynn Robbins (faculty at Missouri State University), using the Anabat system.

The accuracy of identifying bat calls using this method depends upon experience and the relevance of reference call files used (Woodlot 2005a). Woodlot was conservative in its identifications, using reference calls obtained by other researchers, most of which were of western origin. Woodlot labeled poor quality recordings or brief fragments as unknown, except in cases where they were reasonably sure that the fragment was exclusively within the *myotid* frequency range. *Myotids* were not identified to species, due to the similarity of calls between species within this genus.

In addition to *myotids*, silver-haired and big brown bats have calls that can easily be confused. Woodlot attempted to separate the species, based on minimum frequency and call slope. Call sequences with relatively flat profiles and minimum frequencies that were 27 kilohertz (kHz) were identified as silver-haired bats, whereas calls with a steeper profile and minimum frequencies ranging from slightly below 25 kHz to about 30 kHz were identified as big brown bats. This technique may underestimate the number of silver-haired bats because its calls can also be more steeply sloped (Woodlot 2005a).

Once all of the call files were identified, nightly tallies of detected calls by species were compiled for each detector. Mean detection rates (calls per detector-night) were calculated for each night. Detection rates indicate only the number of calls detected and do not necessarily reflect the number of individual bats in the Project area (Woodlot 2005a).

Woodlot also used a handheld ceilometer to detect bats in order to provide insight into the low altitude migrant animal composition. The ceilometer was used for five minutes during each hour of the avian radar study and was hand-held so that a target could be followed for several seconds. Species identification was not attempted during ceilometer studies.

Due to technical difficulties, the Anabat detector deployed at seven meters did not work for the duration of the study, and the detector deployed at 15 meters (50 feet) only obtained recordings from April 19 to April 23, and from May 12 to June 15 (Woodlot 2005a). In addition, static recorded by the detector further limited the amount of usable data collected.

Consequently, only four bat call sequences were recorded during the study. The overall detection rate was 0.07 calls per night. All recorded calls were identified as *myotids*. No bats were observed during ceilometer surveys conducted in association with the avian radar survey. Because so few bats were recorded/observed, no obvious relationship with weather or other factors that could affect bat occurrence and activity were determined (Woodlot 2005a).

The low levels of bat activity observed during the two-month spring sampling period could be attributable to equipment failure, limitations of the Anabat II detectors, a small bat population in the region, avoidance of the area by bats, or poor habitat conditions for bats.

Anabat surveys are often utilized because they represent a time efficient means to assess bat species richness. However, species identification using the Anabat method can be problematic due to the fact that bat calls can be highly variable within a species (O'Farrell and Gannon, 1999). Other limitations of the Anabat method include the fact that they do not provide additional information such as, gender and age ratios, and absolute abundances (Francl et al. 2004). In preferred scenarios, Anabat surveys are coupled with mist-netting to minimize the biases of each technique and maximize species detection (Francl et al. 2004).

Kunz et al. (2007) notes that acoustic detection of bats provides a practical and effective means to monitor for bat presence, activity, and relative abundance. However, they caution against extrapolating numbers of individuals from passage rate data as one individual may be detected multiple times during the same monitoring event. They also strongly recommend that bat detection equipment be deployed at the height of the rotor-swept area to effectively assess potential flight activity through the relevant airspace (Kunz et al 2007). This is particularly important because the majority of bat fatalities are believed to result from direct strikes by turbine rotors (Horn et al. 2008).

Project bat surveys in 2005 may be of limited value, since detectors were placed at 7 and 15 meters (23 and 49 feet) whereas the rotor-swept zone extends from 38 to 118 meters (125 to 387 feet). In addition equipment malfunction at both detectors limits the usefulness of the data. Only one location was used for the detectors. Current protocols suggest installing bat detectors at the north, south, east, and west periphery of a project site and one at the center of the project. In addition, additional detectors should be placed near variations in terrain, especially those that may potentially serve as a flyway (e.g. forest gaps) (Kunz et al. 2007).

Fall 2005 Acoustic Study

Woodlot continued to monitor bats at the Project site during fall 2005. The survey is included in the Project Record. As in the spring study, Woodlot monitored the nocturnal bat sounds using Anabat II bat detectors and ceilometer surveys.

