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<b>Allen Kurta</b> Eastern Michigan University Department of Biology 316 Mark Jefferson Ypsilanti, MI 48197 (734) 487-4242 / FAX (734) 487-9235 <a href="mailto:akurta@emich.edu">akurta@emich.edu</a>	<b>Michelle Malcosky</b> 266 Atterbury Blvd. Hudson, OH 44236 (330) 968-8272 <a href="mailto:mmalcosky@gmail.com">mmalcosky@gmail.com</a>

<p><b>Rodney McClanahan</b>  265 Moss Lane  Anna, IL 62906  (618) 658-1317  <a href="mailto:turkeyctr@earthlink.net">turkeyctr@earthlink.net</a></p>	<p><b>Mountain State Biosurveys, LLC</b>  Thomas Risch  6703 Ohio River Road  Lesage, WV 25537  (304) 762-2453  <a href="http://www.mtnstatebio.com">www.mtnstatebio.com</a></p>
<p><b>Pittsburgh Wildlife &amp; Environmental, Inc.</b>  Neil Bossart  853 Beagle Club Road  McDonald, PA 15057  (724) 796-5137  <a href="mailto:nbossart@windstream.net">nbossart@windstream.net</a></p>	<p><b>Redwing Ecological Services, Inc.</b>  Benjamin Deetsch  129 South Sixth Street  Louisville, KY 40202  (502) 625-3009  FAX (502) 625-3077  <a href="mailto:kfuchs@rewing.win.net">kfuchs@rewing.win.net</a></p>
<p><b>Lynn Robbins</b>  Southwest Missouri State University  Department of Biology  901 South National Avenue  Springfield, MO 65804-0095  (417) 836-5366  FAX (417) 836-4204  <a href="mailto:lwr704f@smsu.edu">lwr704f@smsu.edu</a></p>	<p><b>Stantec Consulting Services, Inc.</b>  Jeff Brown  11687 Lebanon Road  Cincinnati, OH 45241  (513) 842-8205 / FAX (513) 842-8250  <a href="mailto:jeff.brown@stantec.com">jeff.brown@stantec.com</a></p> <p>Bob Madej  1500 Lakeshore Drive, Suite 100  Columbus, OH 43204  (614) 486-4383 / FAX (614) 486-4387  <a href="mailto:robert.madej@stantec.com">robert.madej@stantec.com</a></p> <p>James Kiser  1901 Nelson Miller Parkway  Louisville, KY 40223  (502) 212-5000 / FAX (502) 212-5055  <a href="mailto:james.kiser@stantec.com">james.kiser@stantec.com</a></p>
<p><b>Merrill Tawse</b>  791 Woodland Road  Mansfield, OH 44906  (419) 756-1203 / cell (419) 989-2335  <a href="mailto:mtawsebats@yahoo.com">mtawsebats@yahoo.com</a></p>	
<p><b>Third Rock Consultants, LLC</b>  Rain Storm  2514 Regency Rd., Suite 104  Lexington, KY 40503  (859) 977-2000 / FAX (859) 977-2001  <a href="mailto:mforee@thirdrockconsultants.com">mforee@thirdrockconsultants.com</a></p>	<p><b>John Timpone</b>  427 Terrington Drive  Ballwin, MO 63021  (417) 894-5554  <a href="mailto:wanderingwolverine13@yahoo.com">wanderingwolverine13@yahoo.com</a></p>
<p><b>Tragus Environmental Consulting</b>  Mike Johnson  Endangered Species Consultants  37 North Highland Avenue  Akron, OH 44303  (330) 472-7013  <a href="mailto:mike@tragusinc.com">mike@tragusinc.com</a></p>	<p><b>Brianne Lorraine Walters</b>  Dept. of Ecology and Organismal Biology  Indiana State University  Terre Haute, IN 47809  (812) 237-8294 / FAX (812) 237-2526  <a href="mailto:bwalters2@isugw.indstate.edu">bwalters2@isugw.indstate.edu</a></p>

<b>Western Ecosystems Technology, Inc.</b> Stephen Brandebura 2003 Central Avenue Cheyenne, WY 82001 (307) 634-1756 / FAX (307) 637-6981 <a href="mailto:sbrandebura@west-inc.com">sbrandebura@west-inc.com</a>	<b>John O. Whitaker, Jr.</b> Department of Life Sciences Indiana State University Terre Haute, IN 47809 (812) 237-2383 / FAX (812) 237-2526 <a href="mailto:jwhitaker3@isugw.indstate.edu">jwhitaker3@isugw.indstate.edu</a>
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\*This list reflects permit data available as of December 13, 2010, and is subject to periodic revision to reflect permit changes



# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

## Ohio Division of Wildlife

Vicki J. Mountz, Acting Chief  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
Phone: (614) 265-6300

February 16, 2011

To all interested parties,

Based upon the updated project boundary map received on 8 February 2011, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these revised survey recommendations for Nordex's proposed project located in Seneca County.

Currently the project falls within regions that DOW has identified as needing extensive monitoring efforts. If the developer decides to amend the boundaries or based upon DOW site visit, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or [brian.mitch@dnr.state.oh.us](mailto:brian.mitch@dnr.state.oh.us)

Project	
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.
Raptor nest monitoring	There is 1 eagle nest located on or within the 2 miles of the proposed project; as well 2 additional nests are just past the 2 mile buffer. The pair within the 2 mile radius should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.





# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	11
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	22
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	1

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist  
Olentangy Wildlife Research Station  
Ohio Division of Wildlife  
8589 Horseshoe Road  
Ashley, OH 43003  
Office phone: 740-747-2525 x 26  
Cell: 419-602-3141  
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service  
Mr. Brian Mitch, Ohio Department of Natural Resources

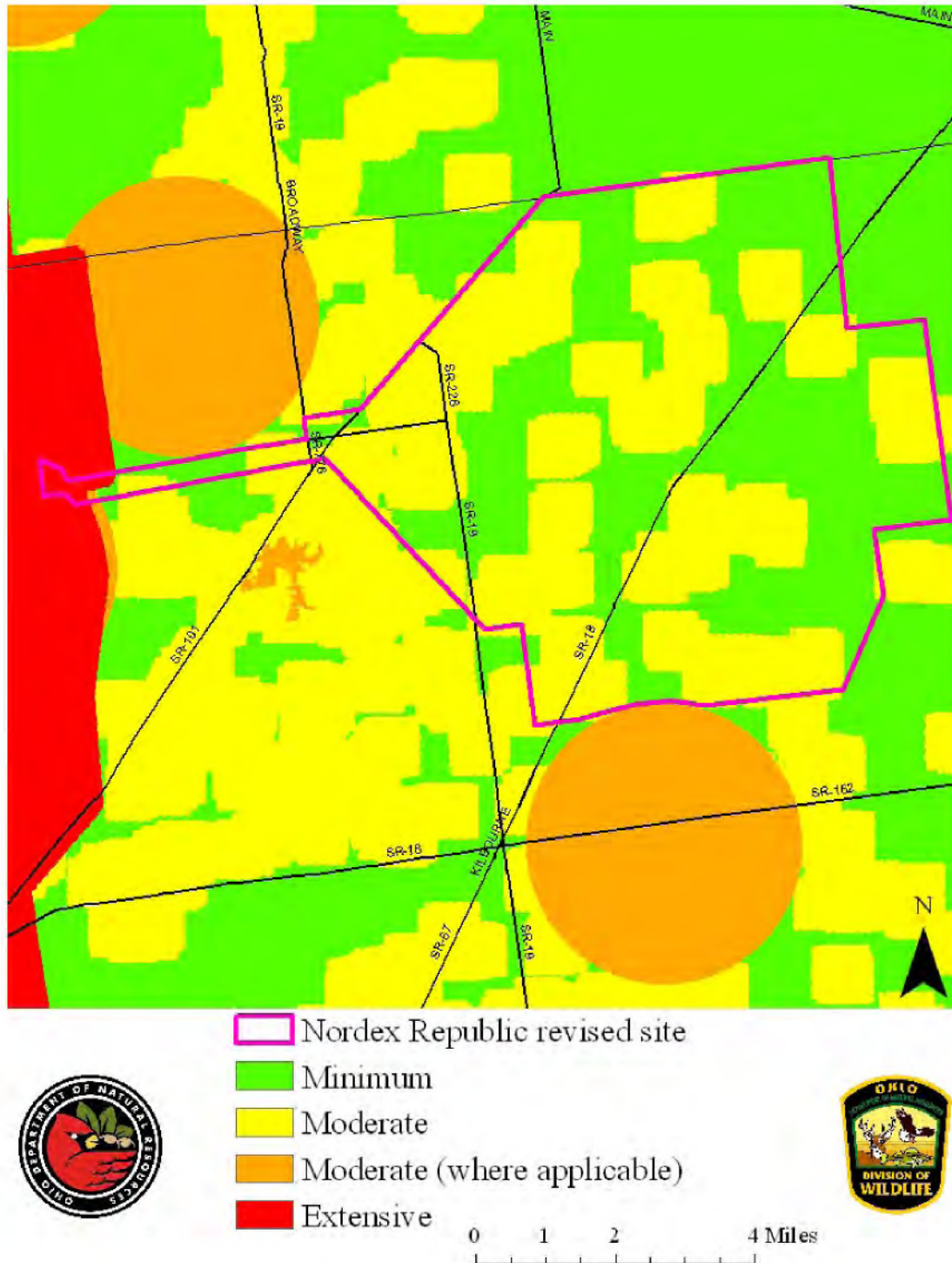


# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Figure 1. Survey effort map with revised boundary for Nordex's proposed Republic project.



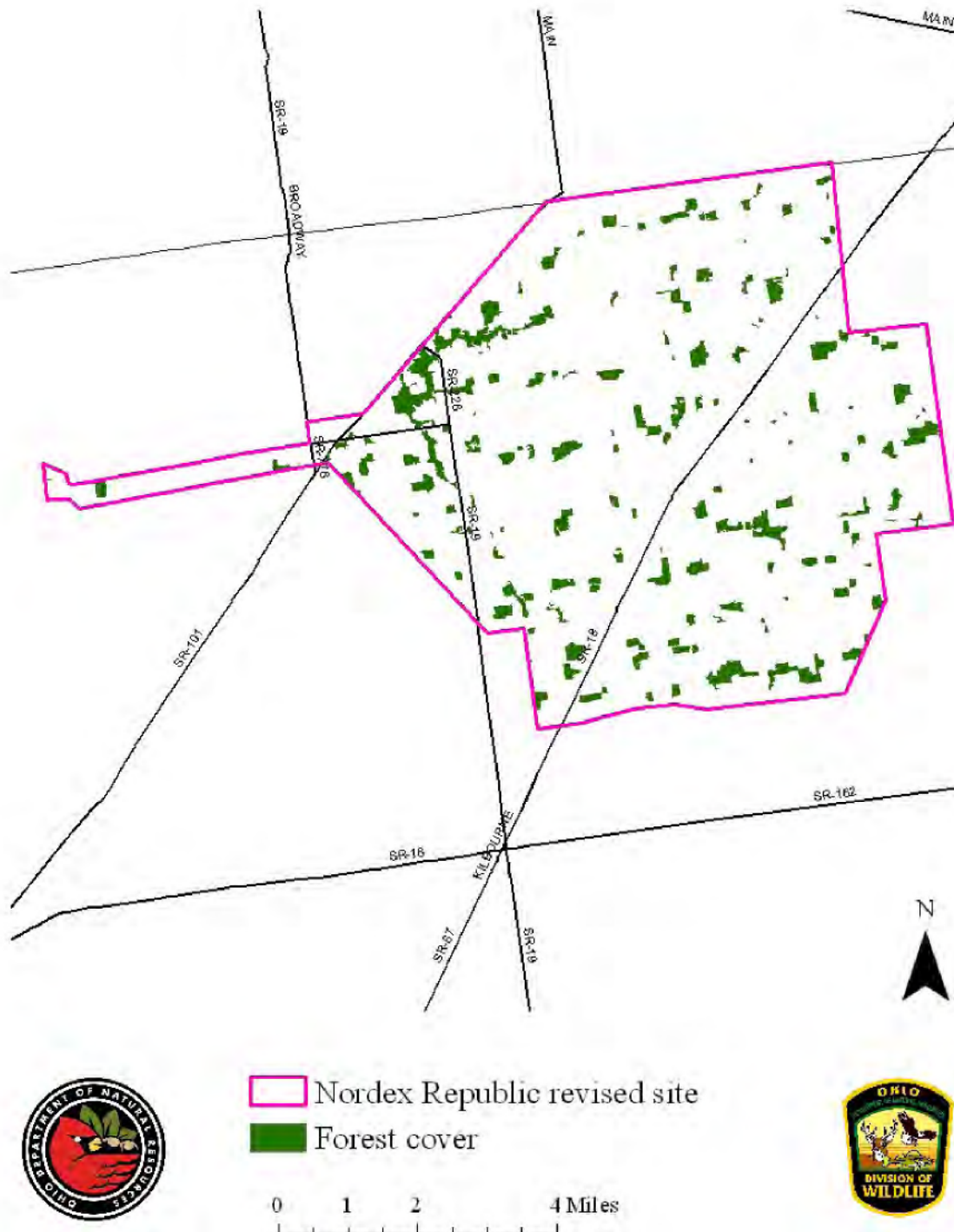


# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Figure 2. Forest cover map with revised boundary for Nordex's proposed Republic project.







# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

## Ohio Division of Wildlife

Vicki J. Mountz, Acting Chief  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
Phone: (614) 265-6300

January 25, 2011

To all interested parties,

Based upon the project boundary map received on 24 January 2011, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for Nordex's proposed project located in Seneca County.

Currently the project falls within regions that DOW has identified as needing moderate (where applicable) monitoring efforts. If the developer decides to amend the boundaries, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or [brian.mitch@dnr.state.oh.us](mailto:brian.mitch@dnr.state.oh.us)

### Project

Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.
Raptor nest monitoring	There is 1 eagle nest located on or within the 2 miles of the proposed project. This pair should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.





# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINI, DIRECTOR

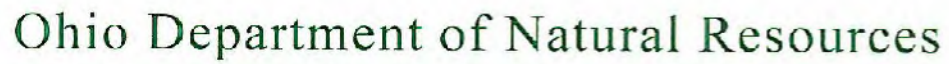
Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	11
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	15
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	NS

NS = Not required based on the lack of suitable habitat.

