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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. EA-2018-0202

WRITTEN REBUTTAL TESTIMONY

OF

DR. KATHRYN WOMACK

ON

BEHALF OF

MISSOURI DEPARTMENT OF CONSERVATION

*****DENOTES HIGHLY CONFIDENTIAL INFORMATION*****

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REBUTTAL TESTIMONY OF KATHRYN WOMACK
MISSOURI DEPARTMENT OF CONSERVATION
CASE NO. EA-2018-0202

1 **I. INTRODUCTION**

2 **Q. Please state your name, title, and business address.**

3 A. Kathryn Womack, Ph.D., Resource Scientist, Missouri Department of
4 Conservation’s Agricultural Systems Field Station, 3500 S. Baltimore Street,
5 Kirksville, MO 63501.

6 **Q. What are your qualifications and experience?**

7 A. I have a Ph.D. in Natural Resources from the University of Missouri
8 where my dissertation focused on multi-scale factors that affected bat and insect
9 abundance in savannas, woodlands, and forests throughout the Ozark Highlands of
10 Missouri. My Master’s thesis focused on the foraging and roosting ecology of female
11 Indiana bats during the maternity season in northeast Missouri. I have worked in
12 bat ecology for over 10 years and have been with the Missouri Department of
13 Conservation (“Department” or “MDC”) since June 2017 as a Resource Scientist. My
14 specific job duties include being the Missouri’s bat biologist and white-nose
15 syndrome (“WNS”) response lead.

16 **Q. What is the purpose of your testimony?**

17 A. The purpose of my testimony is to respond to Ameren Missouri’s
18 witness, Ajay Arora, and his testimony that describes “conservation of endangered
19 species” as of one the five main risks associated with the High Prairie Wind Project

1 (the “Project”), and further describes how Ameren has mitigated this risk. (Arora
2 Direct17: 4-13, 23: 11-22). I am familiar with the Project site and have reviewed
3 Ameren’s testimony and responses to MDC data requests. Before I describe my
4 concerns with the Project, Ameren’s proposed mitigation of risk for the Project, and
5 my recommendations, I would like to provide some background information with
6 respect to bats in Missouri generally, and then specifically in relation to the Project.

7 **Q. Will you be providing recommendations as part of your**
8 **testimony?**

9 A. As I will describe later, I believe that the Project poses significant risks
10 to Missouri’s bat resources, most notably to the endangered Indiana bat. If
11 constructed, these risks should be mitigated through operational measures, and
12 robust post-construction monitoring and reporting should be required to determine
13 the scope of the impact to Missouri’s bat resources and the Department’s
14 investment in those resources. My recommendations are further described on pages
15 38-42.

16 **II. BACKGROUND ON BATS IN MISSOURI**

17 **Q. What bat species occur in Missouri?**

18 A. Historically, 14 bat species are known to occur in Missouri (Table 1).

Table 1. Missouri’s bat species.

Common Name	Scientific Name
Indiana bat	<i>Myotis sodalis</i>
Northern long-eared bat	<i>Myotis septentrionalis</i>

Gray bat	<i>Myotis grisescens</i>
Little brown bat	<i>Myotis lucifugus</i>
Eastern small-footed bat	<i>Myotis leibii</i>
Southeastern myotis	<i>Myotis austroriparius</i>
Big brown bat	<i>Eptesicus fuscus</i>
Evening bat	<i>Nycticeius humeralis</i>
Eastern red bat	<i>Lasiurus borealis</i>
Tri-colored bat	<i>Perimyotis subflavus</i>
Hoary bat	<i>Lasiurus cinereus</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>
Ozark big-eared bat*	<i>Corynorhinus townsendii ingens</i>

* This federally endangered sub-species is presumed extirpated from Missouri.¹ Presumed extirpation in this use means that a species has not been located despite intensive search efforts of historic sites and other appropriate habitat, and virtually no likelihood that the species will be rediscovered in Missouri.

1 **Q. Are there any bat species that are federally listed as**
2 **threatened or endangered in Missouri?**

3 A. There are three federally listed species found in Missouri. The Indiana
4 bat and gray bat are federally endangered; the Indiana bat was listed in 1967 and
5 the gray bat was listed in 1976. Both species were listed due to human disturbance
6 during hibernation. The northern long-eared bat was listed as federally threatened
7 under the 4D rule in April 2015 due to population declines related to white-nose

¹ Missouri Department of Conservation. Missouri species and communities of conservation concern checklist 2018. Jefferson City, MO. January 2018.

1 syndrome.² An additional bat species, the tri-colored bat (formerly known as the
2 eastern pipistrelle bat) was petitioned to be listed and is under a 12-month Species
3 Status Assessment (“SSA”)³ by the United States Fish and Wildlife Service
4 (“Service” or “USFWS”) after an affirmative 90-Day Finding.⁴ The tri-colored bat
5 has been proposed to be federally protected due to population declines related to
6 WNS. A population crash in Missouri has resulted in listing it as a Missouri species
7 of conservation concern (“SOCC”). See Table 2.

8 In addition to the listing of species as endangered or threatened under
9 federal law, the Missouri Department of Conservation (Department) has a list of
10 species of conservation concern (SOCCs).

² The 4(d) Rule is one of many tools found within the Endangered Species Act (“ESA”) and is found in Section 4(d) of the act. Typically, the Service uses the 4(d) rule to issue regulations to incentivize positive conservation practices and to help streamline the regulatory process for minor impacts to threatened species under the ESA. This rule also describes what forms of take are or are not prohibited by the Service to protect listed species.

³ A SSA is a thorough review of literature and often a request for updated data from state and federal agencies, universities, and other parties that may have relevant information regarding the species and potential threats to the species to determine whether the species warrants listing.

⁴ A 90-Day Finding is the result of a quick review of a petition to the Service that determines if the petition presents substantial scientific or commercial information indicating that the petition action may be warranted.

Species	2012/2013	2014/2015	2016/2017	% change 2012 - 2017
Big brown bat	1,539	1,567	1,292	-16%
Eastern small-footed bat	2	0	0	-
Evening bat	0	0	1	-
Gray bat	67,053	50,565	60,239	-10.2%
Indiana bat	138,554	184,953	215,107	55.3
Little brown bat	5,624	9,478	748	-86.7%
Northern long-eared bat	4,591	2,281	2	-99.9%
Silver-haired bat	0	0	1	-
Tri-colored bat	24,105	24,318	11,147	-53.8%
Unknown bat	1,011	1,996	97	-
Totals	242,479	275,158	288,634	

Table 2. Population counts between 2012/2013 and 2016/2017 at 183 Missouri hibernacula for all documented bat species post-discovery of WNS in Missouri.⁵

1 When a species becomes a SOCC, it means that all records in Missouri are
2 tracked in the Natural Heritage Database (“NHD”) mainly through our Wildlife
3 Collector Permit process but also Missourians can submit new records for species on
4 the MDC website. Species are listed as SOCCs for a variety of reasons, from
5 population declines to rare occurrences. With respect to bats, Missouri’s SOCCs
6 include these federally listed species as well as five additional bat species: tri-
7 colored bat, little brown bat, silver-haired bat, southeastern myotis, and eastern
8 small-footed bat. The tri-colored and little brown bat were listed as SOCCs due to
9 population declines from WNS. See Table 2. The hoary bat is not currently listed as
10 a state SOCC but will be listed in 2019 due to recent population count projects and
11 the increased interest in wind energy within Missouri.⁶ Hoary bats are also on the
12 Service’s radar for potential listing as one study has estimated up to a 90 percent

⁵ Colatskie, S. (2017). Missouri Bat Hibernacula Survey Results from 2011-2017, Following White-nose Syndrome Arrival. *Missouri Department of Conservation, Technical Brief.*

⁶ Frick, W. F., Baerwald, E. F., Pollock, J. F., Barclay, R. M. R., Szymanski, J. A., Weller, T. J., ... & McGuire, L. P. (2017). Fatalities at wind turbines may threaten population viability of a migratory bat. *Biological Conservation, 209*, 172-177.