Woodlot deployed Anabat II detectors on guy wires of the two met towers located at the southern ends of the Eastern and Western Project sites. Detectors were deployed either singly or in pairs on the met towers. On nights when two detectors were used, they were deployed at heights of 15 meters and 30 meters (45 feet and 100 feet). When deployed individually, detectors were placed at 30 meters (100 feet). In addition to the configuration described above, two other sample periods were analyzed from late September and late October in the Western Project site. During these late events, detectors were placed in pairs, with one at 30 meters (100 feet) on the met tower and one along the tree line of the met tower clearing. Recordings were made between the hours of 7:00 PM and 7:00 AM.

Potential call files were extracted from data files using CFCread© software. Calls were identified by qualitative visual comparisons to calls in reference libraries collected by Chris Corben (inventor of Anabat system) and Lynn Robbins (faculty at Missouri State University), and the University of Maine Mammalogy Department using the Anabat system. *Mytoids* were not identified to species due to the similarity of the calls among the genus. Once all calls were identified, nightly tallies of detected calls by species were compiled for each detector. Mean detection rates (calls per detector-night) were calculated for each detector and each site.

One hundred fifty-three detector-nights were sampled during the study (34 from the Eastern Project site and 119 from the Western Project site). As in the spring 2005 survey, the detectors did not operate during the entire deployment and static was recorded on some nights. Despite these problems, 79 bat call sequences were recorded during the study, 39 from the Eastern Project site and 40 from the Western Project site. The overall detection rate for the fall 2005 Acoustic Study was 0.5 calls per detector-night (Woodlot 2005b). Woodlot determined that the mean detection rate for the study was 1.15 calls per detector-night at the Eastern Project site and 0.34 calls per detector-night at the Western Project site (Woodlot 2005b).

Detection rate at the different detectors (30-meters, 15-meters, and tree line (0.7-meters) in the Western Project site was 0.2, 0.5, and 0.6 calls per detector-night, respectively. This detection rate was as expected, given that bat activity is typically higher near the tree line and at lower elevations than where the 30-meter detector was deployed. However, this relationship was reversed at the Eastern Project site where the detection rate at the 30-meter detector was 0.5 calls per detector-night, while the detection rate at the 15-meter detector was 0.0 calls per detector-night. Woodlot attributed this outcome to the 15-meter detector functioning on only 12 nights during the survey (Woodlot 2005b).

The majority (54 of 79) of calls recorded belonged to the genus *Myotis*. Twenty-five calls were too short or too poor in quality to identify the bat species. Big brown bats were the most common (20) species recorded followed by those of the *myotids*. Calls of the Eastern red bat, hoary bat, and silver-haired bat were only documented five or six times each. No eastern pipistrelles were recoded during the survey. A summary of the survey effort and species composition is presented in Table E-1 (Woodlot 2005b).

Table E-1: Summary of Bat Detector Surveys at the Project Site During the Fall 2005 Acoustic Study.

Site / Detector	Operational Survey Period	Number of detector nights	Number of Calls / Species						Total
			Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	*Myotis* spp.	Unknown	
Eastern (30m)	7/7 – 9/9	24	13	1	1	0	10	14	39
Eastern (15m)	7/7 – 7/16	10	0	0	0	0	0	0	0
Western (30m)	7/4 – 11/1	73	1	0	2	6	3	4	16
Western (15m)	7/4 – 10/13	29	3	0	3	0	3	5	14
Western tree line (7m)	9/21 – 11/1	17	3	4	0	0	1	2	10
Total		**153**	**20**	**5**	**6**	**6**	**17**	**25**	**79**
Detection Rates									
Eastern (30m)	7/7 – 9/9	24	0.50	0.04	0.04	0.00	0.40	0.60	1.6
Eastern (15m)	7/7 – 7/16	10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Western (30m)	7/4 – 11/1	73	0.01	0.00	0.03	0.10	0.04	0.10	0.2
Western (15m)	7/4 – 10/13	29	0.10	0.00	0.10	0.00	0.10	0.20	0.5
Western tree line (7m)	9/21 – 11/1	17	0.20	0.20	0.00	0.0	0.10	0.10	0.6
Calls per Detector-night		**153**	**0.13**	**0.03**	**0.04**	**0.04**	**0.11**	**0.20**	**0.5**

Woodlot examined the *myotid* calls for potential call sequences by the Indiana bat. The calls were subsequently run through a filter developed by Eric Britzke, a national expert researching the ability to identify Indiana bats by call. No Indiana bat calls were identified during this process.