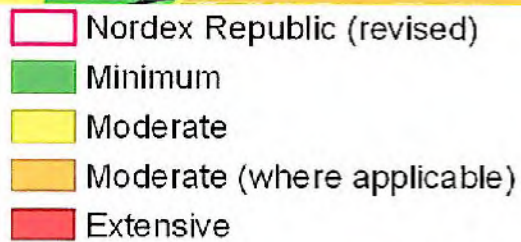
If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist  
Olentangy Wildlife Research Station  
Ohio Division of Wildlife  
8589 Horseshoe Road  
Ashley, OH 43003  
Office phone: 740-747-2525 x 26  
Cell: 419-602-3141  
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service  
Mr. Brian Mitch, Ohio Department of Natural Resources



DAVID MUSTINE, DIRECTOR





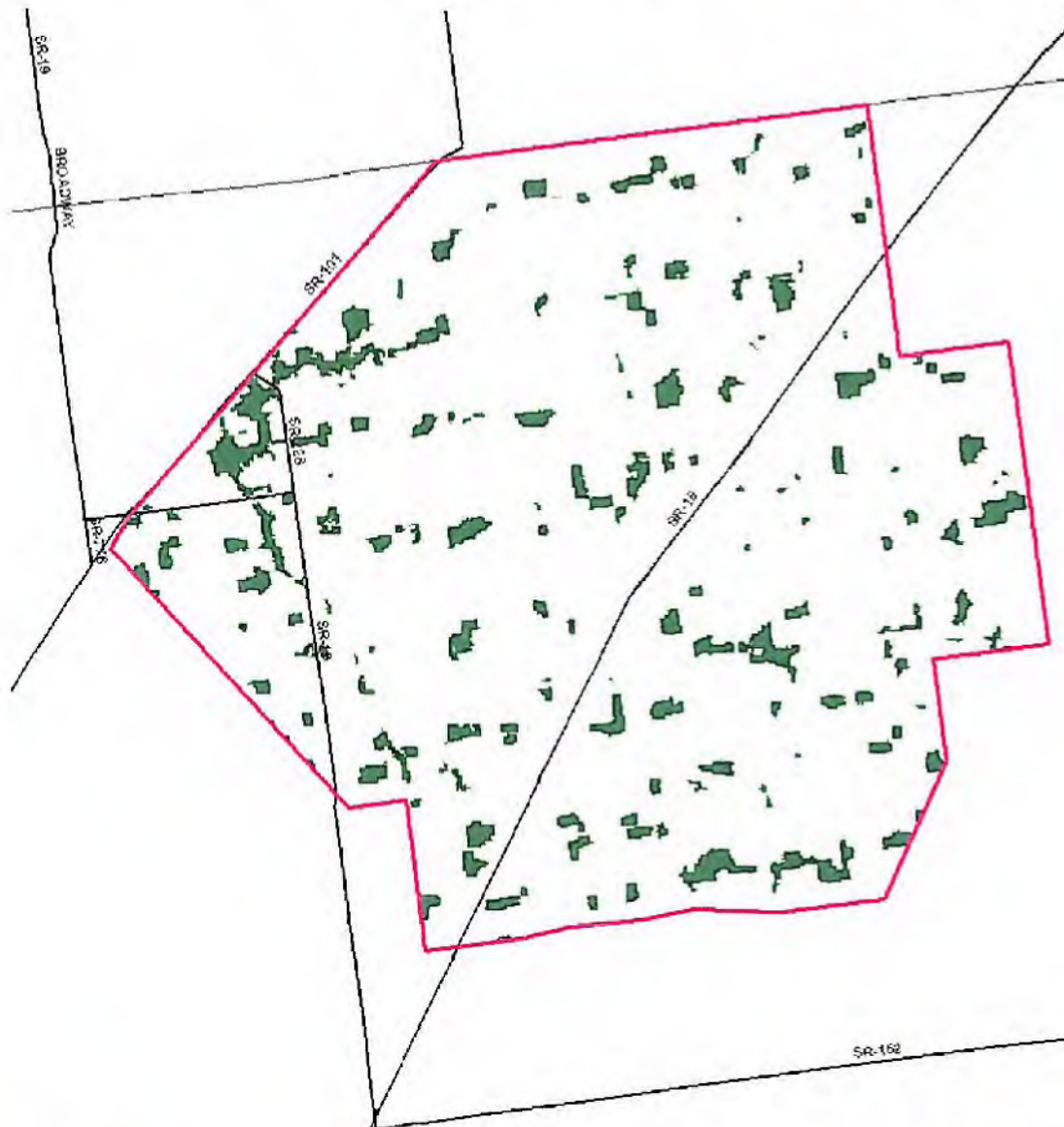




# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Figure 2. Forest cover map with revised boundary for Nordex's proposed Republic project.



 Nordex Republic (revised)  
 Forest cover

0 1 2 4 Miles





# Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR

SEAN D. LOGAN, DIRECTOR

Division of Wildlife  
*David M. Graham, Chief*  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
*Phone: (614) 265-6300*

April 2, 2010

To all interested parties,

Based upon the revised project boundary map received on 2 April 2010, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for the proposed Nordex wind energy project located in Seneca County. After reviewing the project area map provided and site visits conducted within that region, the DOW has determined that this proposed facility would be classified as a "moderate" site under the current monitoring protocols (Fig. 1).

The table below was created based upon the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

Project	
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.



Raptor nest monitoring	There are 2 eagle nests located on or within 2 miles of the proposed project. These pairs should be monitored to assess their daily movement patterns. Should additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.
Bat acoustic monitoring	Acoustic monitoring should be conducted at all meteorological towers.
Passerine migration (# of survey points)	16
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	1
Barn owl surveys	NS
Bat mist-netting (# of survey points)	32
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS

Radar monitoring locations	NS
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NS = Not required based on the lack of suitable habitat.

The DNR looks forward to working with you on this or any other proposed project in the future. If you have any questions, please feel free to contact me.

Keith

Old Woman Creek Nat'l Estuarine Research Reserve and State Nature Preserve  
Ohio Division of Wildlife  
2514 Cleveland Road East  
Huron, OH 44839  
Office phone: 419-433-4601  
Cell: 419-602-3141  
Fax: 419-433-2851

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service

Figure 1.

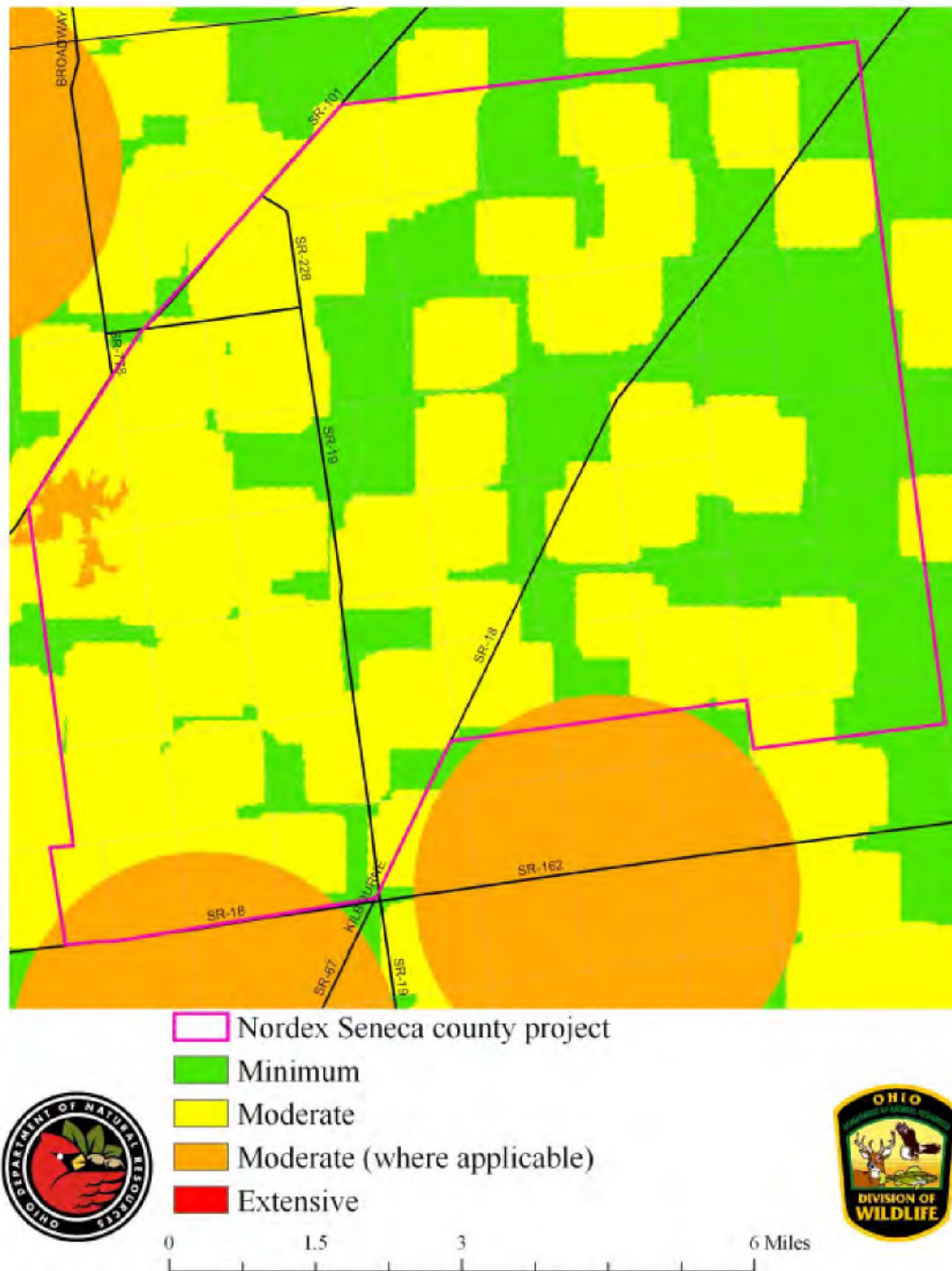
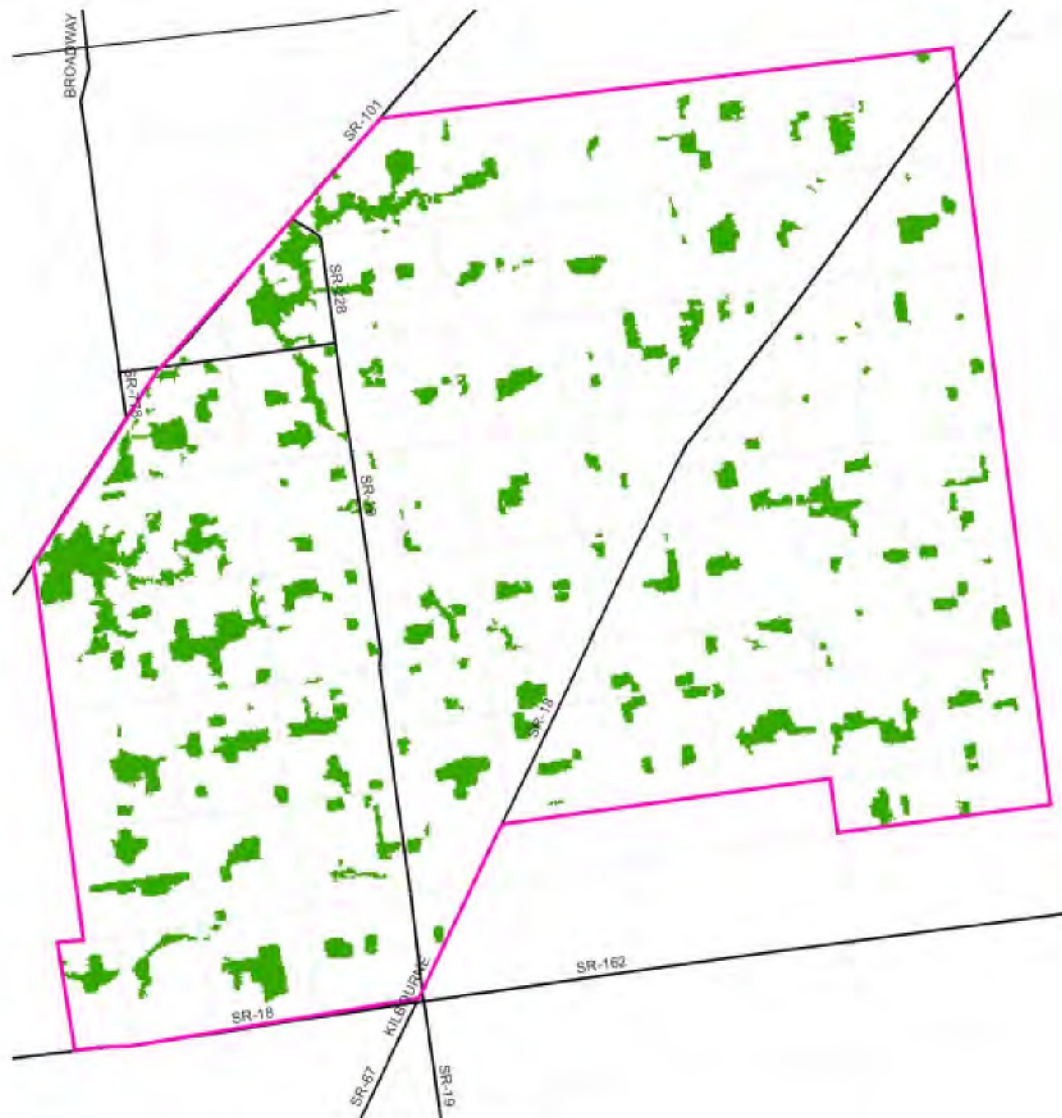


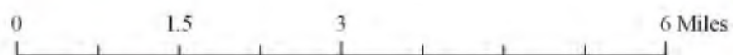


Figure 2.



 Nordex Seneca county project  
 Forest cover





**APPENDIX B**  
Site Photographs



Photo 1. Point 1, facing east.

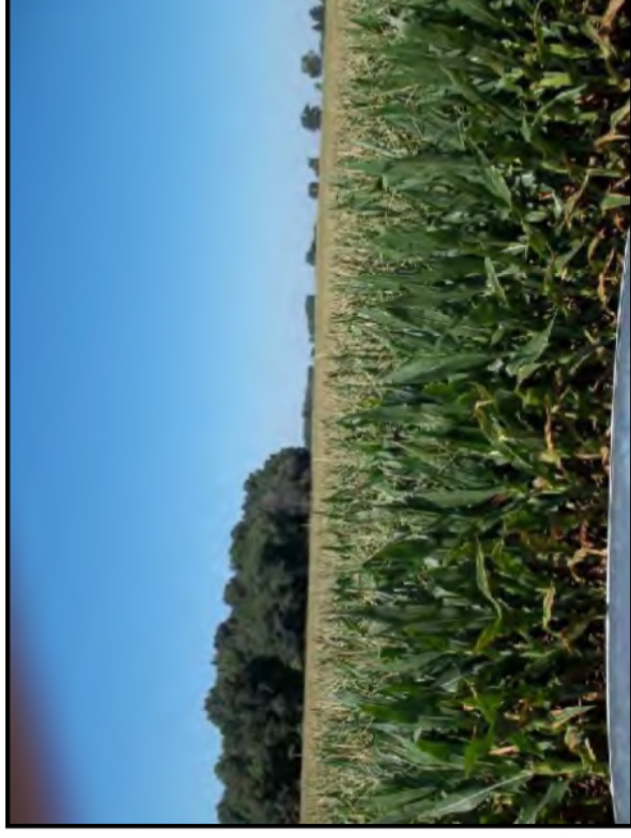


Photo 2. Point 1, facing west.

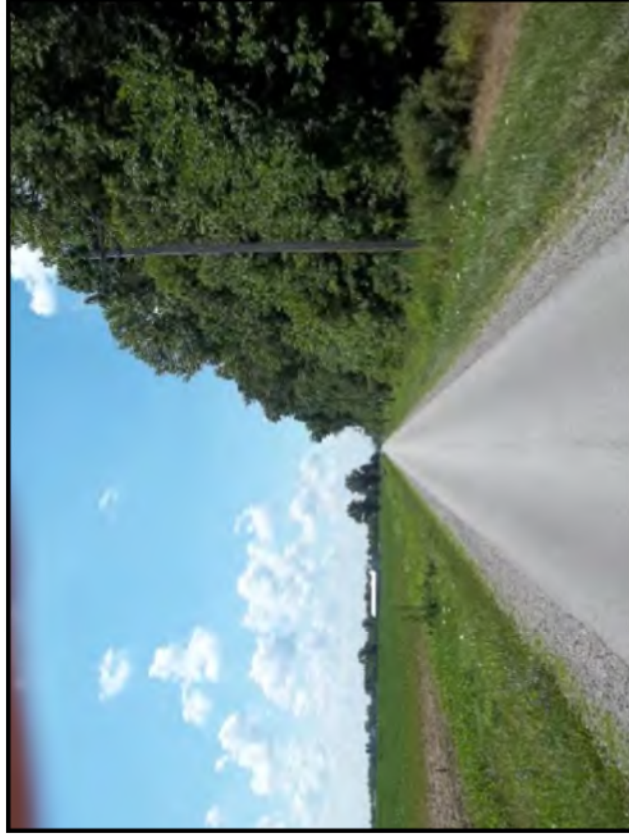


Photo 3. Point 2, facing south.



Photo 4. Point 2, facing west.