1 decline in hoary bat populations in the next 50 years due to wind turbine strikes.⁷
2 Hoary bats are the primary species killed by turbine collisions mainly in late
3 summer through fall migration.^{8,9}

4 **Q. Please describe relevant bat characteristics, especially for**
5 **protected bats potentially impacted by the Project.**

6 A. All bats have some common characteristics. Bats are slow reproducing
7 (one to four pups per year depending on the species) and are long-lived (up to 20
8 years or more). All Missouri bat species mate in the fall and start gestation in early
9 spring (approximately a 60-day gestation period). Female bats have offspring in late
10 May through early June, depending on the weather. Missouri bats use two general
11 life history strategies to survive winter: (1) hibernation (cave bats) or (2) migration
12 (tree bats). Cave bats include the Indiana bat, northern long-eared bat, gray bat,
13 tri-colored bat, little brown bat, big brown bat, small-footed bat, southeastern
14 Myotis, Ozark big-eared bat, and Rafinesque big-eared bat. Tree bats include the
15 eastern red bat, silver-haired bat, and hoary bat. Both life history strategies require
16 migration in the spring and fall between summer (maternity grounds) and winter
17 habitats. Migratory distances range from 50 to 1,000 miles depending on the
18 species. Tree bats are thought to migrate longer distances than cave bats.

⁷ Frick *et al.* (2017), *supra* n. 6.

⁸ Kunz, T. H., Arnett, E. B., Erickson, W. P., Hoar, A. R., Johnson, G. D., Larkin, R. P., ... & Tuttle, M. D. (2007). Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment*, 5(6), 315-324.

⁹ Arnett, E. B., Brown, W. K., Erickson, W. P., Fiedler, J. K., Hamilton, B. L., Henry, T. H., ... & Nicholson, C. P. (2008). Patterns of bat fatalities at wind energy facilities in North America. *The Journal of Wildlife Management*, 72(1), 61-78.

1 Indiana Bat

2 The Indiana bat (*Myotis sodalis*) is a federally-endangered hibernating bat
3 species found throughout much of the eastern United States. The range-wide
4 population has decreased by 20 percent in the last ten years from 636,846 to
5 530,705.¹⁰ This decline is directly and indirectly linked to WNS. See Figure 1.
6 However, the Missouri Indiana bat population is estimated at 217,884 individuals
7 in 2017 and shows a 0.9 percent increase.¹¹ Missouri’s population estimates make
8 up 41.1 percent of the entire population. See Figure 2. Almost 198,000 of Missouri’s
9 Indiana bats hibernate in a mine at Sodalys Nature Preserve (“SNP”) in Hannibal,
10 Missouri.¹²

¹⁰ United States Fish and Wildlife Service (USFWS) .2017. 2017 Indiana bat (*Myotis sodalis*) population status update. Compiled by Andy King. Indiana Ecological Services Field Office, Bloomington, IN. 9 pgs.
<https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf>

¹¹ Arnett *et al.* (2008), *supra* n. 9.

¹² Colatskie (2017), *supra* n. 5.

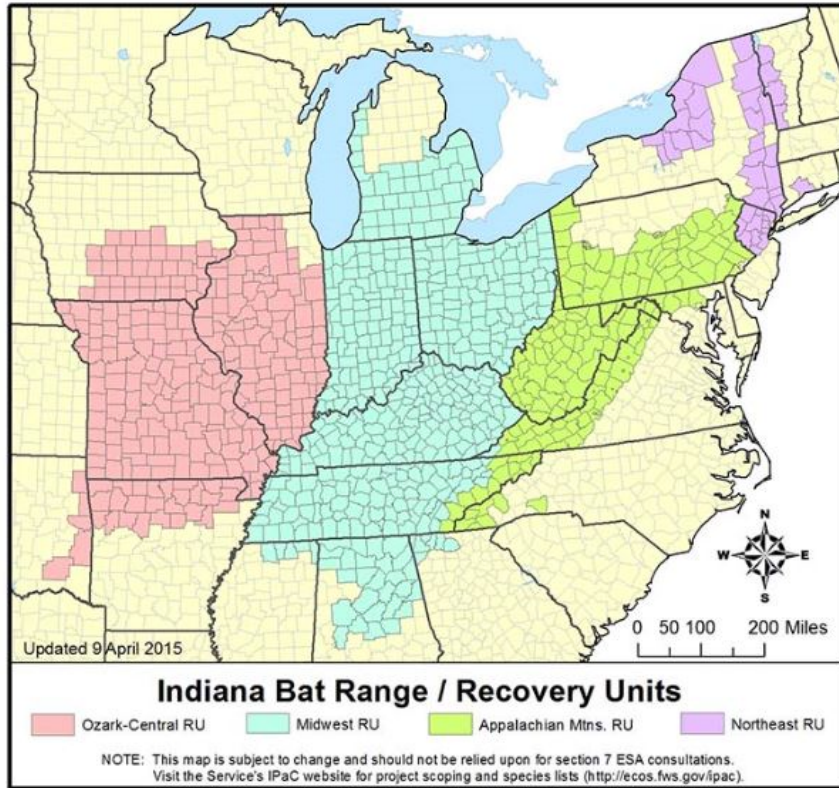


Figure 1. Indiana bat range and USFWS recovery units. ¹³

¹³ United States Fish and Wildlife Service (USFWS) 2018. Indiana bat range map. U.S. Fish and Wildlife Services Endangered Species, available at <https://www.fws.gov/midwest/endangered/mammals/inba/RangeMapINBA.html>.