The fall 2005 bat survey has similar limitations as the spring 2005 survey. Detectors failed and static was recorded on some nights. More detectors were utilized in fall 2005 than in the spring 2005 survey.

Spring 2006 Acoustic Study

Woodlot continued to monitor bat activity at the Project site during 2006. Woodlot deployed five bat detectors—two in the Eastern Project site and three in the Western Project site. Two detectors were deployed on each of the met towers in the Eastern and Western Project sites, and one detector was deployed along a tree line in the northern third of the Western Project site. Detectors were deployed on April 14 and ran until October 27. For the purposes of describing spring migration, data up until the night of June 13 was examined. Detectors were deployed at heights of approximately 10 meters (33 feet) and 20 meters (67 feet) in the Eastern Project site, and at heights of 15 meters (49 feet) and 35 meters (115 feet) in the Western Project site. The detector positioned along the tree line was deployed at seven meters (23 feet). Potential call files were downloaded and analyzed as described in Woodlot's earlier bat migration studies. Call sequences were identified based on visual comparison of call sequences with reference libraries of known calls recorded by Woodlot during mist netting surveys in 2006 in New York and Pennsylvania. Supplemental reference calls that were used were provided by Lynn Robbins and Chris Corben.

Call sequences were identified to species when possible. However, in contrast to previous studies, Woodlot classified the calls into four guilds because bat sequences among several bat species are very similar. The classification scheme follows the scheme of Gannon et al. 2003. The guilds are described below.

- Unknown – all call sequences with too few pulses (fewer than seven) or of poor quality (such as indistinct pulse characteristics or background static)
- Myotid – all bats of the genus *Myotis*. While there are some general characteristics believed to be distinctive for several of the species in this genus, these characteristics do not occur consistently enough for any one species to be relied upon at all times when using Anabat recordings.
- Red bat/pipistrelle – includes Eastern red bats and Eastern pipistrelles. Like so many of the other northeastern bats, these two species can produce calls distinctive only to each species. However, significant overlap in the call pulse shape, frequency range, and slope can also occur.
- Big Brown – includes big brown bat, silver-haired bat, and hoary bat. These species' call signatures commonly overlap and have therefore been included as one guild.

Once all of the call files were identified and placed into appropriate guilds, nightly tallies of detected calls were compiled. Mean detection rates (number of calls/detector-night) for the entire sampling period were calculated for each detector and for all detectors combined. Woodlot also conducted a ceilometer and radar to survey for birds and bats on 31 nights. Birds and bats cannot be conclusively identified using radar; however, Woodlot's experience from previous years' studies suggest that targets that move erratically or in curving paths in the radar are typical of bats whereas birds tend to have straight flight paths.

One-hundred-ninety four detector-nights of data were collected over the course of the spring sampling period (April 14 to June 13), during which only 15 bat call sequences were recorded. The overall detection rate was 0.07 calls per detector-night. The mean detection rate for the spring 2006 study was 0.04 calls per detector-night at the Eastern Project site and 0.13 calls per detector-night at the Western Project site.

The range in detection rates from all detectors was from 0 to 0.3 calls per detector-night. The number of call sequences recorded at each detector ranged from 0 at the eastern 10-meter detector and western 35-meter detector, to 7 calls per detector-night at the western 15-meter detector. Woodlot reported that the calls were generally recorded infrequently during the spring migration, but uniformly throughout that survey period. A summary of the detection rates by each detector is in Table E-2 (Woodlot 2006).