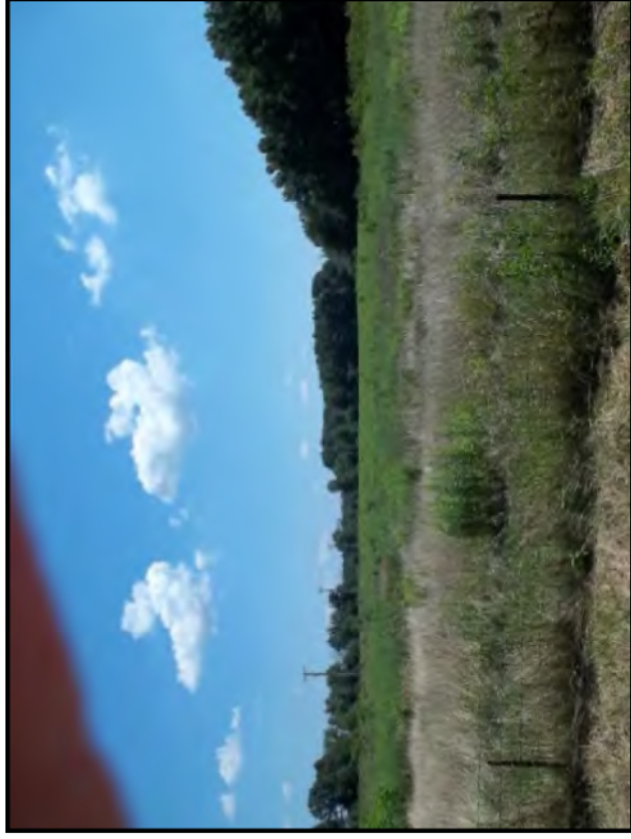


Photo 5. Point 3, facing east.



Photo 6. Point 3, facing west.



Photo 7. Point 4, facing north.



Photo 8. Point 4, facing south.





Photo 9. Point 5, facing north.

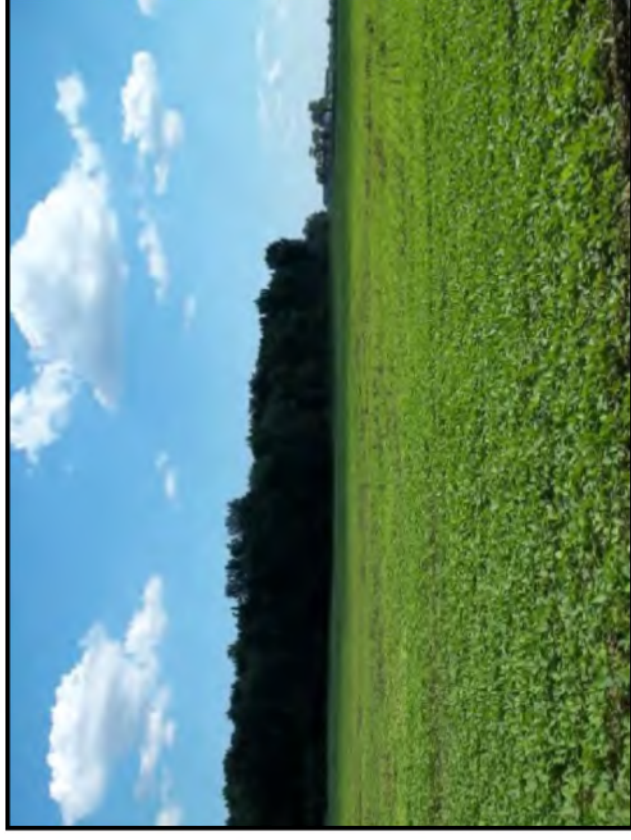


Photo 10. Point 5, facing south.



Photo 11. Point 6, facing east.



Photo 12. Point 6, facing west.





Photo 13. Point 7, facing south.



Photo 14. Point 7, facing west.



Photo 15. Point 8, facing north.



Photo 16. Point 8, facing south.



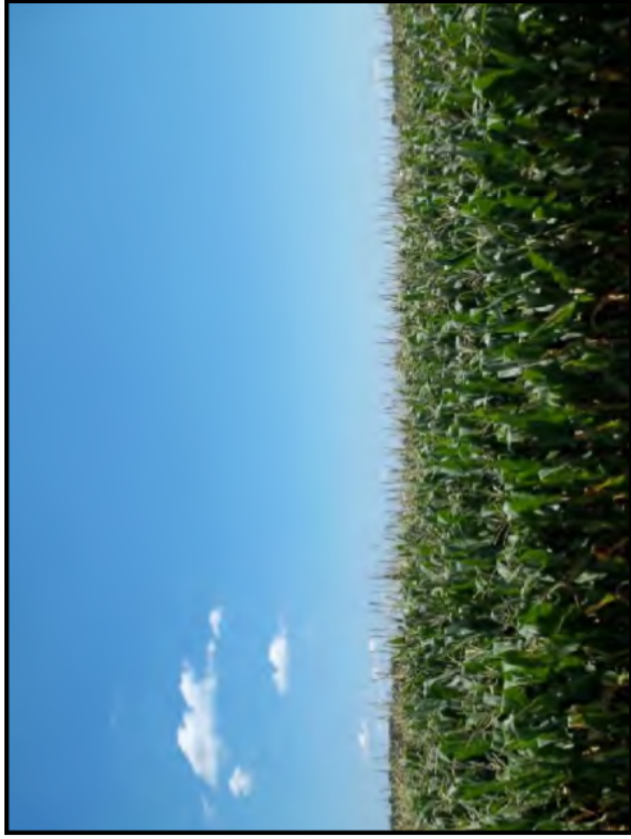


Photo 17. Point 9, facing east.



Photo 18. Point 9, facing west.



Photo 19. Point 10, facing north.



Photo 20. Point 10, facing south.



Photo 21. Point 11, facing east.



Photo 22. Point 11, facing west.



Photo 23. Point 12, facing east.



Photo 24. Point 12, facing west.



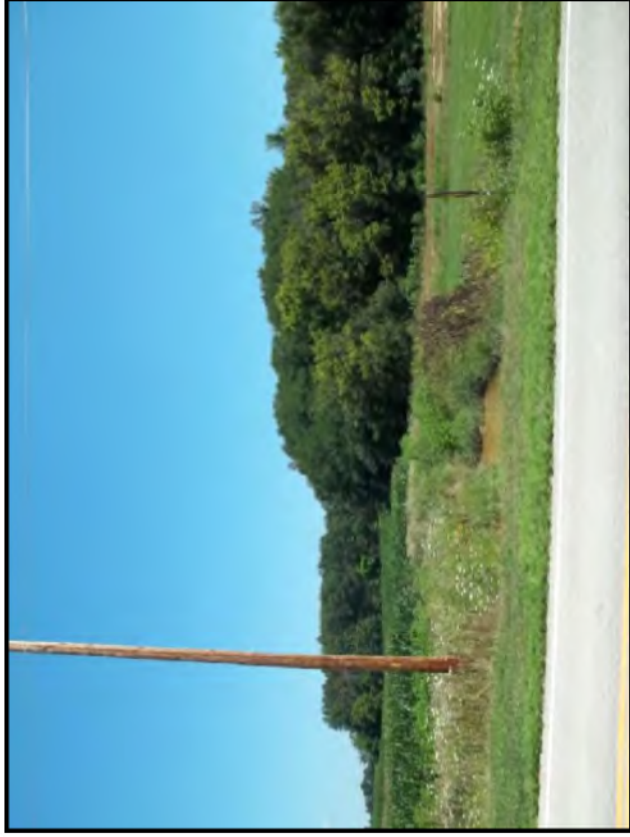


Photo 25. Point 15, facing east.



Photo 26. Point 15, facing west.



Photo 27. Point 16, facing north.

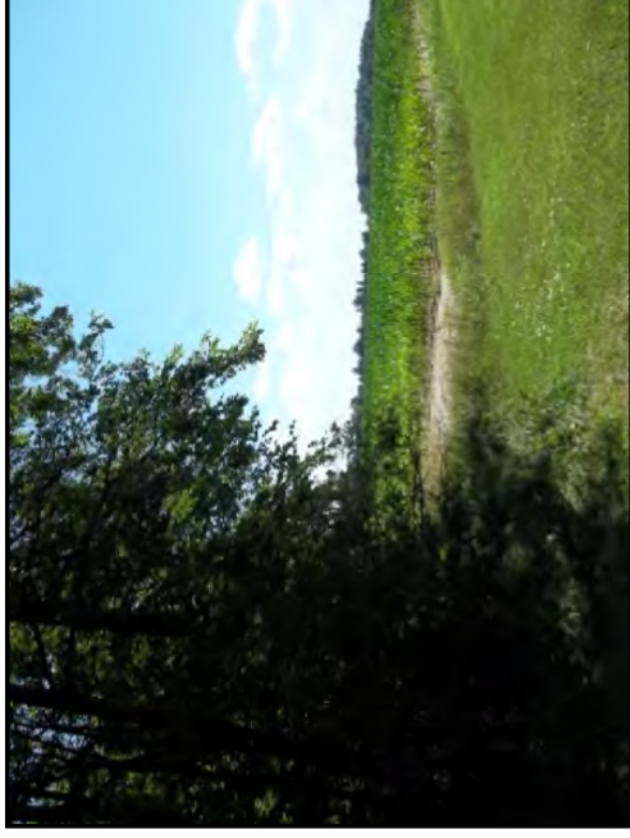


Photo 28. Point 16, facing south.



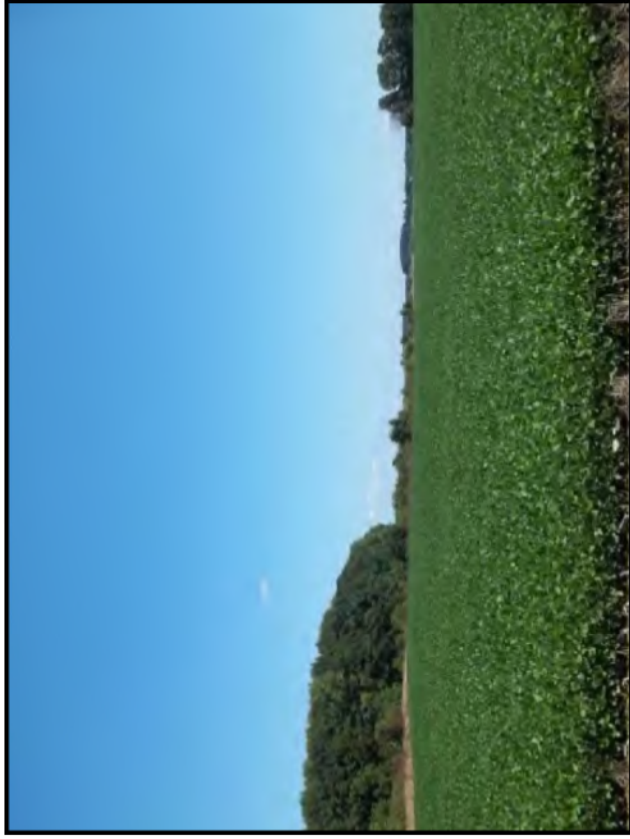


Photo 29. Point 17, facing east.



Photo 30. Point 17, facing west.

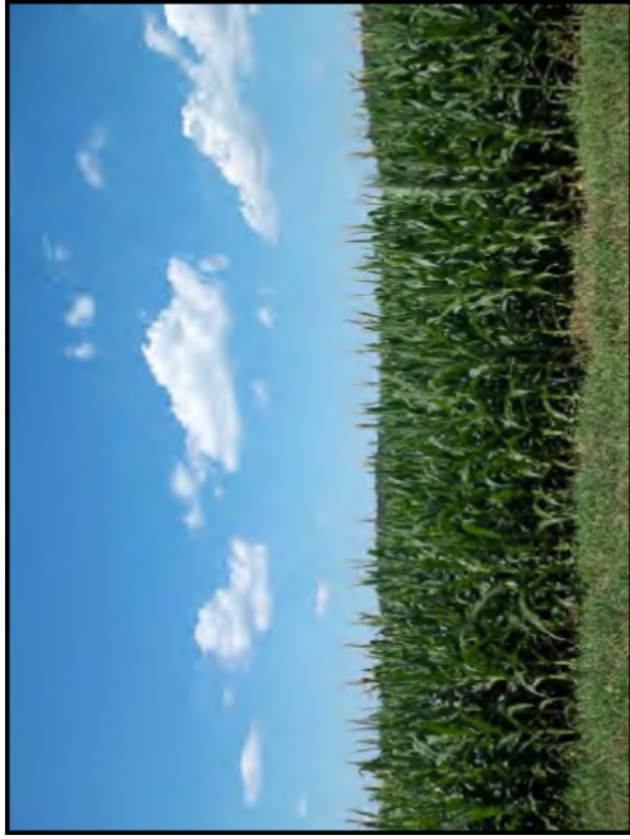


Photo 31. Point 18, facing north.



Photo 32. Point 18, facing south.





Photo 33. Point 19, facing east.



Photo 34. Point 19, facing west.



Photo 35. Point 20, facing east.



Photo 36. Point 20, facing west.





Photo 37. Point 21, facing north.



Photo 38. Point 21, facing south.



Photo 39. Point 22, facing east.

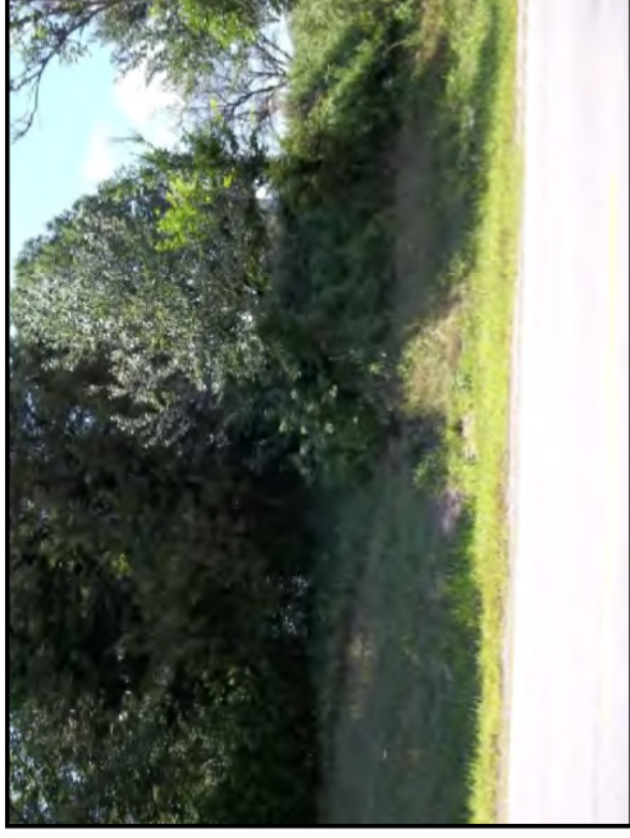


Photo 40. Point 22, facing west.



Photo 41. Point 23, facing east.



Photo 42. Point 23, facing west.



Photo 43. Point 24, facing south.



Photo 44. Point 24, facing west.





Photo 1. Point 1, facing north.



Photo 2. Point 1, facing south.



Photo 3. Point 2, facing north.

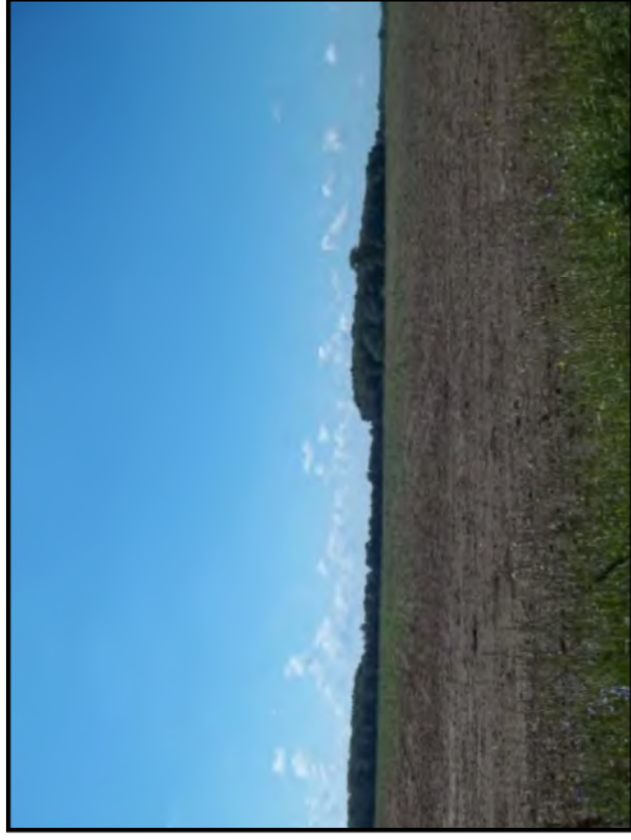


Photo 4. Point 2, facing south.