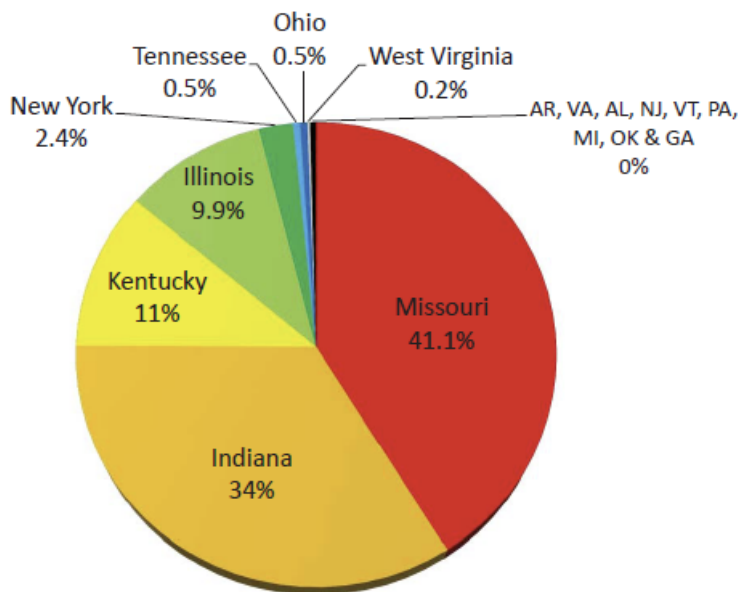


Figure 2. Percentage of the 2017 range-wide Indiana bat population estimated during hibernation (approximately 530,705 bats) within each state.¹⁴

- 1 Wing band recovery studies reveal that Indiana bat females migrate up to 290 miles
- 2 from hibernation sites to maternity sites. Maternity sites for Indiana bat females
- 3 are called roost trees. Females have 1 pup per year in late May or early June.
- 4 Maternity colonies are generally comprised of multiple roost trees and can average
- 5 50-80 individuals.¹⁵ The Department has records of 100 or more female Indiana
- 6 bats exiting a single maternity roost tree in northeastern Missouri.¹⁶ Female
- 7 Indiana bats show high site fidelity to the same maternity sites and sometimes even
- 8 the same roost trees, year after year. The northeastern part of Missouri is the core

¹⁴ USFWS 2017), *supra* n. 10.

¹⁵ Whitaker Jr, J. O., Brack Jr, V., & Cope, J. B. 2002. Are bats in Indiana declining?. In *Proceedings of the Indiana Academy of Science*. 111(1): 95-106.

¹⁶ Missouri Department of Conservation (MDC). Unpublished data. Indiana bat maternity roost emergence data in northeast Missouri.

1 maternity habitat in Missouri and falls within the “high-likelihood” zone for
2 Indiana bats.¹⁷ See Figures 3 and 4. Indiana bat location data from the NHD with
3 important summer (maternity) and winter (hibernaculum).

4 Indiana bats feed on flying insects. They tend to forage among and adjacent
5 to tree canopies and in forest corridors. Indiana bats usually forage in riparian and
6 floodplain forest, but also may use upland forest, forest edges, old fields, and
7 openings over ponds. Indiana bat home range sizes vary depending on the method
8 used to calculate home range size, geographic location, and habitat within and
9 surrounding study locations. A study in northern Missouri found that on average
10 pregnant Indiana bats had a 50 percent core home range size of approximately 417
11 acres and 600 acres on average for lactating bats.¹⁸ Other home range studies using
12 a variety of methods to calculate home range size found mean home range to be 205
13 acres in Vermont,¹⁹ 398 acres in Illinois,²⁰ and 524 acres in Ohio.²¹ In Missouri the
14 average maximum distance females traveled nightly from roost trees to forage was
15 2.3 miles for pregnant individuals and 3 miles for lactating bats.²²

¹⁷ Missouri Department of Conservation (MDC). 2016. Guidelines for Avoiding and Minimizing Impacts to

Federally-Listed Bats on Missouri Department of Conservation Lands. Jefferson City, MO.

¹⁸ Womack, K. M., S. K. Amelon, and F. R. Thompson III. 2013. Summer home range size of female Indiana bats (*Myotis sodalis*) in Missouri, USA. *Acta Chiropterologica* 152:423–429.

¹⁹ Watrous, K. S., Donovan, T. M., Mickey, R. M., Darling, S. R., Hicks, A. C., & Von Oettingen, S. L. (2006). Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. *The Journal of Wildlife Management*, 70(5), 1228-1237.

²⁰ Menzel, J.M., Ford, W.M., Menzel, M.A., Carter, T.C., Gardner, J.E., Garner, J.D., Hofmann, J.E., 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. *Journal of Wildlife Management*. 69, 430–436.

²¹ Kniowski, A.B., and S.D. Gehrt. 2014. Home range and habitat selection of the Indiana bat in an agricultural landscape. *Journal of Wildlife Management* 78: 503-512.

²² Womack et al. (2013), *supra* n. 18.

1 Indiana bats can be found flying in a wide range of habitats during summer
2 but wooded lots are necessary for roost locations. During the active season (March
3 15 – October 31), Indiana bats roost primarily under the loose bark of living or dead
4 trees with a diameter-at-breast-height (DBH) over 9 inches with high solar
5 exposure. Male Indiana bats may roost singly or in small groups during summer;
6 some males may be found with females in maternity colony areas although others
7 remain near their hibernation caves.

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²³ Missouri Department of Conservation (MDC). 2016. Guidelines for avoiding and minimizing impacts to federally-listed bats on Missouri Department of Conservation lands. Jefferson City, MO.

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1 Northern Long-Eared Bat

2 Another protected bat species that could be impacted by the Project is the
3 northern long-eared bat. The northern long-eared bat was once found across much
4 of North America. See Figure 5. The species hibernates in underground sites
5 throughout the winter and uses a variety of wooded habitats during the summer
6 maternity season. Northern long-eared bats were listed as threatened under the
7 Endangered Species Act on April 2, 2015.²⁴ Prior to its listing, the northern long-
8 eared bat had been considered relatively common throughout much of its North
9 American range. As such there are no known maternity trees within the Project
10 area, although maternity activity (reproductive females) were captured within the
11 Project site in 2011.²⁵ ***

12
13

14 ^{26***} While other negative influences on the population (i.e., habitat
15 destruction and modification, overutilization, regulatory inadequacy, and collisions
16 with wind turbines) have varying levels of local impacts, the leading reason for
17 Federal listing is population declines due to WNS. Hibernacula counts indicate
18 declines of 98–99 percent for northern long-eared bat across eight states in the

²⁴ United States Fish and Wildlife Service (USFWS). 2015. Endangered and threatened wildlife and plants; Threatened species status for the northern long-eared bat with 4(d) rule. Final Rule and Interim Rule. 50 CFR Part 17. 80(63). 61 ps.2 April 2015.

²⁵ Robbins, L.W., B.T. Hale, S. Romeling and J.R. Lemen. 2012. Evaluation of Myotis activity: Capture, telemetry, and acoustic analysis of potential interactions at a wind energy facility. Prepared by Missouri State University for Normandeau Associates. March 7, 2012.

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1 northeastern United States.²⁷ MDC has documented over a 99.9 percent reduction
2 of this species in Missouri at repeatedly visited sites since winter 2012/2013. See
3 Table 2.