Table E-2: Summary of Spring 2006 Bat Detector Rates and Survey Effort

Site / Detector	Dates	Number of Detector Nights[1]	Number of Recorded Sequences	Detection Rate[2]	Maximum Number of Calls Recorded / Night[3]
Eastern (20m)	4/14–6/13	60	4	0.1	1
Eastern (10m)	4/14–5/31	47	0	0.0	—
Western (35m)	4/14–5/2 and 5/11–5/20	29	0	0.0	—
Western (15m)	4/14–4/25 and 5/8–5/16	21	7	0.3	5
Western Tree Line (7m)	4/14–4/24 and 5/17–6/11	37	4	0.1	1
Overall Results	**4/14–6/13**	**194**	**15**	**0.07**	**7**

Notes:
1 = Detector-night is a sampling unit during which a single detector is deployed overnight. On nights when two detectors are deployed, the sampling effort equals two detector-nights.
2 = Number of bat passes recorded per detector-night.
3 = Maximum number of bat passes recorded from any single detector for a 12-hour sampling period.

Of the recorded call sequences (n=15), four were classified as unknown due to poor file quality or too few call pulses to make identification. Five call sequences were identified as within the big brown bat guild (which includes the big brown bat, silver-haired bat, and hoary bat), and five were identified as *myotids*. One call was identified as either an Eastern red bat or Eastern pipistrelle (Woodlot 2006). A summary of the calls is listed in Table E-3.

Table E-3: Summary of the Composition of Recorded Bat Call Sequences Recorded at the Project Site (April 14–June 12, 2006).

Site / Detector	Guild				
	Big brown guild	Red bat / E. pipistrelle	*Myotis*	Unknown	Total
Eastern (20m)		1	2	1	4
Eastern (10m)	—	—	—	—	0
Western (35m)	—	—	—	—	0
Western (15m)	5	—	1	1	7
Western Tree line (7m)	—	—	2	2	4
Total	**5**	**1**	**5**	**4**	**15**

Woodlot found that the spring 2005 and spring 2006 detection rates at the Project area were both approximately 0.07 calls per detector-night. Woodlot compared the spring season bat detection rates with the previous surveys at the Project area and at other proposed wind projects in the Northeast. These results are similar, if not slightly lower, than those observed at other Northeastern sites Woodlot has studied. Table E-4 presents this comparison.

Table E-4: Summary of Woodlot's Spring Bat Detector Results in the Northeast

Project	Location	Season	Calls / detector-night
Deerfield	Searsburg, Vermont	Spring 2005	0.07
Deerfield	Searsburg, Vermont	Spring 2006	0.07
Sheffield	Sheffield, Vermont	Spring 2005	0.2
Marble River	Churubusco, New York	Spring 2005	0.3
Jordanville	Warren, New York	Spring 2005	0.5
Cohocton	Cohocton, New York	Spring 2005	0.7
Prattsburgh	Prattsburgh, New York	Spring 2005	0.3
Liberty Gap	Franklin, West Virginia	Spring 2005	0.5

Only one bat was observed during the course of ceilometer observations, and review of radar (horizontal) data indicated 1,701 target trails that were identified as potential bats. No altitude data was collected.

The spring 2006 survey documented the occurrence of bat species that would be expected to occur in the Project area based on species' range, abundance, and habitat preference. The overall detection rate is also similar to what has been observed in previous years and at other sites.

Summer–Fall 2006 Bat Migration Study

Woodlot continued monitoring bats at the Project area through the summer and fall 2006. Five detectors were deployed through October 27 at the heights and locations described previously. As in the spring season, all detectors were programmed to record nightly from 7:00 PM to 7:00 AM.

Data analysis followed procedures established by Woodlot in previous acoustic studies at the site, and bat call sequences were identified by guilds. Woodlot also collected weather data from the Wilmington, Vermont Wastewater/Compost Facility, which is 8.1 kilometers (5 miles) away to assess if weather had any affect on bat behavior.

During the study, there were times when the individual detectors powered down, animals damaged a detector, or inclement weather interrupted the detectors. The five detectors recorded 421 detector nights of bat echolocation from June 13 to October 27. The five detectors recorded 380 bat call sequences during this survey period. The mean detection rate for all detectors was 0.9 calls per detector-night. The detection rate at the Eastern Project site (1.2 calls per detector-nights) was greater than at the Western Project site detectors (0.7 calls per detector-night). A summary of detector results for summer and fall 2006 is presented in Table E-5. A summary of the recorded bat sequences by guild is presented in Table E-6 (Woodlot 2007).

Table E-5: Summary of the Bat Detector Survey Effort and Results at the Project Site During Summer and Fall 2006.