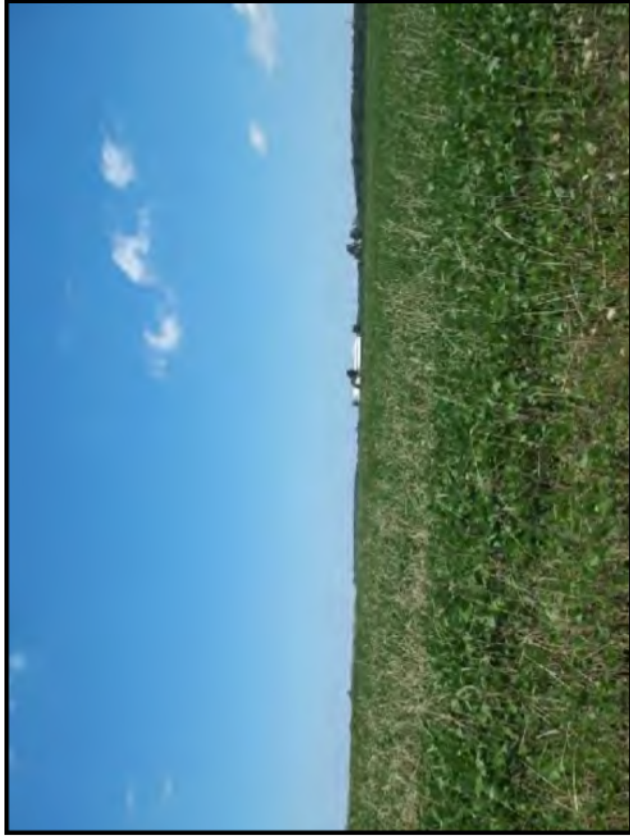


Photo 5. Point 3, facing north.

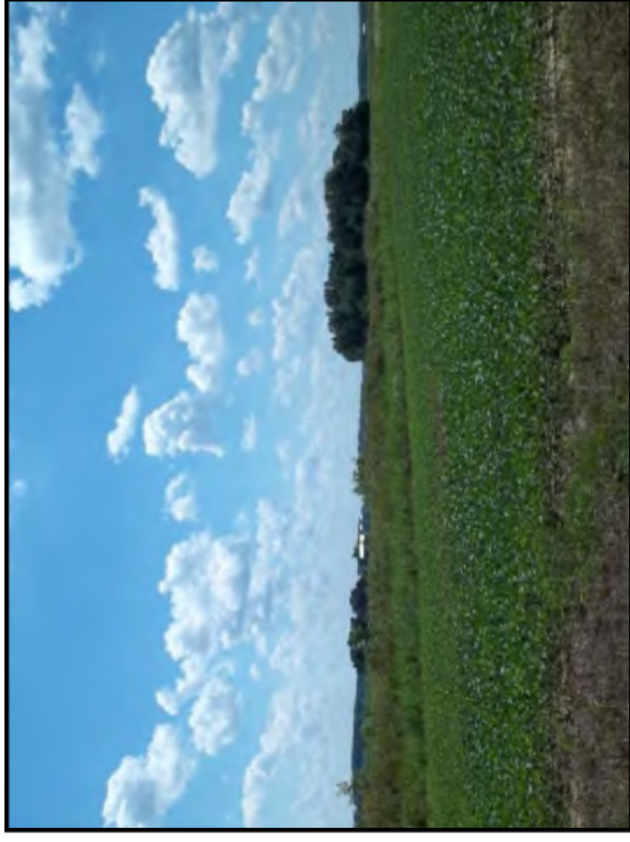


Photo 6. Point 3, facing south.



Photo 7. Point 4, facing north.



Photo 8. Point 4, facing south.



Photo 9. Point 5, facing north.



Photo 10. Point 5, facing south.



Photo 11. Point 6, facing east.



Photo 12. Point 6, facing west.





Photo 13. Point 7, facing north.

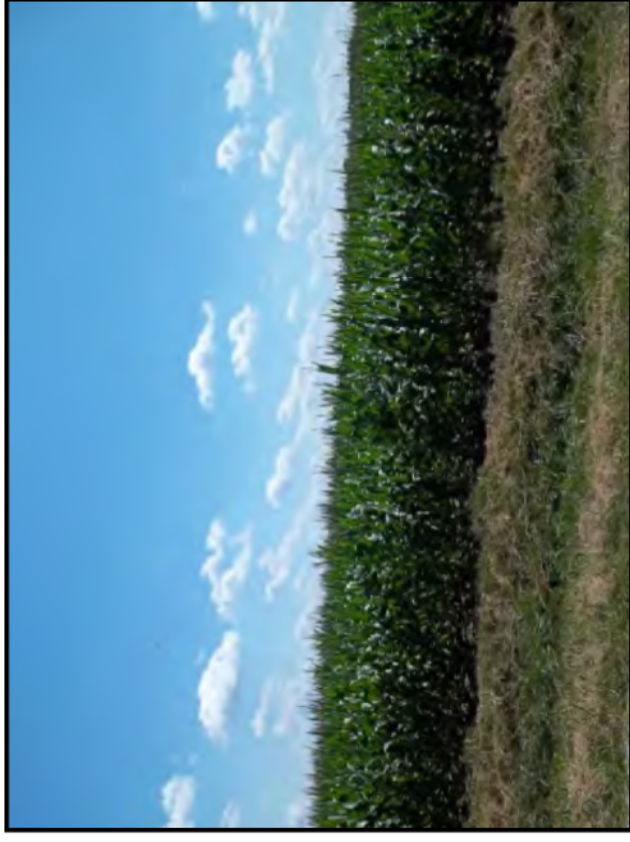


Photo 14. Point 7, facing south.



Photo 15. Point 8, facing north.



Photo 16. Point 8, facing south.



## **APPENDIX C**

**Birds Observed at Republic Wind, LLC Project Area, Seneca and Sandusky Counties, Ohio,  
During Breeding Bird Surveys in May, June, and July 2011**

Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Start	Survey Time Stop	Survey Weather Temp °C	Survey Weather Wind	Conditions Cloud
31-May-2011	1	MODO Mourning Dove	100	North	2		537	546	9	2	35%
		HOLA Horned Lark	60	Northeast	1						
		HOLA Horned Lark	30	Northwest	1						
		AMRO American Robin	50	South	1						
		AMGO American Goldfinch	20	Southwest	4						
		MODO Mourning Dove	50	South	1						
		INBU Indigo Bunting	30	Northwest	1						
		COGR Common Grackle	50	Northeast	5						
		RWBL Red-winged Blackbird	90	Northwest	2						
BHCO Brown-headed Cowbird	5	West	2								
31-May-2011	2	FISP Field Sparrow	60	Northeast	1		555	604	9	0	30%
		HOLA Horned Lark	40	Southwest	1						
		RWBL Red-winged Blackbird	20	Northeast	4						
		RBWO Red-bellied Woodpecker	100	East	1						
		SOSP Song Sparrow	10	North	1						
		INBU Indigo Bunting	25	Northwest	1						
COGR Common Grackle	60	Northwest	1								
31-May-2011	3	GRCA Gray Catbird	50	Northwest	1		616	625	10	2	25%
		NOCA Northern Cardinal	50	West	1						
		NOFL Northern Flicker	50	Southeast	1						
		ETTI Tufted Titmouse	50	East	1						
		NOCA Northern Cardinal	100	Northwest	1						
		COGR Common Grackle	20	North	4						
		RWBL Red-winged Blackbird	40	South	2						
		AMRO American Robin	20	Southwest	1						
AMRO American Robin	50	North	1								
31-May-2011	4	AMCR American Crow	100	Southwest	1		636	645	10	0	25%
		REVI Red-eyed Vireo	50	Northeast	1						
		HOLA Horned Lark	40	Southwest	1						
		RWBL Red-winged Blackbird	40	Northeast	1						
		SOSP Song Sparrow	30	West	1						
		EUST European Starling	60	South	7						
		BRNS Barn Swallow	15	West	2						
		COGR Common Grackle	40	East	3						
		RWBL Red-winged Blackbird	30	Southwest	2						
31-May-2011	5	COHA Cooper's Hawk	30	South	1		656	705	11	0	20%
		COGR Common Grackle	10	Southwest	1						
		GRCA Gray Catbird	10	North	1						
		COGR Common Grackle	30	North	2						
		BHCO Brown-headed Cowbird	50	North	1						
		AMRO American Robin	15	South	1						
		HOWR House Wren	80	South/Southwest	1						
		HOFL House Finch	20	North/Northwest	2						
31-May-2011	6	KILL Killdeer	50	East	1		717	726	11	2	20%
		AMRO American Robin	80	North	1						
		COGR Common Grackle	90	East	4						
		SOSP Song Sparrow	30	West	1						
		WOTH Wood Thrush	90	North	1						
		SAVS Savannah Sparrow	40	West	1						
		SAVS Savannah Sparrow	30	North	1						
		HOWR House Wren	20	West	1						
31-May-2011	7	RBGR Rose-breasted Grosbeak	20	North	1		739	748	12	0	20%
		BLIA Blue Jay	60	West	2						
		AMRO American Robin	30	North	1						
		INBU Indigo Bunting	20	South	1						
		WOTH Wood Thrush	30	Northeast	1						
		EWPE Eastern Wood Peewee	70	North	1						
SOSP Song Sparrow	10	South	1								
31-May-2011	8	HOSP House Sparrow	50	North	5		757	806	12	2	20%
		WOTH Wood Thrush	80	Northwest	1						
		RWBL Red-winged Blackbird	50	West	1						
		VESP Vesper Sparrow	30	West	1						
		RBWO Red-bellied Woodpecker	20	North	1						
		RHWO Red-headed Woodpecker	35	West	1						
		EUST European Starling	25	West	6						
		FISP Field Sparrow	60	Northwest	1						
SAVS Savannah Sparrow	50	Northwest	1								
31-May-2011	9	MODO Mourning Dove	40	North	2		818	827	12	0	10%
		MODO Mourning Dove	50	South	1						
		BHCO Brown-headed Cowbird	50	North	1						
		EUST European Starling	70	South	12						
		SAVS Savannah Sparrow	20	South	1						
		HOLA Horned Lark	30	East	2						
		HOSP House Sparrow	60	North	4						
		RWBL Red-winged Blackbird	50	Southwest	3						
NOCA Northern Cardinal	10	West	1								
31-May-2011	10	HOLA Horned Lark	30	Northwest	1		837	846	12	7	10%
		BRNS Barn Swallow	30	Northwest	2						
		CHSP Chipping Sparrow	50	North	1						
		SOSP Song Sparrow	50	Northwest	1						
		CHSW Chimney Swift	20	North	2						
		AMCR American Crow	100	Southwest	3						
		HOSP House Sparrow	20	East	3						
		BCCH Black-capped Chickadee	20	West	1						
MODO Mourning Dove	30	North	2								
31-May-2011	11	WOTH Wood Thrush	110	West	1		858	907	14	2	10%
		RWBL Red-winged Blackbird	80	Northwest	3						
		BOBO Bobolink	70	South	1						
		SAVS Savannah Sparrow	20	East	1						
		COGR Common Grackle	70	Northwest	1						
		HOLA Horned Lark	20	West	1						
		EAME Eastern Meadowlark	20	East	1						
		EAME Eastern Meadowlark	40	Southeast	1						
		EAME Eastern Meadowlark	50	Southwest	1						
		GRSP Grasshopper Sparrow	30	Northwest	1						
		RWBL Red-winged Blackbird	50	South	1						
RWBL Red-winged Blackbird	30	East	4								



Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
							Start	Stop	Temp °	Wind	Cloud
31-May-2011	12	RBGR Rose-breasted Grosbeak	30	Northwest	1		915	924	14	0	10%
		FISP Field Sparrow	60	Northeast	1						
		HOLA Horned Lark	20	Northeast	1						
		EABL Eastern Bluebird	50	Northwest	1						
		BLJA Blue Jay	60	East	1						
		AMCR American Crow	40	Northeast	22						
2-Jun-2011	13	RBWO Red-bellied Woodpecker	60	North	1		545	554	12	7	60%
		AMCR American Crow	100	Southwest	2						
		KILL Killdeer	30	Northeast	1						
		RWBL Red-winged Blackbird	15	West	1						
		COGR Common Grackle	30	East	2						
		SOSP Song Sparrow	25	Northwest	1						
2-Jun-2011	14	COGR Common Grackle	50	North	1		603	612	12	2	60%
		AMRO American Robin	40	South	1						
		FISP Field Sparrow	30	South	1						
		BHCO Brown-headed Cowbird	20	South	2						
		SOSP Song Sparrow	50	Southeast	1						
		AMCR American Crow	100	Northwest	3						
2-Jun-2011	15	CHSP Chipping Sparrow	20	Northwest	2		621	630	13	0	50%
		BAOR Baltimore Oriole	60	Southwest	1						
		AMRO American Robin	30	South	1						
		GRCA Gray Catbird	15	Northwest	1						
		INBU Indigo Bunting	40	West	1						
		REVI Red-eyed Vireo	40	West	1						
2-Jun-2011	16	RBWO Red-bellied Woodpecker	40	East	1		642	651	13	2	50%
		AMCR American Crow	90	Northwest	1						
		SOSP Song Sparrow	50	Northwest	1						
		NOFL Northern Flicker	40	West	1						
		WOTH Wood Thrush	80	South	1						
		EABL Eastern Bluebird	50	North	2						
2-Jun-2011	17	INBU Indigo Bunting	25	South	1		701	720	14	0	40%
		SOSP Song Sparrow	30	Southwest	1						
		CHSP Chipping Sparrow	40	West	1						
		AMCR American Crow	80	Northwest	3						
		RWBL Red-winged Blackbird	20	South	4						
		SCTA Scarlet Tanager	30	West	1						
2-Jun-2011	18	BCCB Black-capped Chickadee	20	Southwest	1		729	738	14	0	30%
		ETTI Tufted Titmouse	30	South	1						
		GCFL Great Crested Flycatcher	50	West	1						
		BAOR Baltimore Oriole	80	Northeast	1						
		AMCR American Crow	90	South	3						
		AMGO American Goldfinch	30	West	3						
2-Jun-2011	19	INBU Indigo Bunting	30	West	1		747	756	14	2	30%
		AMRO American Robin	40	Northeast	1						
		RWBL Red-winged Blackbird	50	Northwest	6						
		KILL Killdeer	20	Southeast	1						
		HOLA Horned Lark	30	West	1						
		AMRO American Robin	40	West	1						
2-Jun-2011	20	EABL Eastern Bluebird	20	Southwest	2		803	812	15	0	25%
		AMGO American Goldfinch	10	Southwest	4						
		EUST European Starling	30	West	3						
		RBGR Rose-breasted Grosbeak	15	South	1						
		RHWO Red-headed Woodpecker	20	South	1						
		CHSP Chipping Sparrow	50	Northwest	1						
2-Jun-2011	21	AMRO American Robin	40	Southwest	1		821	830	15	2	25%
		COGR Common Grackle	30	West	1						
		AMRO American Robin	20	South	1						
		SOSP Song Sparrow	30	Northwest	1						
		AMCR American Crow	20	North	1						
		EAME Eastern Meadowlark	30	Northeast	1						
2-Jun-2011	22	HOLA Horned Lark	40	North	1		838	847	15	0	25%
		NOCA Northern Cardinal	40	Southwest	1						
		SOSP Song Sparrow	20	Southeast	1						
		AMRO American Robin	15	West	1						
		AMCR American Crow	20	North	1						
		BCCB Black-capped Chickadee	20	West	1						
2-Jun-2011	23	SOSP Song Sparrow	40	Northwest	1		858	907	16	0	20%
		AMRO American Robin	15	Southwest	1						
		COGR Common Grackle	25	West	1						
		HOFI House Finch	50	Northeast	5						
		CHSP Chipping Sparrow	30	North	1						
		SOSP Song Sparrow	20	West	1						
2-Jun-2011	24	INBU Indigo Bunting	50	North	1		915	924	16	2	20%
		BLJA Blue Jay	80	West	1						
		RWBL Red-winged Blackbird	50	Southwest	1						
		SAVS Savannah Sparrow	30	South	1						
		HOWR House Wren	30	Southeast	1						
		AMRO American Robin	50	North/Northeast	1						
2-Jun-2011	25	AMGO American Goldfinch	20	South	1		915	924	16	2	20%
		BLJA Blue Jay	50	East	1						
		COGR Cooper's Hawk	20	North	1						
		INBU Indigo Bunting	20	East	1						
		AMRO American Robin	60	Southwest	1						
		RWBL Red-winged Blackbird	40	Southwest	1						
2-Jun-2011	26	RWBL Red-winged Blackbird	70	North	5		915	924	16	2	20%
		COGR Common Grackle	15	South	1						
		HOLA Horned Lark	20	Northwest	1						
		BLJA Blue Jay	30	Northwest	1						
		AMRO American Robin	60	Southwest	1						
		RWBL Red-winged Blackbird	40	Southwest	1						

Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather		Conditions						
							Start	Stop	Temp °	Wind	Cloud						
13-Jun-2011	1	HOLA Horned Lark	30	Northeast	2		530	539	11	2	95						
		HOWR House Wren	100	North	1												
		HOLA Horned Lark	50	Southeast	1												
		AMRO American Robin	110	Northwest	1												
		MODO Mourning Dove	100	North	1												
		SOSP Song Sparrow	70	South	1												
		AMRO American Robin	70	Southeast	1												
		AMGO American Goldfinch	40	Southwest	3												
		AMRO American Robin	30	South	1												
MODO Mourning Dove	50	South	1														
13-Jun-2011	2	SOSP Song Sparrow	5	North	1		544	553	12	2	85%						
		INBU Indigo Bunting	20	Northwest	1												
		AMRO American Robin	100	North	1												
		AMGO American Goldfinch	20	South	1												
		FISP Field Sparrow	70	Northeast	1												
		HOLA Horned Lark	50	Northwest	1												
		COGR Common Grackle	70	Northwest	1												
		RBWO Red-bellied Woodpecker	120	East	1												
		HOLA Horned Lark	40	Southwest	1												
MODO Mourning Dove	100	North	1														
13-Jun-2011	3	AMRO American Robin	30	West	1		558	607	12	2	85%						
		EATO Eastern Towhee	40	Southeast	1												
		NOCA Northern Cardinal	50	West	1												
		NOCA Northern Cardinal	90	Northwest	1												
		ETTI Tufted Titmouse	40	East	1												
		GRCA Gray Catbird	60	Northwest	1												
		NOFL Northern Flicker	50	East/Southeast	1												
		SOSP Song Sparrow	50	Northeast	1												
		RTHA Red-tailed Hawk	60	Northeast	1												
13-Jun-2011	4	EATO Eastern Towhee	30	Northeast	2		611	620	12	2	40%						
		HOLA Horned Lark	40	Southwest	2												
		REVI Red-eyed Vireo	60	Northeast	1												
		RWBL Red-winged Blackbird	50	Northeast	1												
		AMCR American Crow	110	Southwest	3												
		SOSP Song Sparrow	30	West	1												
		HOLA Horned Lark	30	South	2												
		BRNS Barn Swallow	10	West	1												
		EUST European Starling	70	South	4												
COGR Common Grackle	30	East	2														
13-Jun-2011	5	GRCA Gray Catbird	5	North	1		624	633	12	40							
		COGR Common Grackle	5	West	1												
		AMRO American Robin	20	East	1												
		COGR Common Grackle	50	Southwest	1												
		HOWR House Wren	70	South	1												
		COGR Common Grackle	15	North	1												
		AMRO American Robin	10	South	2												
		COGR Common Grackle	15	South	2												
		BHCO Brown-headed Cowbird	10	West	2												
HOFL House Finch	10	North	3														
13-Jun-2011	6	SOSP Song Sparrow	30	West	1		638	647	12	2	60%						
		AMRO American Robin	90	North	1												
		AMRO American Robin	80	East	1												
		WOTH Wood Thrush	100	Northwest	1												
		SAVS Savannah Sparrow	40	West	1												
		KILL Killdeer	60	East	1												
		COGR Common Grackle	100	East	5												
		RWBL Red-winged Blackbird	40	North	1												
		13-Jun-2011	7	WOTH Wood Thrush	25	Northeast						1		652	701	12	2
AMGO American Goldfinch	20			East	1												
INBU Indigo Bunting	15			South	1												
SOSP Song Sparrow	10			South	2												
BLJA Blue Jay	70			West	2												
BHVI Blue-headed Vireo	50			West	1												
AMRO American Robin	40			North	1												
13-Jun-2011	8	RHWO Red-headed Woodpecker	40	West	1		706	715	13	0	70%						
		VESP Vesper Sparrow	30	West	1												
		RWBL Red-winged Blackbird	20	South	2												
		WOTH Wood Thrush	90	Northwest	1												
		KILL Killdeer	50	Northwest	1												
		EUST European Starling	40	Northeast	1												
		HOSP House Sparrow	70	North	7												
		FISP Field Sparrow	60	Northwest	1												
		SAVS Savannah Sparrow	40	Northwest	1												
		RWBL Red-winged Blackbird	50	West	1												
		EUST European Starling	30	West	2												
13-Jun-2011	9	SAVS Savannah Sparrow	15	South	2		719	728	13	2	65%						
		GBHE Great Blue Heron	70	West	4												
		GRSP Grasshopper Sparrow	20	Southeast	1												
		MODO Mourning Dove	50	South	1												
		MODO Mourning Dove	30	North	1												
		HOLA Horned Lark	25	East	2												
		HOSP House Sparrow	70	North	3												
		BHCO Brown-headed Cowbird	40	North	1												
		SOSP Song Sparrow	50	South	1												
		RWBL Red-winged Blackbird	40	Southwest	2												
		EUST European Starling	80	South	18												
13-Jun-2011	10	BRNS Barn Swallow	10	North	2		734	743	13	0	50%						
		EUST European Starling	15	West	1												
		MODO Mourning Dove	20	North	1												
		WBNU White-breasted Nuthatch	30	West	1												
		AMCR American Crow	150	South	2												
		HOSP House Sparrow	10	East	3												
		CHSP Chipping Sparrow	60	North	1												
		SOSP Song Sparrow	50	Northwest	1												
13-Jun-2011	11	EAME Eastern Meadowlark	30	Northeast	1		748	757	14	0	60%						
		RWBL Red-winged Blackbird	10	East	1												
		SAVS Savannah Sparrow	15	East	1												
		HOLA Horned Lark	15	West	1												
		RWBL Red-winged Blackbird	70	Northwest	2												



Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time Start	Survey Time Stop	Survey Temp °C	Survey Wind	Survey Conditions Cloud
13-Jun-2011	11	COGR Common Grackle	70	North	1		748	757	14	0	60%
		RWBL Red-winged Blackbird	80	South	1						
		GRSP Grasshopper Sparrow	25	Northwest	1						
		TUVU Turkey Vulture	100	South	2						
		BOBO Bobolink	70	South	2						
		RWBL Red-winged Blackbird	50	Southwest	2						
13-Jun-2011	12	BLIA Blue Jay	40	West	1		804	813	14	0	60%
		BLIA Blue Jay	70	East	1						
		HOLA Horned Lark	30	Northeast	1						
		FISP Field Sparrow	50	Northeast	1						
		AMRO American Robin	60	North	1						
		EABL Eastern Bluebird	50	Northwest	1						
		SAVS Savannah Sparrow	40	North	1						
		RBWO Red-bellied Woodpecker	90	Northwest	1						
14-Jun-2011	13	KILL Killdeer	20	West	1		534	543	9	11	100%
		RWBL Red-winged Blackbird	10	West	1						
		RWBL Red-winged Blackbird	10	East	2						
		AMCR American Crow	120	Southwest	4						
		COGR Common Grackle	40	East	3						
		KILL Killdeer	40	Northeast	1						
		AMRO American Robin	100	South	1						
		SOSP Song Sparrow	30	Northwest	1						
14-Jun-2011	14	ETIT Tufted Titmouse	110	Southeast	1		554	603	9	12	100%
		GRCA Gray Catbird	10	North	1						
		AMRO American Robin	40	South	1						
		BHCO Brown-headed Cowbird	5	South	1						
		FISP Field Sparrow	30	South	1						
		AMCR American Crow	100	Northwest	1						
		SOSP Song Sparrow	60	Southeast	1						
		BAOR Baltimore Oriole	70	Southwest	1						
		WITU Wild Turkey	50	South	1						
		EAKI Eastern Kingbird	30	East	1						
		CANG Canada Goose	10	West	37						
		CHSP Chipping Sparrow	15	Northwest	2						
14-Jun-2011	15	CHSP Chipping Sparrow	20	North	1		614	623	9	7	100%
		EABL Eastern Bluebird	60	North	2						
		RBWO Red-bellied Woodpecker	40	East	1						
		RWBL Red-winged Blackbird	5	East	2						
		REVI Red-eyed Vireo	50	East	1						
		SOSP Song Sparrow	20	East	1						
		NOFL Northern Flicker	50	West	1						
		WOTH Wood Thrush	80	Southeast	1						
		REVI Red-eyed Vireo	50	West	1						
		ACFL Acadian Flycatcher	40	West	1						
		AMCR American Crow	100	Northwest	1						
		INBU Indigo Bunting	40	West	1						
		SOSP Song Sparrow	50	Northwest	1						
		SCTA Scarlet Tanager	5	West	1	Female feeding young					
14-Jun-2011	16	RWBL Red-winged Blackbird	15	South	7		635	644	10	7	100%
		AMCR American Crow	90	North	1						
		NOCA Northern Cardinal	60	East/Northeast	1						
		SOSP Song Sparrow	25	Southwest	1						
		EWPE Eastern Wood Peewee	40	East/Southeast	1						
		CHSP Chipping Sparrow	30	West	1						
14-Jun-2011	17	HOLA Horned Lark	5	West	1		653	702	10	2	100%
		COGR Common Grackle	5	Southwest	1						
		AMRO American Robin	25	North	1						
		AMCR American Crow	120	Southwest	2						
		KILL Killdeer	15	Southeast	1						
		INBU Indigo Bunting	50	West	1						
		AMGO American Goldfinch	40	West	2						
		BAOR Baltimore Oriole	90	East/Northeast	1						
		GCFL Great Crested Flycatcher	60	West	1						
		RWBL Red-winged Blackbird	40	Northwest	1						
		WIFL Willow Flycatcher	50	Northeast	1						
		COYE Common Yellowthroat	60	East/Northeast	1						
14-Jun-2011	18	RHWO Red-headed Woodpecker	10	Southwest	2		717	726	11	0	100%
		RBGR Rose-breasted Grosbeak	5	Southwest	2						
		AMGO American Goldfinch	10	Southwest	2						
		KILL Killdeer	60	East	2						
		COGR Common Grackle	20	West	1						
		EUST European Starling	20	West	22						
		EABL Eastern Bluebird	15	Southwest	2						
		EUST European Starling	30	West	2						
		HOLA Horned Lark	40	North	1						
		AMRO American Robin	50	Southwest	1						
		AMCR American Crow	60	Southwest	1						
		CHSP Chipping Sparrow	40	Northwest	1						
14-Jun-2011	19	KILL Killdeer	15	North	1		737	746	11	13	100%
		COGR Common Grackle	25	Northwest	1						
		RWBL Red-winged Blackbird	30	West	1						
		HOLA Horned Lark	30	East	1						
		SAVS Savannah Sparrow	10	North	2						
14-Jun-2011	20	AMCR American Crow	20	East	24		755	804	11	7	90%
		HOLA Horned Lark	30	West	1						
		HOSP House Sparrow	50	South	6						
		MODO Mourning Dove	80	South	5						
		CHSP Chipping Sparrow	40	Southeast	1						
		SAVS Savannah Sparrow	25	East	1						
14-Jun-2011	21	AMRO American Robin	80	South/Southeast	1		819	828	11	7	100%
		NOCA Northern Cardinal	50	Southwest	1						
		AMRO American Robin	50	South	1						
		SOSP Song Sparrow	30	Southeast	1						
		HOLA Horned Lark	40	North	1						
14-Jun-2011	22	EAME Eastern Meadowlark	5	Northeast	1		839	848	12	0	90%
		AMRO American Robin	5	East	1						
		AMRO American Robin	20	Southwest	1						
		BCCH Black-capped Chickadee	10	West	1						
		SOSP Song Sparrow	55	East	1						
		CHSP Chipping Sparrow	30	Northwest	1						
14-Jun-2011		SOSP Song Sparrow	25	Southeast	1						
		SOSP Song Sparrow	25	Southeast	1						

Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time Start	Survey Time Stop	Survey Weather Temp °	Survey Weather Wind	Survey Weather Conditions Cloud
14-Jun-2011	22	NOCA Northern Cardinal	25	Northwest	1		839	848	12	0	90%
		HOFI House Finch	50	Northeast	1						
		COGR Common Grackle	30	West	1						
		INBU Indigo Bunting	50	North	1						
		COYE Common Yellowthroat	60	Northeast	1						
14-Jun-2011	23	COGR Common Grackle	20	North	1		839	848	12	0	90%
		COGR Common Grackle	30	North	1						
		HOWR House Wren	25	Southeast	1						
		CHSW Chimney Swift	10	East	1						
		AMGO American Goldfinch	15	South	1						
		SOSP Song Sparrow	25	South	1						
		AMRO American Robin	60	North	1						
		RWBL Red-winged Blackbird	55	North	1						
		BLJA Blue Jay	90	West	1						
		RWBL Red-winged Blackbird	60	Southwest	1						
14-Jun-2011	24	HOSP House Sparrow	30	Southeast	4		900	909	13	2	90%
		NOFL Northern Flicker	100	Northwest	1						
		TUVU Turkey Vulture	30	South	1						
		AMRO American Robin	50	Southwest	1						
		RWBL Red-winged Blackbird	60	Northwest	1						
27-Jun-11	1	REVI Red-eyed Vireo	70	Southwest	1		538	547	50	2	5%
		AMRO American Robin	90	Northwest	1						
		HOWR House Wren	80	West	1						
		AMRO American Robin	70	South	1						
		SAVS Savannah Sparrow	40	Southeast	1						
		HOSP House Sparrow	5	South	3						
		AMGO American Goldfinch	80	West	3						
		HOLA Horned Lark	30	East	2						
		DICK Dickcissel	30	South	1						
		INBU Indigo Bunting	70	South	1						
27-Jun-11	2	COGR Common Grackle	30	Northeast	1		557	606	12	0	5%
		HOLA Horned Lark	40	East	1						
		INBU Indigo Bunting	20	West	1						
		INBU Indigo Bunting	60	South	1						
		SOSP Song Sparrow	70	Northeast	1						
		SAVS Savannah Sparrow	40	Southeast	1						
		NOCA Northern Cardinal	120	South/Southeast	1						
		RTHA Red-tailed Hawk	30	Southwest	1						
		AMRO American Robin	30	West	1						
		AMCR American Crow	70	Southwest	1						
27-Jun-11	3	ETTI Tufted Titmouse	40	Southwest	1		617	626	12	0	5
		CARW Carolina Wren	20	South	1						
		EATO Eastern Towhee	30	South/Southwest	1						
		BRTH Brown Thrasher	30	South	1						
		AMCR American Crow	100	East	2						
		AMRO American Robin	50	Northeast	1						
		FISP Field Sparrow	60	Southwest	1						
		SOSP Song Sparrow	40	East	1						
		RBWO Red-bellied Woodpecker	60	Southeast	1						
		EABL Eastern Bluebird	50	Northeast	9						
27-Jun-11	4	COYE Common Yellowthroat	60	East	1		637	646	12	0	5
		GRCA Gray Catbird	40	East	1						
		BRNS Barn Swallow	5	West	2						
		FISP Field Sparrow	10	West	1						
		FISP Field Sparrow	10	Southwest	1						
		HOLA Horned Lark	50	West	1						
		ETTI Tufted Titmouse	120	South	1						
		RBGR Rose-breasted Grosbeak	120	Southeast	1						
		ETTI Tufted Titmouse	40	Northwest	1						
		BLJA Blue Jay	50	Southwest	1						
27-Jun-11	5	AMRO American Robin	120	Southeast	1		655	704	13	0	5
		AMRO American Robin	50	East	1						
		COGR Common Grackle	100	West	36						
		EWPE Eastern Wood Peewee	50	Northwest	1						
		KILL Killdeer	90	East/Southeast	1						
		COGR Common Grackle	20	South	1						
		MODO Mourning Dove	40	East	1						
		SOSP Song Sparrow	5	North	1						
		WAVI Warbling Vireo	30	Northeast	1						
		HOSP House Sparrow	40	Northwest	7						
27-Jun-11	6	AMGO American Goldfinch	20	East	2		717	726	15	2	10
		COGR Common Grackle	10	South	1						
		BRTH Brown Thrasher	30	West	1						
		NOCA Northern Cardinal	50	Northwest	1						
		GRCA Gray Catbird	100	Southwest	1						
		EUST European Starling	30	South	1						
		COGR Common Grackle	20	West	1						
		KILL Killdeer	5	North	1						
		HOSP House Sparrow	10	South	4						
		RWBL Red-winged Blackbird	10	South	1						
27-Jun-11	7	AMRO American Robin	10	South	1		736	745	16	0	5
		RWBL Red-winged Blackbird	30	Northwest	1						
		AMRO American Robin	50	West	1						
		REVI Red-eyed Vireo	30	Northwest	1						
		AMGO American Goldfinch	20	West	2						
		WBNU White-breasted Nuthatch	20	Northwest	1						
		AMCR American Crow	30	Southwest	1						
		ACFL Acadian Flycatcher	40	Southwest	1						
		MODO Mourning Dove	60	East	1						
		AMRO American Robin	5	West	2						
27-Jun-11	8	SOSP Song Sparrow	5	East	2		758	807	17	2	40
		SOSP Song Sparrow	20	Southwest	1						
		AMRO American Robin	5	East	1						
		SAVS Savannah Sparrow	30	Southwest	1						
		GRCA Gray Catbird	30	South	1						
		HOSP House Sparrow	30	South	3						
		TUVU Turkey Vulture	100	North	1						
		HOLA Horned Lark	40	North	1						
		FISP Field Sparrow	60	South	1						
		SAVS Savannah Sparrow	10	West	1						



Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
							Start	Stop	Temp °	Wind	Cloud
27-Jun-11	9	RWBL Red-winged Blackbird	20	South	1		816	825	18	0	40
		SOSP Song Sparrow	40	South	1						
		HOLA Horned Lark	30	West	1						
		HOLA Horned Lark	40	Southeast	1						
		SAVS Savannah Sparrow	50	Northeast	1						
		BHCO Brown-headed Cowbird	40	Southwest	1						
		EABL Eastern Bluebird	30	Northeast	1						
		AMRO American Robin	40	South/Southwest	1						
27-Jun-11	10	GRSP Grasshopper Sparrow	20	Northwest	1		837	846	18	0	30
		COGR Common Grackle	5	North	1						
		HOSP House Sparrow	15	West	5						
		EUST European Starling	10	South	3						
		HOSP House Sparrow	20	East	6						
		AMRO American Robin	15	West	1						
		AMGO American Goldfinch	10	South	1						
		SOSP Song Sparrow	20	West	1						
27-Jun-11	11	MODO Mourning Dove	25	West	1		856	905	20	0	30
		HOLA Horned Lark	5	South	2						
		SAVS Savannah Sparrow	AO	South	1						
		GRSP Grasshopper Sparrow	5	Southeast	1						
		EAME Eastern Meadowlark	40	Southeast	1						
		ETTI Tufted Titmouse	120	Southeast	1						
		ETTI Tufted Titmouse	100	West	1						
		COGR Common Grackle	20	North	2						
27-Jun-11	12	RWBL Red-winged Blackbird	30	Southwest	1		914	923	20	0	25
		BLJA Blue Jay	50	Northwest	1						
		FISP Field Sparrow	40	Northeast	1						
		REVI Red-eyed Vireo	60	West	1						
		INBU Indigo Bunting	60	North/Northwest	1						
		COGR Common Grackle	40	Northwest	1						
		GCFL Great Crested Flycatcher	70	Northwest	1						
		WOTH Wood Thrush	70	West	1						
28-Jun-11	13	ETTI Tufted Titmouse	100	East	1		540	549	16	0	0
		KILL Killdeer	40	East	1						
		AMCR American Crow	100	North	4						
		INBU Indigo Bunting	35	West	1						
		RWBL Red-winged Blackbird	15	West	3						
		SOSP Song Sparrow	30	Northwest	1						
		COGR Common Grackle	40	East	3						
		KILL Killdeer	50	West	1						
28-Jun-11	14	CHSP Chipping Sparrow	20	Northwest	1		553	602	16	0	0
		GRCA Gray Catbird	10	Northwest	1						
		COGR Common Grackle	25	Northwest	7						
		BHCO Brown-headed Cowbird	15	South	2						
		AMCR American Crow	100	Northwest	3						
		AMRO American Robin	40	South	1						
		SOSP Song Sparrow	60	Southeast	1						
		FISP Field Sparrow	40	South	1						
28-Jun-11	15	CHSP Chipping Sparrow	30	South	1		607	616	17	0	0
		AMCR American Crow	40	East	5						
		INBU Indigo Bunting	50	West	1						
		WOTH Wood Thrush	80	South/Southeast	1						
		AMCR American Crow	100	Northwest	2						
		NOFL Northern Flicker	50	West	1						
		SOSP Song Sparrow	30	East	1						
		REVI Red-eyed Vireo	40	West	1						
28-Jun-11	16	RBWO Red-bellied Woodpecker	40	East	1		621	630	17	0	0
		EABL Eastern Bluebird	50	Northwest	2						
		AMRO American Robin	40	Northwest	1						
		RWBL Red-winged Blackbird	10	East	3						
		AMCR American Crow	90	Northwest	4						
		SCIA Scarlet Tanager	20	West	1						
		RWBL Red-winged Blackbird	20	South	5						
		SOSP Song Sparrow	40	Southwest	1						
28-Jun-11	17	NOCA Northern Cardinal	50	Northeast	1		635	644	18	0	0
		ETTI Tufted Titmouse	30	South	1						
		WBNU White-breasted Nuthatch	30	Southwest	1						
		INBU Indigo Bunting	40	West	1						
		HOLA Horned Lark	20	West	1						
		AMCR American Crow	100	Southwest	2						
		BAOR Baltimore Oriole	70	Northeast	1						
		RWBL Red-winged Blackbird	50	Northwest	3						
28-Jun-11	18	AMRO American Robin	30	North	1		648	657	18	0	0
		GCFL Great Crested Flycatcher	60	West	1						
		KILL Killdeer	20	Southeast	1						
		AMGO American Goldfinch	40	West	2						
		WIFL Willow Flycatcher	50	Northeast	1						
		EUST European Starling	25	West	9						
		RHWO Red-headed Woodpecker	15	South	2						
		RBGR Rose-breasted Grosbeak	10	Southwest	1						
28-Jun-11	19	KILL Killdeer	50	East	1		703	722	19	0	0
		CHSP Chipping Sparrow	40	Northwest	1						
		EABL Eastern Bluebird	20	Southwest	2						
		AMRO American Robin	40	Southwest	2						
		HOLA Horned Lark	50	Northwest	1						
		EUST European Starling	40	North	25						
		COGR Common Grackle	30	West	9						
		HOLA Horned Lark	40	East	2						
28-Jun-11	20	RWBL Red-winged Blackbird	40	West	4		736	745	20	0	0
		SAVS Savannah Sparrow	20	North	1						
		COGR Common Grackle	25	Northwest	2						
		BHCO Brown-headed Cowbird	30	North	1						
		AMRO American Robin	20	South	1						
		SOSP Song Sparrow	40	South	1						
		CHSP Chipping Sparrow	50	Southeast	1						
		SAVS Savannah Sparrow	30	East	1						
28-Jun-11	20	MODO Mourning Dove	60	Southeast	5		736	745	20	0	0
		HOSP House Sparrow	50	South	5						
		HOLA Horned Lark	30	West	1						
		AMRO American Robin	40	West	1						
		AMCR American Crow	30	East	4						
		AMRO American Robin	80	Southeast	1						

Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
							Start	Stop	Temp °	Wind	Cloud
28-Jun-11	21	NOCA Northern Cardinal	40	Southwest	1		751	800	20	0	0
		HOLA Horned Lark	50	North	1						
		EAME Eastern Meadowlark	20	Northeast	1						
		AMRO American Robin	40	Southwest	2						
		AMCR American Crow	60	North	4						
		INBU Indigo Bunting	25	Southeast	1						
28-Jun-11	22	INBU Indigo Bunting	50	North	1		807	816	21	0	0
		GRCA Gray Catbird	15	Northwest	1						
		AMRO American Robin	20	Southwest	1						
		SOSP Song Sparrow	35	East	1						
		HOFI House Finch	50	Northeast	4						
		AMRO American Robin	20	East	1						
		BCCH Black-capped Chickadee	20	West	1						
		ETTI Tufted Titmouse	30	Northeast	1						
		NOCA Northern Cardinal	30	Northwest	1						
		COGR Common Grackle	80	North	17						
28-Jun-11	23	CHSP Chipping Sparrow	30	North	1		821	830	21	2	0
		HOWR House Wren	30	Southeast	1						
		BLJA Blue Jay	70	West	2						
		AMGO American Goldfinch	20	South	3						
		COGR Common Grackle	30	North	3						
		INBU Indigo Bunting	25	East	1						
		SAVS Savannah Sparrow	30	South	1						
		RWBL Red-winged Blackbird	50	North	2						
		BLJA Blue Jay	40	Southeast	1						
		AMRO American Robin	50	Northeast	1						
28-Jun-11	24	HOSP House Sparrow	30	Southeast	5		835	844	22	0	5
		RWBL Red-winged Blackbird	70	North/Northwest	3						
		REVI Red-eyed Vireo	70	Southwest	1						
		BLJA Blue Jay	40	Northwest	1						
		COGR Common Grackle	20	Southwest	2						
		HOLA Horned Lark	20	Northwest	1						
		RTHA Red-tailed Hawk	40	North	1						
7-Jul-11	1	AMRO American Robin	50	Southwest	2		545	554	20	2	15
		RWBL Red-winged Blackbird	40	East	2						
		RWBL Red-winged Blackbird	10	East	1						
		NOCA Northern Cardinal	30	Northeast	1						
		HOLA Horned Lark	10	South	3						
		DICK Dickcissel	30	West	1						
		AMCR American Crow	50	West	7						
		MODO Mourning Dove	30	West	9						
		GRSP Grasshopper Sparrow	40	Northwest	1						
		HOWR House Wren	70	North	1						
		COGR Common Grackle	50	South	9						
		FISP Field Sparrow	20	North/Northwest	1						
		AMGO American Goldfinch	30	South	1						
		DICK Dickcissel	20	Northwest	1						
		EUST European Starling	10	South	3						
7-Jul-11	2	VESP Vesper Sparrow	60	Southwest	1		559	608	20	0	15
		HOSP House Sparrow	50	Southeast	6						
		MODO Mourning Dove	30	East	33						
		GRYE Greater Yellowlegs	50	West/Southwest	1						
		GRYE Greater Yellowlegs	10	Southwest	2						
		KILL Killdeer	10	Southwest	3						
		WODU Wood Duck	30	North	1						
		MALL Mallard	30	North	5						
		SAVS Savannah Sparrow	60	Southwest	1						
		AMCR American Crow	120	Northeast	1						
7-Jul-11	3	RWBL Red-winged Blackbird	20	West/Southwest	1		613	622	21	2	15
		HOLA Horned Lark	20	South	1						
		DICK Dickcissel	30	Southeast	2						
		AMRO American Robin	40	West/Southwest	1						
		LESA Least Sandpiper	30	Northwest	1						
		AMCR American Crow	100	North	5						
		BRNS Barn Swallow	20	West	5						
		RWBL Red-winged Blackbird	5	East	2						
		FISP Field Sparrow	30	Southeast	1						
		SOSP Song Sparrow	15	Southeast	2						
7-Jul-11	4	HOLA Horned Lark	40	Southwest	1		627	636	21	0	10
		SOSP Song Sparrow	30	South	1						
		COYE Common Yellowthroat	30	South	1						
		HOWR House Wren	70	West/Northwest	1						
		GBHE Great Blue Heron	40	South	2						
		RWBL Red-winged Blackbird	10	West	8						
		COYE Common Yellowthroat	20	Southwest	2						
		EAME Eastern Meadowlark	40	East	1						
7-Jul-11	5	SOSP Song Sparrow	30	Southeast	1		644	653	22	0	10
		COYE Common Yellowthroat	50	Southeast	1						
		GBHE Great Blue Heron	30	South	1						
		RWBL Red-winged Blackbird	50	South	2						
		WOTH Wood Thrush	100	South	1						
		FISP Field Sparrow	40	North	1						
		ETTI Tufted Titmouse	70	North	1						
		COYE Common Yellowthroat	50	West	2						
7-Jul-11	6	SOSP Song Sparrow	40	West	1		703	712	24	0	5
		YBCU Yellow-billed Cuckoo	100	North	1						
		VESP Vesper Sparrow	50	Northwest	1						
		SOSP Song Sparrow	70	Northwest	1						
		AMCR American Crow	80	Northwest	2						
		COYE Common Yellowthroat	30	East	1						
		COYE Common Yellowthroat	45	Southeast	1						
		SOSP Song Sparrow	50	Southeast	1						
		RWBL Red-winged Blackbird	25	Southeast	1						
		FISP Field Sparrow	60	Southeast	1						
		REVI Red-eyed Vireo	90	South/Southwest	1						
		HESP Henslow's Sparrow	60	North/Northeast	1						
7-Jul-11		RWBL Red-winged Blackbird	90	North/Northeast	1						
		AMCR American Crow	100	East	4						
		SAVS Savannah Sparrow	50	East	1						
		HOLA Horned Lark	40	Northwest	5						



Date	Point Number	Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
							Start	Stop	Temp °	Wind	Cloud
7-Jul-11	7	CHSP Chipping Sparrow	5	North	1		725	734	24	0	0
		RWBL Red-winged Blackbird	20	North	3						
		DOWO Downy Woodpecker	5	North	1						
		SOSP Song Sparrow	20	Northwest	1						
		EUST European Starling	40	Northwest	6						
		HOSP House Sparrow	5	North	8						
		GRCA Gray Catbird	20	North	1						
7-Jul-11	8	DICK Dickcissel	20	North	1		749	758	25	0	0
		SOSP Song Sparrow	30	Northwest	1						
		SOSP Song Sparrow	40	East	1						
		BRNS Barn Swallow	50	North	1						
		SAVS Savannah Sparrow	40	Northeast	1						
		GRSP Grasshopper Sparrow	30	East	1						
		COVE Common Yellowthroat	60	North	1						

## **Exhibit P. Acoustic Bat Survey**





## **Bat Acoustic Monitoring Survey Report - 2011**

### **Republic Wind Farm, Seneca County, Ohio**



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**December 2011**

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## **1.0 INTRODUCTION**

### **1.1 Project Overview**

Republic Wind, LLC proposes to develop the Republic Wind Farm (Project) near Belleview, Ohio (Figure 1-1). The Project site is located in Seneca and Sandusky County in north central Ohio. Land use in the proposed Project area comprises agricultural fields interspersed with forested riparian habitat that follows streams and storm water drainage. This report presents baseline (pre-construction) bat acoustic monitoring data collected during the spring, summer, and fall 2011 migration season at the Project's meteorological tower (met tower) (Figure 1.1).