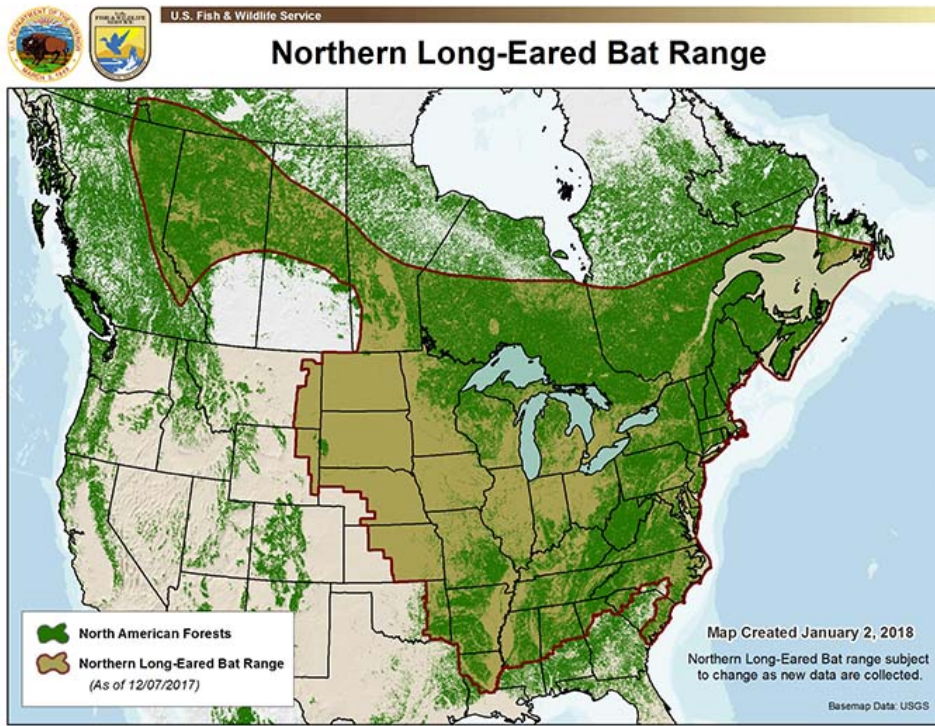


Figure 5. Northern long-eared bat range map from U.S. Fish and Wildlife Service.²⁸

²⁷ Turner G.G., Reeder D.M., Coleman J.T.H. 2011. A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. *Bat Research News* 52(3):13–27.

²⁸ U.S. Fish and Wildlife Service (USFWS). 2018. Northern long-eared bat range map. U.S. Fish and Wildlife Services Endangered Species. <https://www.fws.gov/midwest/endangered/mammals/nleb/nlebrangemap.html>

1 During winter, northern long-eared bats hibernate in caves and mines.
2 Nearly 300 northern long-eared bat hibernacula are documented across Missouri,
3 primarily in the eastern and central Ozarks. See Figure 6. Hibernating individuals
4 have been found in Missouri as far southwest as McDonald County and as far
5 northeast as Marion County at SNP.²⁹

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²⁹ Missouri Department of Conservation (MDC). 2016. Guidelines for avoiding and minimizing impacts to federally-listed bats on Missouri Department of Conservation lands. Jefferson City, MO.

1 The northern long-eared bat is presumed to occur throughout most of
2 Missouri during the active season (i.e., non-hibernation period) and has been found
3 to roost in cracks and crevices of rock bluffs, under loose bark of trees, or in man-
4 made structures. Mist-net captures of this species have been reported from counties
5 at or near all four corners of the state (Newton, Nodaway, Clark, and Cape
6 Girardeau counties). However, due to WNS Missouri's population has decreased by
7 99.9 percent in 183 hibernacula that were surveyed biennially since winter
8 2012/2013. See Table 2. Compared to Indiana bats, maternity colonies of northern
9 long-eared bats are generally smaller (30 to 50 individuals), and they often use
10 smaller diameter trees. The structure of the roost tree and its immediate
11 surroundings appears to be more important in roost site selection than tree species.
12 Northern long-eared bat roost trees may occur in the forest understory and are
13 often located on side slopes or ridge tops. Northern long-eared bats also show high
14 maternity site fidelity and return to the same location annually although different
15 trees may be used as roosts each year.^{30,31}

16 **Q. Are there any additional threats to that Missouri's bat species**
17 **are facing?**

18 A. Yes, one of the most significant threats facing Missouri's cave bat
19 species is white-nose syndrome ("WNS"). The disease has been documented in

³⁰ Sasse, D. B. and P. J. Perkins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the White Mountain National Forest, p. 91-101. In: Barclay, R. M. R. and R. M. Brigham (eds.). *Bats and forests*. Ministry of Forests, Victoria, British Columbia.

³¹ Timpone, J. C., Boyles, J. G., Murray, K. L., Aubrey, D. P., & Robbins, L. W. (2010). Overlap in roosting habits of Indiana bats (*Myotis sodalis*) and northern bats (*Myotis septentrionalis*). *The American Midland Naturalist*, 163(1), 115-123.

1 northern long-eared bats, Indiana bats, tri-colored bats, little brown bats, and big
2 brown bats could be impacted by the Project as described below. White-nose
3 syndrome is caused by a white fungus, *Pseudogymnoascus destructans*, that infects
4 the skin of hibernating bats. The disease can be devastating to bat populations and
5 there is no known cure. Once it appears in a cave, WNS can kill 90-100 percent of
6 bat species.³² WNS was first documented in New York in 2006 and is now affecting
7 bats in 33 U.S. states and 7 Canadian provinces. See Figure 7.