Location	Dates	Number of Detector Nights[1]	Number of Recorded Sequences	Detection Rate[2]	Maximum Number of Call Sequences Recorded/Night[3]
Eastern Met Tower High (20m)	6/13–8/9 8/25–9/26 10/9–10/26	111	125	1.1	9
Eastern Met Tower Low (10m)	7/12–8/9 8/23–10/26	94	112	1.2	10
Western Met Tower High (35m)	6/29–7/15 7/27–8/7 8/23–9/7 10/9–10/11	49	9	0.2	2
Western Met Tower Low (15m)	6/13–7/1 7/13–8/2 8/23–10/27	105	134	1.3	5
Western Tree Detector (7m)	6/13–8/1, 8/3, 8/23–8/26 9/1–9/5 10/9–10/10	62	0	0	4
Overall Results	**6/13–10/27**	**421**	**380**	**0.9**	**—**

Notes:
1 = Detector-night is a sampling unit during which a single detector is deployed overnight. On nights when two detectors are deployed, the sampling effort equals two detector-nights, etc.
2 = Number of bat passes (calls recorded) per detector-night.
3 = Maximum number of bat passes recorded from any single detector for a 12-hour sampling period.

Table E-6: Summary of the Composition of Recorded Bat Call Sequences at the Project Site During Summer and Fall 2006.

Detector	Guild				
	Big Brown Bat	Red Bat/ E. Pipistrelle	Myotis	Unknown	Total
Eastern Met Tower High (20m)	19	5	32	69	125
Eastern Met Tower Low (10m)	11	6	31	64	112
Western Met Tower High (35m)	3	1	1	4	9
Western Met Tower Low (15m)	25	4	49	56	134
Western Tree Detector (7m)	0	0	0	0	0
Total	**58**	**16**	**113**	**193**	**380**

One hundred ninety-three of the 380 (54%) recorded call sequences were labeled as unknown due to very short call sequences (less than seven pulses), poor call signature formation, bats flying at the edge of the detection zone, bats flying away from the detector, or static interference. Myotids were the most common call sequences identified (28%) followed by the big brown guild (13%), and red bat/eastern pipistrelle guild (5%) (Woodlot 2007).

Of the 113 call sequences in the myotid group, 74 (85.5%) were identified as *Myotis* genus because the pulses in the call sequences were too indistinct to allow identification of species. Approximately 12% of the myotid call sequences were identified as little brown bat, 2% as northern myotis, and less than 1% as possibly Eastern small-footed myotis (Woodlot 2007).

Fifty-eight call sequences were attributed to the big brown bat guild. Of these, seven (12%) appeared to be big brown bat, five (9%) silver-haired bat, and 13 (22%) hoary bat. The remaining sequences in the big brown bat guild could not be identified to species with certainty, but were either that of the big brown bat or silver-haired bat. These sequences did not appear to include any hoary bat calls. Within the red bat/Eastern pipistrelle guild (n=16), 81% of the call sequences were likely red bat and 13% Eastern pipistrelle. The remainder could not be identified to species with certainty (Woodlot 2007).

Call detection rates were low (one or no recorded sequence) during June and began to increase in the second half of July. The call sequences peaked (12 to 19 calls per night) in early August and then remained relatively low (two to eight calls per night) through the first half of October. Vandalism resulted in the loss of approximately two weeks of data from all detectors in mid-to late August (Woodlot 2007).

Mean nightly wind speeds near the Project area varied between 0 to 29 kilometers per hour (0 to 18 miles per hour). Mean nightly temperatures ranged from 0.25º and 26.3º Celsius (32.5º to 79.3º Fahrenheit). Woodlot did not find any significant relationship between temperature, wind, and bat call sequences. In general, however, fewer call sequences were recorded on nights with the highest wind speeds (greater than 10 kilometers [6.2 miles per hour] per hour), and temperatures cooler than 10º Celsius (50º Fahrenheit) (Woodlot 2007).

Observational data over years of Woodlot studies indicate that passage rates are generally lower on nights of poor visibility and inclement weather and higher, both in terms of numbers and elevation, on nights of greater visibility. Data obtained at the Project site were consistent with Stantec internal and published data sources (Stantec, 2008).

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