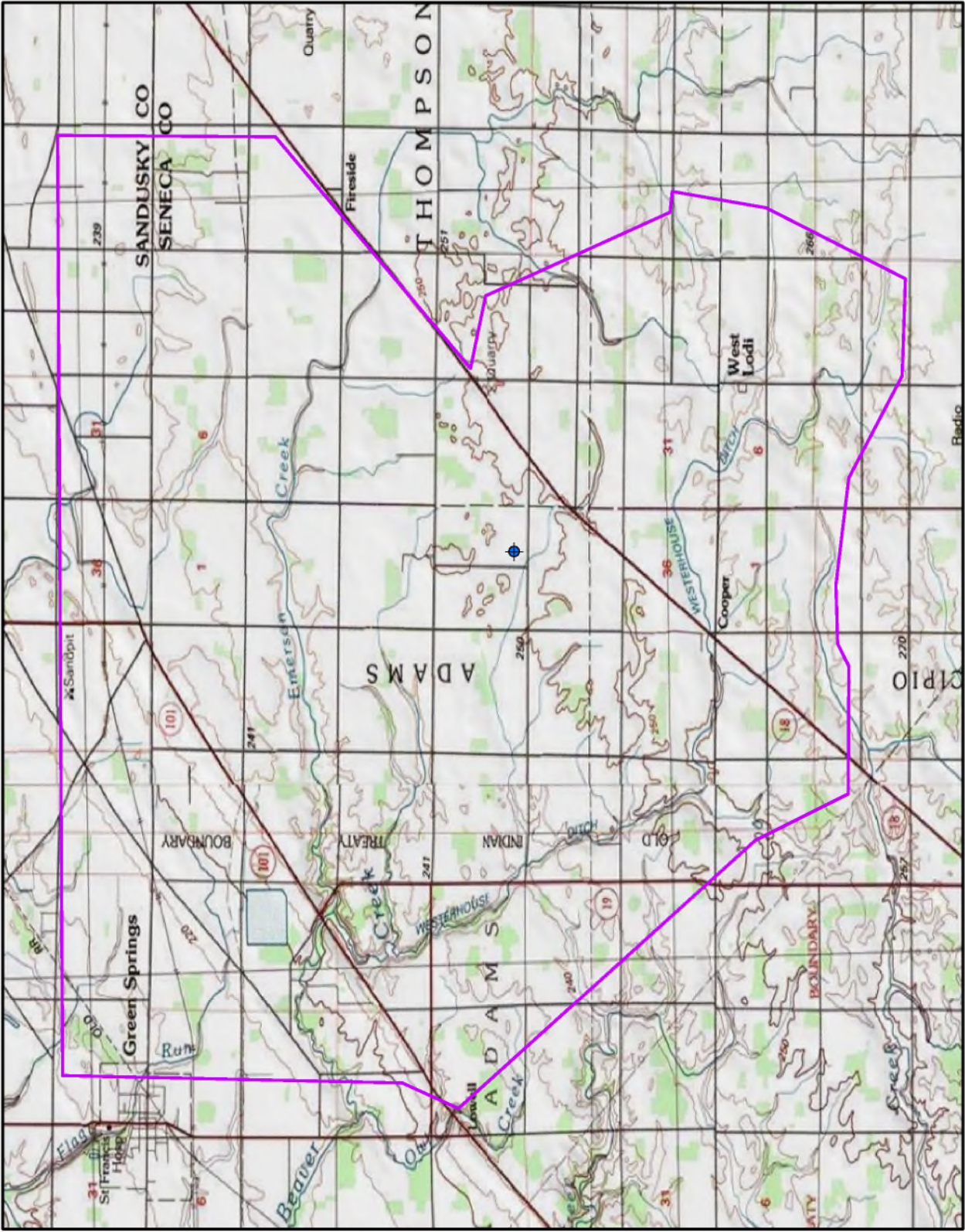
### **1.2 Goals and Objectives**

The goal of the bat acoustic monitoring survey was to assess bat phenology within the Project area, for an extended period, between March 16 and November 16, 2011. The objectives of the bat survey were to:

- 1) identify the peak activity periods for bats;
- 2) determine the bat species composition in the Project area (near the bat detectors); and,
- 3) determine an index of bat activity at different heights above ground level.



**Figure 1.1.** Republic Bat Acoustic Monitoring Sites – 2011.



**Legend**

Bat Acoustic Detectors

Project Area



0 0.5 1 2  
Miles

**Figure 1.1. 2011 Met Tower and Bat Detector Location.**

Prepared For:

Republic Wind, LLC

Prepared By:



Date:

12/2011

Source: NGS, Topo US 2D, Detector location data provided by Tetra Tech.

Coordinate System: WGS84.



## 2.0 METHODS

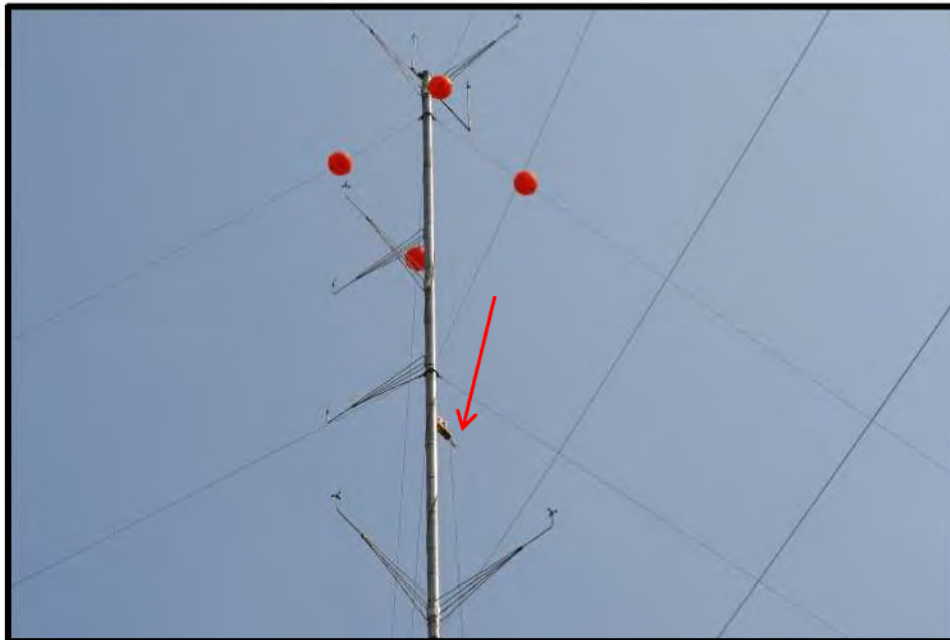
### 2.1 Data Collection

Tetra Tech conducted bat acoustic surveys at the Project area in the spring, summer, and fall of 2011. The surveys conformed to the ODNR-On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio (May 2004).

Bat activity was monitored using ultrasonic acoustic recorders (Anabat SD-2, Titley Scientific, Inc.) at the Project's met tower. The area around the met tower was an agricultural field, that was used to grow corn. The nearest forested area was approximately 670 meters northeast of the met tower. This section presents the cumulative results of 245 nights of bat activity monitoring during the spring migration, summer residency period, and fall migration in 2011.

Two bat acoustic detectors were deployed at the met tower. The two detectors were suspended from the tower on March 16, 2011, at heights of 45 meters (m) and 5 m above ground level; these detectors will be referred to as the 'High' and 'Low' detectors, respectively (Figure 2.1 and 2.2). Each of the two detectors remained in the same location throughout the survey period. To ensure that the greatest period of bat activity was surveyed each night, detectors were programmed to begin recording 30 minutes before sunset and stop recording 30 minutes after sunrise. Each detector was calibrated to detect a 40 kHz tone at a distance of 20 m using a Bat Chirp (Tony Messina, Nevada Bat Technology). Acoustic monitoring at the met tower was continuous throughout the survey period.

Each detector station consisted of an Anabat SD-2 bat acoustic detector powered by a 10-watt solar panel and a 12-volt battery encased in a waterproof housing (Figure 2.1 and 2.2). A pre-amplified microphone cable, pre-amplified microphone, and bracket were used to suspend the Anabat microphone from the tower. A plastic deflector shield angled at 45 degrees below the microphone facilitated recording of the airspace above and adjacent to the detector. Each detector was manually checked by trained technicians approximately every 2 weeks during the survey period.





**Figure 2.1.** Photograph of the High detector suspended from the met tower guy wire array – Republic Wind Farm, 2011. The red arrow indicates the detector location.



**Figure 2.2.** Photograph of the Low detector suspended from a specialized met tower pulley system – Republic Wind Farm, 2011. The red arrow indicates the detector location.

## 2.2 Data Analysis

Potential bat call files were extracted from data files using CFCread<sup>®</sup> software (Titley Electornics, Inc.). CFCread<sup>®</sup> software screens all data recorded by the bat detector and extracts call files using a filter. The default settings for the CFCread<sup>®</sup> software were used during the file extraction process to ensure comparability among datasets. These settings include a maximum time between calls (TBC) of 5 seconds, a minimum pulse fragment line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to the degree that adjacent data points are averaged. The higher the smoothing factor, the less restrictive the filter, resulting in more noise files and poor quality call sequences retained within the dataset. A call is defined as a single pulse of sound produced by a bat. A call sequence is defined as a combination of two or more pulses recorded in a single call file. Call sequences with less than 2 pulses were not analyzed.

A qualitative visual comparison was made between recorded bat call sequences and established reference libraries of calls. This technique allowed for relatively accurate identification of bat species (O'Farrell et al. 1999; O'Farrell and Gannon 1999). All call sequences were also run through a series of conservative filters based on call sequence characteristics outlined in Szewczak et al. (2008) and from known species call sequences (hand released and zip-line individuals) from a regional call library. A call sequence was considered of suitable quality and duration to be included in data analysis if the individual

call pulse(s) exhibited the full spectrum of frequency modulation produced by a bat (i.e., consisting of sharp, distinct lines) with a minimum of two pulses.

In addition to the qualitative visual analysis, all bat calls recorded during the monitoring period were processed using an Indiana bat specific call filter. Call sequences can be difficult to definitively classify due to overlap in call pulse characteristics across species. Species such as hoary bat (*Lasiurus cinereus*) emit calls that are distinct in slope, duration, characteristic frequency, and frequency range (i.e., parameterizations). However, for other species, particularly those of the *Myotis* genus, it is difficult to accurately differentiate among species based on call sequence characteristics due to the similarities in call parameters. Nevertheless, it is often possible to make accurate classification inferences based on good quality calls of species including Indiana bat, little brown bat (*Myotis lucifugus*), and northern long-eared bat (*Myotis septentrionalis*). Call sequences of eastern red bat (*Lasiurus borealis*) and tri-colored bat (*Perimyotis subflavus*) are typically unique but occasionally appear similar to each other or *Myotis* species, especially if the recording is of poor quality. Classification is often complicated by the presence of static or incomplete call pulses within a recording. Fragments and poor quality calls are prevalent in recordings from passive detectors monitoring for a long duration.

Relative abundance, or the magnitude of each species' contribution to spatial and temporal use, was determined by calculating an Index of Activity (IA) modified from Miller (2001). The method is based on the presence/absence of a species call sequence within one-minute time increments. Thus, IA was the sum of minute-increments with a species presence divided by the unit effort ( $IA = \# \text{ minutes} / \text{detector-nights} * 100$ ). The IA calculations allows for samples with different levels of effort (i.e., different total number of detector-nights) to be accurately compared, thereby reducing the potential bias associated with differences in study effort. IA calculations follow those employed by Miller (2001) and O'Farrell and Shanahan (2006).

### 3.0 RESULTS

The 2011 bat acoustic monitoring survey started on March 16 and ended on November 16, 2011 (Table 2.1). During the 245-night survey period detectors operated for 490 detector-nights (number of detectors multiplied by the number of nights that detectors were operational). A total of 534 bat call sequences were recorded within 531 one-minute intervals of bat activity (number of minutes with bat call sequences present) yielding an overall IA of 108.4 (Table 3.1).

The highest IA rate ( $\# \text{ of one minute intervals of bat activity} / \text{detector-nights} * 100$ ) was recorded by the Low detector (IA = 197.1). The smallest IA rate (19.6) was recorded by the High Detector, which detected 50 call sequences within 48 minutes of activity (Table 3.1).



**Table 3.1.** Summary results of acoustic monitoring survey effort by detector – Republic Wind Farm, 2011.

Detector	Period of Operation	Detector-Nights	Number of Minutes with Bat Activity	Total Number of Call Sequences Recorded	Overall Index of Activity
High (45 m)	Mar. 16 - Nov. 16	245	48	50	19.6
Low (10 m)	Mar. 16 - Nov. 16	245	483	484	197.1
<b>Total</b>		<b>490</b>	<b>531</b>	<b>534</b>	<b>108.4</b>

Bat call sequences were identified to the lowest possible taxonomic level (Table 3.2). Sixty-six (66) percent of recorded calls were classified to species ( $n = 354$ ). Calls were then combined into five categories based on similarities in call sequence structure: Low Frequency Species, Middle Frequency Species, High Frequency Non-Myotis Species, High Frequency Myotis Species, and Unknown (Table 3.2). Some call sequences did not meet the parameters required for species level identification ( $n = 132$ ) and were classified based on the frequency modulation exhibited in the call sequence. Some of these calls ( $n = 4$ ) were classified as Unknown because they consisted of feeding buzzes that could not be accurately attributed to any single species or guild, and therefore could not be labeled as either a middle or high frequency calls [it is likely that most of these were evening bat (*Nycticeius humeralis*) calls].

Seven species were identified from the call sequences recorded during the 2011 acoustic monitoring effort. A total of 248 calls (46.4 percent of all calls recorded), were attributed to migratory bats including the hoary bat, silver-haired bat, eastern red bat, and evening bat. The greatest number ( $n = 125$ ) of recorded call sequences attributable to a single species was from silver-haired bat. Silver-haired bat produce call sequences with relatively unique characteristics that can generally be accurately identified to species level, and tend to be lower in frequency than other species, and therefore do not attenuate as quickly in the atmosphere. A number of hoary bat ( $n = 54$ ), eastern red-bat ( $n = 48$ ), and evening bat ( $n = 21$ ) were also recorded.

IA values were calculated for each species by detector. The greatest IA was for silver-haired bat at the low detector (IA = 43.7). For each of the species recorded IA values were greatest at the Low detector (Figure 2.4). Hoary bat was the second most active species overall (as measured by IA), and was the most active species at the High detector (IA = 9.4) (Figure 3.1).

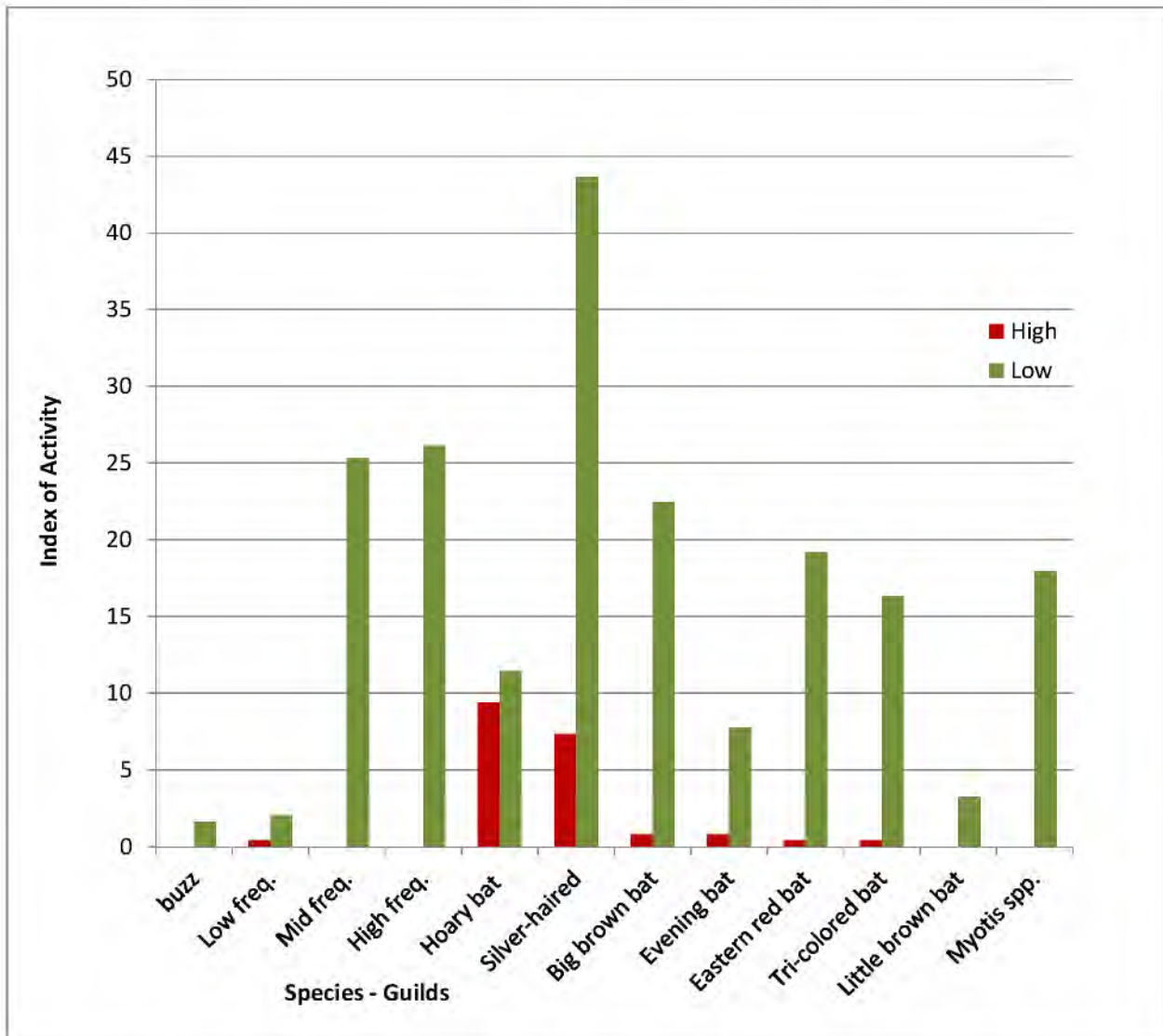
No calls of federally listed bat species were positively identified during the survey. Indiana bats are known to occur in the vicinity of the Project area, and species classifications for many *Myotis* calls recorded during the 2011 surveys ( $n = 44$ ) was not feasible; therefore it is possible that Indiana bats were recorded but not identified in the dataset. Although none of the 44 *Myotis* calls identified during the passive acoustic monitoring surveys at the met tower exhibited characteristics typical of Indiana bat calls. In addition, the overall low levels of *Myotis* species activity recorded may indicate that the type of habitat around the met tower is not frequented by *Myotis*. The distance from wooded areas (approximately 670 m) may make the likelihood of Indiana bat occurrence lower near the met tower. Avoidance of large open areas by Indiana bat, especially agricultural land with little forested habitat,, has been documented (Murray and Kurta 2004).