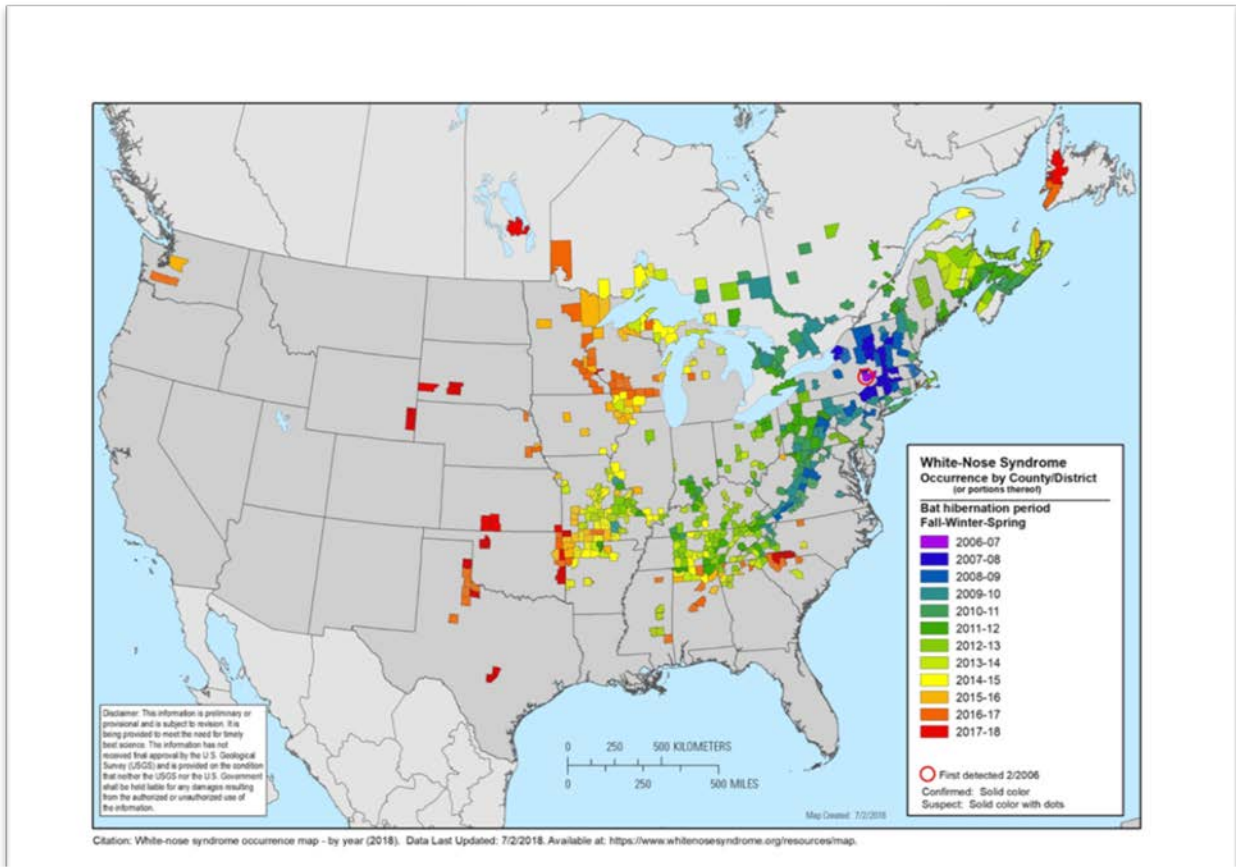


Figure 7. White-nose syndrome spread map created by the U.S. Fish and Wildlife Service.³³

³² Frick, W. F., Pollock, J. F., Hicks, A. C., Langwig, K. E., Reynolds, D. S., Turner, G. G., ... & Kunz, T. H. (2010). An emerging disease causes regional population collapse of a common North American bat species. *Science*, 329(5992), 679-682.

³³ U.S. Fish and Wildlife Service (USFWS). 2018. White-nose syndrome spread map. U.S. Fish and Wildlife Service's *White-nose syndrome response team*. www.whitenosesyndrome.org.

1 The presence of *Pseudogymnoascus destructans* (*Pd*) was documented in
2 Missouri in April 2010, and the first WNS positive bat was found in March of 2012.
3 *Pd* is the fungus associated with the WNS disease. MDC has coordinated and led
4 WNS and *Pd* surveillance efforts along with partners from other state and federal
5 agencies, non-profit partners, and private citizens to document the arrival and
6 spread of WNS in Missouri. Although there is little pre-WNS data for the majority
7 of Missouri bat hibernacula, 183 hibernacula were surveyed during winters
8 2012/2013, 2014/2015, and 2016/2017. See Table 2. Northern long-eared bats, little
9 brown bats, and tri-colored bats have seen the steepest decline in hibernacula
10 population estimates similar to the declines seen in other states. See Table 2. The
11 numbers for Indiana bats increased during this time likely due to additional
12 locations within SNP being mapped and surveyed so these numbers do not
13 necessarily reflect an actual change in population size. SNP is the largest Indiana
14 bat hibernacula in the world. SNP is also a hibernaculum for the gray bat, northern
15 long-eared bat, tri-colored bat, and little brown bat. All other major Indiana bat
16 hibernacula sites in Missouri have seen a decline in numbers since the winter of
17 2012/2013 (Table 3), further highlighting the importance of SNP for Indiana bats.

18 As described above, reproductive rates are generally low for bats.
19 Consequently, protecting critical summer maternity habitat resources and sites is
20 one of primary mitigation strategies for addressing WNS, in hopes that any
21 resistant individuals will reside and breed.

Year	Onyx - Crawford	Bear - Crawford	Copper Hollow Sinkhole - Franklin	Brooks - Pulaski	Great Spirit - Pulaski	Ryden - Pulaski	Bat Cave - Shannon	Martin - Shannon	Great Scott - Washington	Pilot Knob Mine - Iron	Scotia Hollow - Washington	Totals
1979	11,100	3,250	8,850	19,375	549	10,550	42,821	8,100	68,700	139,000	2,750	176,045
1981	5,325	1,750	5,200	11,850	1,792	5,800	32,800	2,425	72,350	125,130	3,100	142,392
1983	3,267	1,100	3,150	11,150	1,171	4,950	30,750	5,350	85,700	111,262	4,550	151,138
1985	2,250	650	1,050	5,500	500	2,000	30,450	3,550	77,950	97,391	3,400	127,300
1987	2,050	525	600	4,900	40	700	4,150	4,900	60,650	83,521	5,300	83,815
1989	1,575	400	250	5,200	35	1,359	4,275	2,600	38,875	69,652	5,150	59,719
1991	1,275	300	160	2,700	8	160	4,275	2,975	32,125	55,782	6,225	50,203
1993	700	225	125	1,550	625	80	6,175	2,250	22,750	41,912	4,550	39,030
1995	325	190	140	750	450	40	941	2,125	14,850	28,042	3,600	23,411
1997	260	95	175	600	195	14	450	1,500	11,875	14,173	1,615	16,779
1999	155	80	155	400	175	14	6,175	1,000	9,100	303	2,375	19,629
2001	265	105	185	235	285	10	89	2,460	8,250	647	450	12,334
2003	210	90	250	130	160	13	1,020	2,100	8,875	991	290	13,138
2005	180	100	250	70	40	10	0	1,300	6,450	1,334	150	8,550
2007	180	110	380	65	60	3	16	950	5,100	1,678	90	6,954
2009	118	106	323	21	1	2	2	913	4,674		41	6,201
2011	90	120	457	50	0	3	327	781	3,936		30	5,794
2013	113	125	706	41	120*	2	136	1,268	3,556		21	5,968
2015	58	9	354	0	63	0	703	2,986	2,824		15	7,012
2017	40	0	161	0	15	0	297	1,684	2,483		11	4,691

Table 3. Indiana bat population estimates in 11 major Missouri hibernacula from 1979-2017. The Sodalis Nature Preserve (SNP) is a large limestone mine complex in Hannibal, Missouri. SNP is a Priority 1 Indiana Bat hibernaculum with a 2017 survey yielding an estimated 198,000 +/- individuals. This table was adapted from Elliott and Clawson 2007.

1 **Q. Before discussing impacts to bats from wind turbines and the**
2 **Project, please describe what economic benefits bats convey to Missouri**
3 **citizens?**

4 A. Several studies have quantified ecosystem services of bat species found
5 in Missouri. Ecosystem services are the economic valuation of the benefits obtained
6 from the environment that increase overall human well-being. As insectivores,
7 Missouri bats are the primary predators to night time insects which include both
8 agriculture and forest pest species. One study asserts that bats are likely one of the
9 most economically important non-domesticated animals in North America.³⁴ This
10 study modeled the economic importance of bat species in the United States and
11 estimated the value of bats to the agriculture industry to be on average
12 approximately \$22.9 billion per year.³⁵ Two studies have estimated that female
13 little brown bats consume over 100 percent of their body weight in insects each
14 night during lactation, and 50 percent of their body weight during the rest of the
15 active season.^{36,37} Indiana and northern long eared bats are related to little brown
16 bats, and likely consume a similar number of insects.

17 **Q. Please describe the Department’s investment of state funds in**
18 **Bats.**

³⁴ Boyles, J. G., Cryan, P. M., McCracken, G. F., & Kunz, T. H. 2011. Economic importance of bats in agriculture. *Science*, 332(6025), 41-42.

³⁵ Boyles et al., supra n. 33.

³⁶ Kurta, A., Bell, G. P., Nagy, K. A., & Kunz, T. H. 1989. Energetics of pregnancy and lactation in freeranging little brown bats (*Myotis lucifugus*). *Physiological Zoology*, 62(3), 804-818.

³⁷ Anthony, E. L., & Kunz, T. H. 1977. Feeding strategies of the little brown bat, *Myotis lucifugus*, in southern New Hampshire. *Ecology*, 58(4), 775-786.

1 A. The Department’s investment in bats has been significant. Over the
2 last ten (10) years, the Department has spent almost \$1 million on several direct
3 management efforts related to bats. This figure includes but is not limited to:
4 \$136,761 to install cave gates (protection devices) and evaluate caves on public land;
5 \$220,935 to inventory cave wildlife and plants; \$235,929 on estimating occupancy of
6 bats in northern Missouri where wind development was anticipated; and \$26,596
7 estimating occupancy (species presence) and activity of bat communications at
8 different elevations above the ground surface. Since 2007, the Department has
9 spent \$187,183 on bat research that included winter ecology, the effects of fire,
10 maternity habitat range and forest management efforts.

11 Through Memorandums of Understanding, the Department has also spent
12 \$116,446 protecting specific bat habitats with partners like The Nature Conservancy
13 and the Missouri Conservation Heritage Foundation. Subject to the Conservation
14 Commission approval through the annual budget process, the Department plans to
15 conduct the following projects now and into the future:

16 1. From Fiscal Year 2018-2021, the Department anticipates spending \$2.7
17 million on development of a Habitat Conservation Plan for the Department's
18 land management activities in bat habitats. This includes the surveys in
19 northern Missouri to support this effort.

20 2. The Department also will be implementing the Habitat Conservation Plan
21 (HCP) within that time. Because the Department’s HCP is still in
22 development, the cost estimate associated with implementation is not yet

1 available. According to the Department's HCP consultant, the implementation
2 costs for similarly sized and focused HCPs is anticipated to be approximately
3 \$350,000 the first year and \$10 million over the 30-year life of the HCP.

4 3. From Fiscal Years 2018 through 2026, the Department anticipates spending
5 almost \$3 million for bat research on summer habitat and physiological
6 responses and population monitoring throughout the state.

7 **III. HIGH PRAIRIE PROJECT CONCERNS AND RECOMMENDATIONS**

8 **Q. Please explain how bats can be adversely impacted by wind**
9 **turbines.**

10 A. Studies have estimated that hundreds of thousands of bats are killed
11 in the United States annually by wind turbine collisions.^{38,39} Most of these species
12 are migratory tree bats which are not federally listed and, in most cases, not
13 protected by states in which they occur. The primary way bats are killed is by direct
14 impact from turbine blades or by barotrauma when they fly close to blades^{40,41}
15 Barotrauma is an injury caused by low pressure air pockets created by the rotating
16 turbine blades that causes a decompression of the bats internal organs, a change in
17 air pressure typically it involves the ear or lungs. There have been several

³⁸ Arnett, E. B., & Baerwald, E. F. 2013. Impacts of wind energy development on bats: implications for conservation. In *Bat evolution, ecology, and conservation* (pp. 435-456). Springer, New York, NY.

³⁹ Smallwood, K. S. 2013. Comparing bird and bat fatality-rate estimates among North American wind-energy projects. *Wildlife Society Bulletin*, 37(1), 19-33.

⁴⁰ Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current biology*, 18(16), R695-R696.

⁴¹ Grodsky, S. M., Behr, M. J., Gendler, A., Drake, D., Dieterle, B. D., Rudd, R. J., & Walrath, N. L. 2011. Investigating the causes of death for wind turbine-associated bat fatalities. *Journal of Mammalogy*, 92(5), 917-925.

1 hypotheses as to why bat fatalities are so high near turbines.⁴² One likely
2 hypothesis is that bats are attracted to turbines as they resemble a potential tree
3 roost.⁴³ Another is that insect abundances are higher around turbines which
4 attracts feeding bats.⁴⁴ Several videos document this behavior and provide evidence
5 of attraction and foraging activity.^{45,46,47}

6 **Q. Are there specific conditions that make wind turbines more**
7 **lethal to bats?**

8 A. The periods of greatest risks to bats occur during relatively low wind
9 conditions when there is no inclement weather (e.g., periods of rain) and
10 temperatures are greater than 50°F.⁴⁸ Most bat fatalities occur in late summer and
11 fall when bats are mating and migrating to winter grounds.⁴⁹ However, fatality
12 rates vary temporally and annually based on environmental conditions, between
13 turbines, and between wind facilities. A study synthesized mortalities from turbine
14 collisions throughout the United States and found that the risk of bat mortality was

⁴² Kunz, T. H., Arnett, E. B., Erickson, W. P., Hoar, A. R., Johnson, G. D., Larkin, R. P., ... & Tuttle, M. D. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment*, 5(6), 315-324.

⁴³ Cryan, P. M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. *The Journal of Wildlife Management*, 72(3), 845-849.

⁴⁴ Rydell, J., Bach, L., Dubourg-Savage, M. J., Green, M., Rodrigues, L., and Hedenström, A. 2010. Mortality of bats at wind turbines links to nocturnal insect migration?. *European Journal of Wildlife Research*, 56(6), 823-827.

⁴⁵ Horn, J. W., Arnett, E. B., and Kunz, T. H. 2008. Behavioral responses of bats to operating wind turbines. *The Journal of wildlife management*, 72(1), 123-132.

⁴⁶ Cryan, P. M., Gorresen, P. M., Hein, C. D., Schirmacher, M. R., Diehl, R. H., Huso, M. M., Hayman D.T., Fricker P.D., Bonaccorso F.J., Johnson D.H., and Heist K. 2014. Behavior of bats at wind turbines. *Proceedings of the National Academy of Sciences*, 111(42), 15126-15131.

⁴⁷ Foo, C. F., Bennett, V. J., Hale, A. M., Korstian, J. M., Schildt, A. J., & Williams, D. A. 2017. Increasing evidence that bats actively forage at wind turbines. *PeerJ*, 5, e3985.

⁴⁸ Weller, T. J., & Baldwin, J. A. 2012. Using echolocation monitoring to model bat occupancy and inform mitigations at wind energy facilities. *The Journal of Wildlife Management*, 76(3), 619-631.

⁴⁹ Arnett et al. (2013) supra n. 37 and Baerwald et al. (2008) supra n. 39.

1 related to the proportion of grassland within 500 meters of turbines.⁵⁰ Mortality
2 rates decreased at sites with more grasslands habitat surrounding the turbine (and
3 other open habitat types.⁵¹ This decrease is likely because all bat species except
4 gray bats roost in trees during summer, and their foraging habitat is associated
5 with forests or openings over water sources.