Bat activity varied throughout the monitoring period (Figures 3.2). Overall, there was no bat activity recorded before April 10, 2011. Bat activity increased slightly around April 20 but declined again in mid-May. Activity began to increase in early August until peak activity was recorded on August 13. Activity declined after August, although bats were active throughout September, and until October 12, 2011.

**Table 3.2.** Summary of total number of call sequences recorded per species – Republic Wind Farm, 2011.

Group	Characteristic Frequencies*	Species	Total Call Sequences
Low Frequency	12 kHz–24 kHz	Hoary bat	54
		Unknown low frequency call seq.	6
Middle Frequency	24 kHz–38 kHz	Big brown bat	57
		Silver-haired bat	125
		Evening bat	21
		Unknown middle frequency call seq.	62
High Frequency (Non-myotis species)	44–45 kHz	Tri-colored bat	41
		Eastern red bat	48
High Frequency (Myotis species)	46–52 kHz	Little brown myotis	8
		Unknown <i>Myotis</i> species	44
		Unknown high frequency call seq.	64
Unknown		Buzz	4
* Characteristic frequency (Fc) is generally defined as the frequency of the call pulse at the lowest slope, or the lowest frequency of the consistent frequency modulation sweeps. Fc represents the single most useful parameter for species identification.			



**Figure 3.1.** Index of Activity of migratory bat species by detector – Republic Wind Farm, 2011.



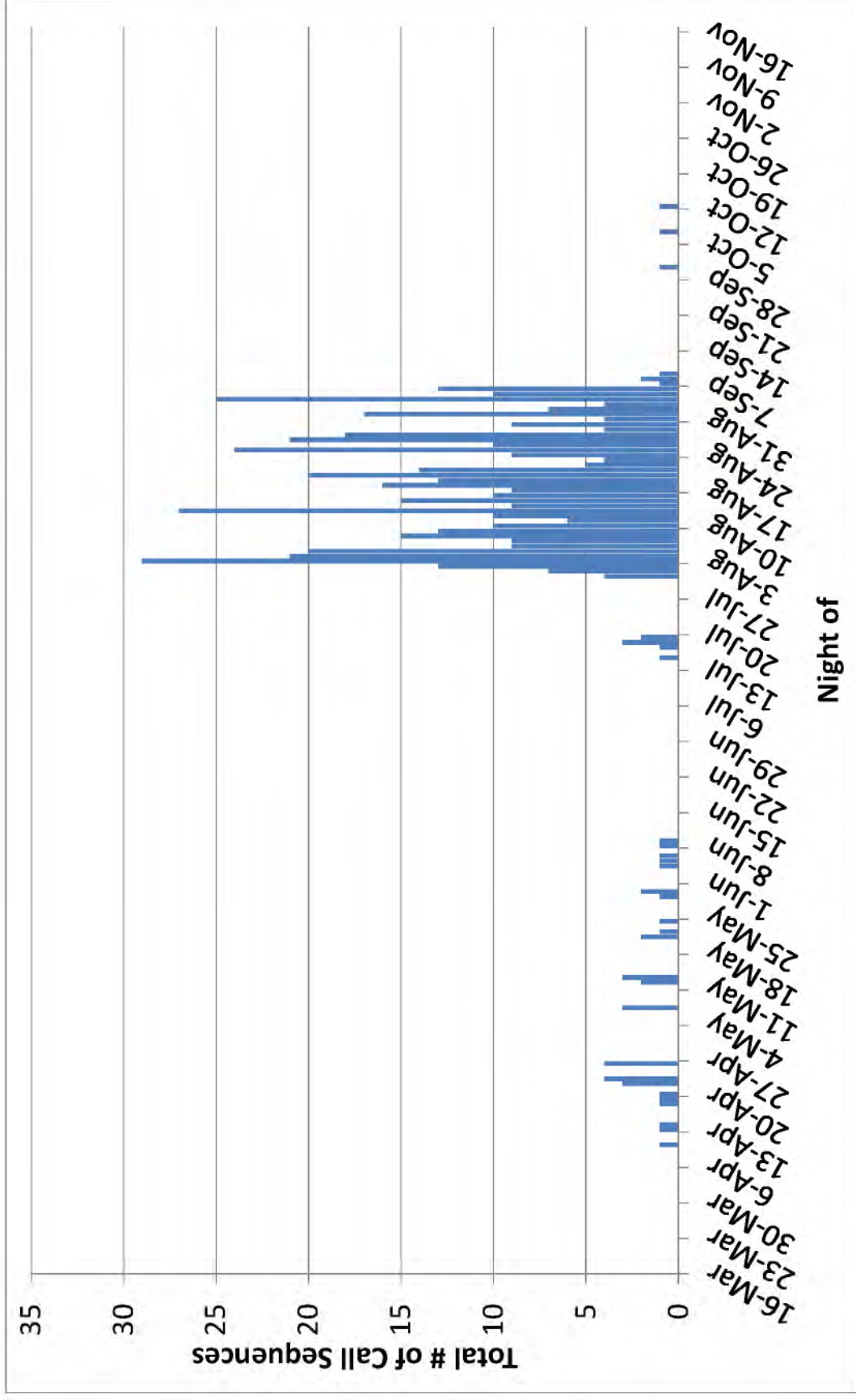


Figure 3.2. Total number of call sequences recorded per night for all detector pooled – Republic Wind Farm, 2011.

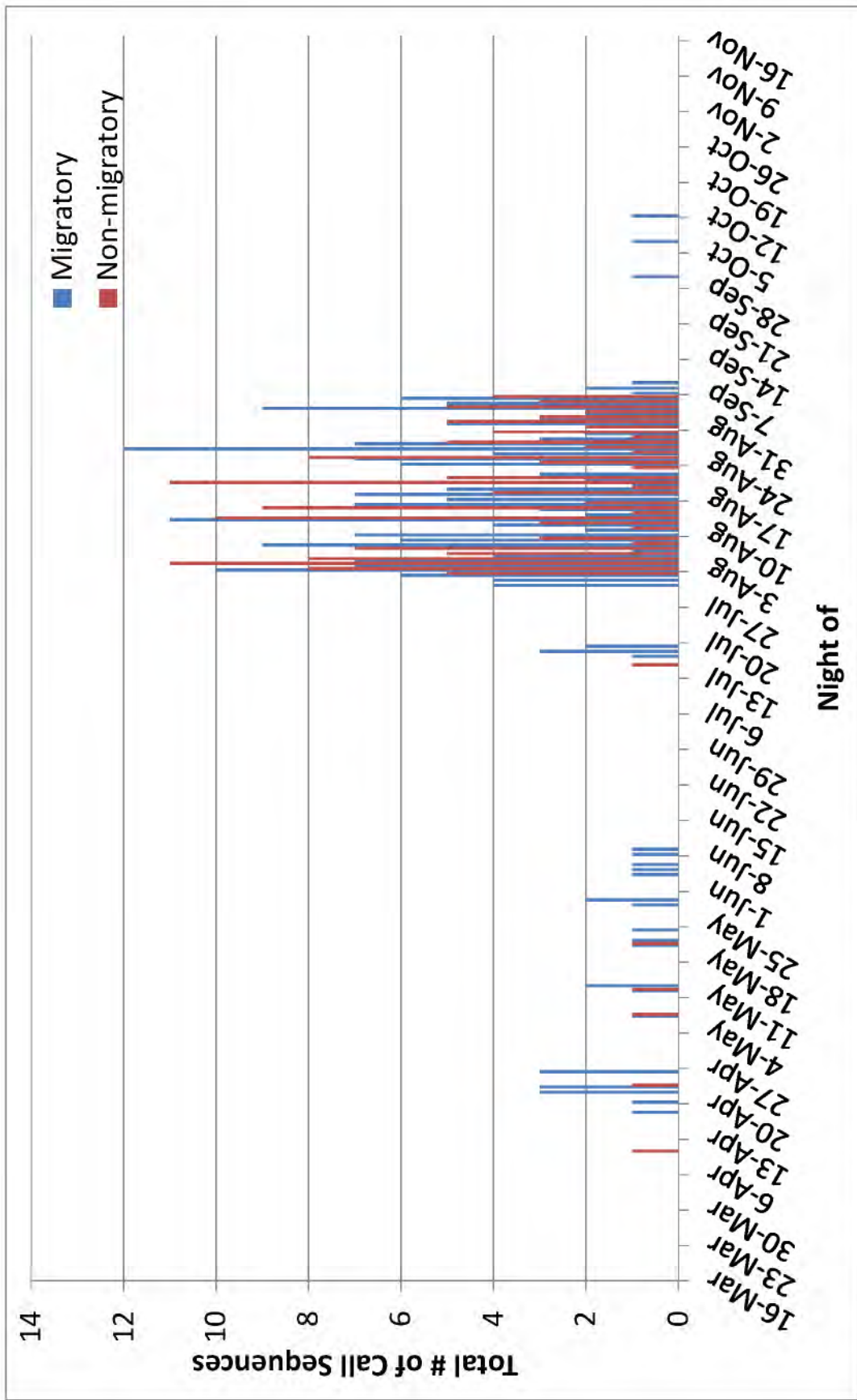


Figure 3.3. Total number of migratory species and non-migratory species call sequences – Republic Wind Farm, 2011.

#### 4.0 DISCUSSION

The migratory species, hoary bat, silver-haired bat, eastern red bat, as well as evening bat, were positively identified from recordings made during the 2011 survey period. Overall, there was more migratory species activity than non-migratory species activity recorded in the Project area. These results are consistent with recent research demonstrating that tree and tree-crevasse roosting migratory bats are the predominant species found during post-construction mortality studies at operational wind farms in North America (Arnett et al. 2008). Results from these mortality studies show the three bat species most commonly encountered during ground searches were long-distance (Lasiurine) migratory bats: hoary bat, silver-haired bat, and eastern red bat (Kunz et al. 2007, Arnett et al. 2008).

Non-migratory species recorded during the 2011 surveys (big brown bat, tri-colored bat, and *Myotis* species) were only slightly more active during August and September than were migratory species recorded (hoary bat, silver-haired bat, eastern red bat, and evening bat). Migratory species were active in August and September, as well as in the spring and fall (Figure 3.3). Overall activity of non-migratory and migratory species was highest during August and September, which is considered the “swarming period”, when bats group together prior to hibernation and/or migration, and often mate (Parsons et al. 2003). The occurrence of migratory bat species during the summer demonstrates that there were likely some long-distance migratory tree and tree crevasse roosting bats spending the summer residency period at the Project area. There also appeared to be few long-distance migrants moving through the Project area during the spring and fall, as evidenced by the low number of calls recorded during those periods.

IA values for all bat species were lowest at the High detector. This indicates that bat activity nearest the rotor swept zone (RSZ) of typical modern wind energy turbines was low compared to bat activity levels below the RSZ and nearest ground level. Migratory species (hoary bat, silver-haired bat, eastern red bat, and evening bat) we recorded primarily just above ground level by the Low detectors. *Myotis* species exhibited low levels of activity, as measured by IA, and were not recorded at the High detector.

The ratio between the total number of call sequences recorded at each detector, and the total number of one-minute intervals with bat activity may be used as an indicator of the “concentration” of bat activity throughout time. For example, the High detector recorded 50 call sequences over the course of 48 minutes of activity. This near one to one ratio (0.96) is a function of low concentrations of bat activity at the High detector; activity events were spread out over time and rarely were two calls recorded in the same one-minute interval. Similarly the ratio between call sequences and minutes of activity at the Low detector was also slightly less than one to one (0.99). Based on these observations it seems that bat activity at the met tower was largely episodic in nature, and that extended periods of constant activity did not occur. Instead, it appears that periods of diffused and inconsistent activity occurred at both detectors. These patterns of activity are not consistent with what would be expected if the met tower location provided significant foraging habitat, or was located within a migration or transit corridor. If the area was important for foraging or migration we would expect to see high numbers of bat calls recorded during limited temporal periods. For example Racey and Swift (1985) demonstrated that foraging bats may trap-line areas where food resources are concentrated, returning to the same foraging areas nightly. High numbers of calls recorded over a short period of monitoring would be more indicative of high use by bats. Bat activity at an important migration corridor might also be more concentrated, with high numbers of passes occurring in rapid succession, as would expected if multiple individuals moved through the area during migration or transit between foraging sites.



Patterns of activity in the Project area do not suggest the presence of a large bat migration corridor in the vicinity of the met tower. If a substantial migration corridor did exist over the Project area, the data should show a higher ratio of minutes of bat activity to detector nights. The sporadic and diffused occurrence of long-distance migratory species in the recording indicates that few individuals use the open area near the met tower. There did not appear to be an episode of dramatic fluctuation in recorded activity that could be definitively attributed to large-scale migration, although an observable increase in activity during August and September was apparent; however this increase was minimal and was not indicative of a large number of bats moving through the Project area (Cryan and Veilleux 2007).

Weather conditions, including mean nightly temperature and wind speed, probably contributed to the patterns of activity recorded by the acoustic detector sets. The increase in bat call sequences recorded in August may have resulted from the following: (1) increased foraging activity near the detectors due to a rise in mean nightly temperatures (Racey and Swift 1985, O'Donnell 2000, Kusch et al. 2004); (2) increases in food resource concentrations near the detectors, (3) an episode of bats leaving a roost and transiting to an established area of concentrated food resource passing the detectors *en route*; or, (4) bat swarming near the met tower. The increase in activity of hoary bat, silver-haired bat, and eastern red bat at the met tower detectors during September was almost certainly attributable to migration and/or pre-migration staging (Cryan and Veilleux 2007).

There is inherent difficulty in attempting to interpret the number of recorded call sequences as an indication of activity levels; however, detection rates, recorded minutes of activity and IA values do provide a relative measure of bat activity near sampling locations. The limited maximum range of a single Anabat detector (approximately 30 m [100 ft]) makes the characterization of landscape-scale movements, such as migration, difficult to assess. However, a comparative assessment of the results from detectors arrayed within a tower at different elevations can facilitate the characterization of spatial distribution and phenology of bat activity.

The total number of bat call sequences and minutes of activity recorded each night by a given detector may or may not reflect the absolute level of bat activity present in the Project area, although some studies have suggested that there may be a relationship between the relative numbers of calls recorded and absolute bat activity levels (Gorresen et al. 2008). The bias in passive acoustic surveys of this type stems from the unknowns that are intrinsic to automated monitoring. For example, a single foraging individual may produce a large number of call sequences that are within the range of a given detector set. Conversely, a large number of individual bats may pass the detector set and produce an equally large number of call sequences. It is also important to note that the survey results are a sample of bat activity in the airspace surrounding the detectors and are not necessarily indicative of bat activity throughout the entire Project area.

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