6 **Q. Are there bat species that are more likely to be killed by wind**
7 **turbines?**

8 A. Yes, according to a chapter describing the impacts of wind energy on
9 bats in *Bat Evolution, Ecology, and Conservation* nearly 80 percent of fatalities are
10 migratory tree bats.⁵² The wind facilities in this paper had fatality rates of 38
11 percent hoary bats, 22 percent eastern red bats, and 19 percent silver-haired bats
12 (tree bats), and 6 percent fatality rates for little brown bats and tri-colored bats
13 (cave bats). However, some facilities in the eastern U.S. had 25 percent tri-colored
14 bat fatalities, highlighting that species mortality rates vary between facilities and
15 depend on the bat species and populations present or moving through the area
16 during migration.⁵³ See Table 4. While tree bats are the hardest hit, there have not
17 been any studies showing the impacts of wind turbines on Indiana bat maternity
18 colonies. Due to the high numbers of known maternity colonies (up to 15 colonies
19 possible with an upper estimate of 1,200 female Indiana bats assuming 80 females

⁵⁰ Thompson, M., Beston, J. A., Etterson, M., Diffendorfer, J. E., & Loss, S. R. (2017). Factors associated with bat mortality at wind energy facilities in the United States. *Biological Conservation*, 215, 241-245.

⁵¹ Id.

⁵² Arnett and Baerwald (2013) *supra* n.37.

⁵³ Id.

1 per colony) within the Project area, the potential to impact Indiana bat is high. We
 2 are not aware of any operating wind facilities that contain known Indiana bat
 3 maternity colonies. Generally, bat mortality peaks late summer and during the fall
 4 when these bats are moving across the landscape and mating.⁵⁴

Scientific name	Common name	% of total fatalities	Lower range	Upper range
<i>Eptesicus fuscus</i>	Big brown bat	4	26,004	52,255
<i>Lasiurus blossevillii</i>	Western red bat	<0.01	69	143
<i>Lasiurus borealis</i>	Eastern red bat	22	143,023	287,403
<i>Lasiurus cinereus</i>	Hoary bat	38	247,040	633,822
<i>Lasiurus cinereus semotus</i>	Hawaiian hoary bat	<0.001	4	8
<i>Lasiurus ega</i>	Southern yellow bat	<0.01	69	143
<i>Lasiurus intermedius</i>	Northern yellow bat	<0.01	553	1,145
<i>Lasiurus noctivagans</i>	Silver-haired bat	18	148,839	308,322
<i>Lasiurus seminolus</i>	Seminole bat	<0.01	1,106	2,290
<i>Lasiurus xanthinus</i>	Western yellow bat	<0.01	622	1,288
<i>Myotis evotis</i>	Long-eared myotis	<0.01	3,731	7,730
<i>Myotis lucifugus</i>	Little brown myotis	6	51,617	106,925
<i>Myotis septentrionalis</i>	Northern myotis	<0.01	1,175	2,433
<i>Myotis sodalis</i>	Indiana bat	<0.01	69	143
<i>Myotis velifer</i>	Cave myotis	<0.01	69	143
<i>Myotis volans</i>	Long-legged myotis	<0.01	69	143
<i>Nyctinomops femorosacca</i>	Pocketed free-tailed bat	<0.01	69	143
<i>Nycticeius humeralis</i>	Evening bat	<0.01	1,589	3,292
<i>Perimyotis subflavus</i>	Tricolored bat	6	45,260	93,756
<i>Parastrellus hesperus</i>	Canyon bat	<0.01	69	143
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	3	21,282	44,087
Unknown spp.	Unknown spp.	2	20,036	41,505
Total	Total		650,104	1,306,378

Table 4. Estimates of cumulative bat fatalities from 2000 to 2011 for the U.S. and Canada. Migratory tree bat species found in the study area are outlined in blue and cave bat species found in the study area are outlined in orange. It is important to note that no wind facility has been built with known Indiana bat maternity colonies.⁵⁵

5 To date, hoary bats have been the primary species killed by collisions with
 6 turbines in the United States.⁵⁶ This species, like all tree bats, roost in trees year-

⁵⁴ *Id.*

⁵⁵ *Id.*, Table 21-3.

⁵⁶ *Id.*

1 round, are highly migratory, and are often not state or federally listed so they are
2 not frequently studied. Population for most of these species is lacking, however, to
3 understand the impact of wind energy estimating the impact of wind strikes on each
4 species in necessary to assess of the species should be state or federally protected.
5 One study created population prediction models using expert opinion and some
6 occurrence data to try to assess the risk of wind turbines for hoary bats
7 populations.⁵⁷ This study estimated up to a 90 percent population decline in hoary
8 bats in the next 50 years with a starting population of 2.5 million bats,
9 acknowledging that this starting population number is likely incorrect.⁵⁸ These
10 projected population models demonstrate several points: (1) other bat species that
11 are currently not federally and, in most cases, not state protected are being killed in
12 large numbers, and (2) collection and tracking demographic information from mist-
13 net captures and bats salvaged below turbines through post-construction
14 monitoring efforts is of extreme importance.

15 **Q. Are there ways to minimize these negative impacts to bats?**

16 A. Most bat mortalities occur on nights with low wind speeds; therefore,
17 curtailment (i.e., increasing the cut-in speed⁵⁹), when the blades would start
18 spinning to generate energy, could greatly reduce bat mortality from collisions with
19 turbines. Additionally, there are other options in development that have potential to
20 reduce turbine collisions for bats and other wildlife species.

⁵⁷ Frick et al. (2017) supra n. 5.

⁵⁸ Id.

⁵⁹ The cut-in speed is the minimum wind speed (mph) at which turbine blades can start to rotate.

1 The following list was adapted from the National Renewable Energy
2 Laboratory's report discussing the effectiveness of multiple strategies to reduce
3 impacts of wind energy facilities on wildlife, including bats:

- 4 • Detect-and-curtail approaches: (informed or smart curtailment) Using either
5 an automated way (acoustic detectors) or human detections of target species
6 within a certain area around a turbine or wind facility to initiate a
7 curtailment cut-in speed and/or feathering of blades to reduce the risk to the
8 species of interest.
- 9 • Detect-and-deter approaches: Also uses automated or human detections of
10 target species, but the detection triggers some kind of deterrent such as
11 lighting, noise, or a combination.
- 12 • Wildlife operational curtailment: Rotor rotation rate is stopped or greatly
13 reduced by increasing the cut-in speed based on a variety of factors
14 (temperature, time of day, weather conditions, time of year, etc.). This can be
15 done several ways and various scenarios are in development.
- 16 • Wildlife seasonal curtailment: Increasing the cut-in speeds during high risk
17 periods of time (migration, maternity season, etc.) based on species life
18 history or from post-construction fatalities on-site.
- 19 • Blade-painting schemes: Paint turbine blades in contrasting color schemes
20 that allow for the turbine blades to be more visible and/or changing the
21 surface texture of the blades so that they do not appear smooth.

- 1 • Deterrents: For bats these are mostly acoustic devices that broadcast high
2 frequency sound waves, or UV lights, that deter bats from approaching the
3 turbine.
- 4 • Wind turbine design modifications: Changing the turbine design in some way
5 to reduce the risk of wildlife entering the strike zone of turbines. Possible
6 methods could utilize deterrents, blade painting schemes, or a combination of
7 other strategies.⁶⁰

8 **Q. What are the known bat species within and surrounding the**
9 **High Prairie Project area?**

10 A. The High Prairie Project area is located in Northeast Missouri in
11 Schulyer and Adair counties. The Department has acoustic and mist-net records for
12 Indiana bats (Endangered and SOCC), northern long-eared bats (Threatened and
13 SOCC), little brown bats (SOCC), tri-colored bats (SOCC), silver-haired bats
14 (SOCC), big brown bats, eastern red bats, hoary bats, and evening bats in Schuyler
15 and Adair counties. This data was collected during April – October from 2013- 2017
16 by the Department as part of a 5-year research study to determine the bat
17 community in areas with high wind development potential versus low wind
18 development potential in north Missouri. We documented species presence within
19 the Project area from April – October annually. This study was designed to collect

⁶⁰ Sinclair, K., & DeGeorge, E. 2016. *Framework for testing the effectiveness of bat and eagle impact-reduction strategies at wind energy projects*. Tech. Rep. NREL/TP-5000-65624. US Department of Energy, National Renewable Energy Laboratory, Golden, CO USA.

1 reference data before wind developments to more fully understand the impact on
2 Missouri bat species.

3 Within the Project area, there are at least five maternity colonies recorded in
4 the Natural Heritage Database from the northern portion of the Project area. See
5 Figure 8. There were 23 Indiana bats and 6 northern long-eared bats captured on
6 the proposed Project area during 2016. See Figure 4 and 6; respectively. The
7 additional area within the Project boundary could contain up to 10-15 additional
8 Indiana bat maternity colonies based on suitable habitat (woodlots or trees);
9 however, the exact number is still unknown as the entire project area has just been
10 surveyed (ending in August 2018) and data has not been shared with MDC as
11 permit reports are not due until the end of the calendar year. Many maternity
12 colonies have on average 50 – 80 individuals.⁶¹ Therefore, we would estimate that
13 on the low end there could potentially be 250 female Indiana bats roosting within
14 the project area (5 known colonies with 50 females in each) and possibly as many as
15 1,200, assuming new colonies are found in previously unsurveyed areas (15 colonies
16 with 80 bats per colony). This many female bats could produce up to 600 juvenile
17 bats start to fly and forage during June and July. These juveniles would be at
18 greater risk of being killed by turbines than adults.

19 In addition to bats roosting within the proposed Project area, there are also
20 bat resources that could be impacted because of where the project is located. As

⁶¹ Whitaker JO Jr, Brack V Jr. 2002. Distribution and summer ecology in Indiana. In: Kurta A, Kennedy J (eds). *The Indiana bat, biology and management of an endangered species*. Bat Conservation International, Austin, TX. pp 48–54.

1 previously explained, the largest known Indiana bat hibernacula occurs in
2 Hannibal, Missouri at Sodalis Nature Preserve (SNP) with almost 198,000 Indiana
3 bats observed in winter 2016/2017). See Figure 4. The proposed Project area is
4 between SNP and tree roosts where many female Indiana bats in northern Missouri
5 raise their young. See Figure 4. Indiana bats have high site fidelity and return to
6 the same maternity colony annually. See Figure 8 through 10. The proposed project
7 area will likely have high numbers of Indiana bats traveling across it during spring
8 and fall migration. See Figure 4.

- ***

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1 Finally, there are a number of bat resources within 10 miles of the Project
2 area. In the past 5 years, the Department conducted summer mist-net surveys for
3 both Indiana and northern long-eared bats on Sugar Creek, Rebel's Cove, Big
4 Creek, Union Ridge, and Indian Hills Conservation Areas in Schuyler, Adair, and
5 Scotland Counties. See Figure 10. There are records for northern long-eared and
6 Indiana bats on all areas except for Indiana bats on Big Creek and most areas had
7 maternity colonies.

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1 **Q. Based upon the above information, what specific concerns do**
2 **you have about this project location in regard to Missouri’s bat resources?**

3 A. I have several concerns related to this project and Missouri’s bat
4 species:

5 (1) The Project area is in the high-likelihood zone for Indiana bat maternity
6 colony occurrence. See Figure 2 and 3 (above).

7 (2) The proposed Project threatens the population that hibernates at SNP,
8 the largest known hibernaculum. We have band records of an Indiana bat
9 captured in Nodaway County being re-sighted in SNP during hibernation.

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1 Therefore, Indiana bats raising young west of the project area are
2 potentially at risk when they migrate between maternity sites and SNP.
3 See Figures 3, 9, and 11.

4 (3) We have Natural Heritage Database records of Indiana bats, northern
5 long-eared bats, and little brown bats in the Project area. See Figure 4, 6,
6 and 10. There are at least 5 maternity colonies based on distances and
7 landscape features associated with capture locations on a portion of the
8 proposed Project area. The Project area expanded in 2017. With the
9 increase project footprint, there could be up to 10-15 colonies within the
10 new Project boundaries based on suitable habitat (woodlots or trees);
11 however, the exact number is still unknown as the entire project area has
12 not been surveyed. Ameren and its agents are completing summer surveys
13 on the entire project area this summer.

14 (4) Little brown bats and tri-colored bats were also documented within the
15 greater Project area in 2016. This species is a state SOCC due to high
16 mortality rates from WNS, and additional fatalities from wind turbines
17 could further endanger this declining population. Natural Heritage
18 Database records are historic to current records; however, both species
19 have seen declines in population size since WNS was discovered in
20 Missouri. See Table 2 and Figure 10 and 11.

21 (5) Silver-haired bats, an SOCC and the other migratory tree bats (eastern
22 red bats and hoary bats) have been documented in or surrounding the

1 proposed Project area. These high-flying species are most likely to be
2 impacted by these turbines with ***

3 ***However, all bat species are at risk within the rotor swept area.
4 Only silver-haired bats are currently being tracked through the NHD, but
5 hoary bats will be added in 2019. See Figure 11.

6 (6) Increased interest by both MDC and the Service on hoary bat mortality
7 rates at wind facilities from turbine strikes. As described above, a paper
8 estimated a 90 percent population reduction over the next 50 years for
9 this species with some very loose assumptions on the current population
10 size of this species across the species range.⁶² Monitoring post-
11 construction fatality rates of this species and all bat species at the Project
12 area will be critical to understand the impacts on Missouri's bat resources.
13 Hoary bats and the other migratory tree bats have been documented to
14 travel longer distances annually so it is reasonable that hoary bats killed
15 in northern Missouri could use southern portions of the state during other
16 times of the year.

⁶² Frick et al. (2017), *supra* n. 5.

**

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1 **Q. What can be done to minimize potential negative impacts to all**
2 **protected bat species and state species of concern?**

3 A. Below are my recommendations for protecting our bat species. These
4 recommendations are specific to the High Prairie Project and are a result of the
5 known species and resources within the Project area. I have broken down ways to
6 reduce the negative impacts to bats species within each stage of the wind facility
7 development process.

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1 **1. Pre-Construction of High Prairie Project**

2 (a) A minimum of 1-year full active season (March 15- October 31) pre-
3 construction monitoring for all bats, including both acoustic and mist net
4 surveys with radio telemetry to find roost trees for Indiana bats and
5 northern long-eared bats.

6 (b) Submit a Natural Heritage Review Request (NHRR) to the Department of
7 Conservation for the Project area. The NHRR will provide any known
8 records of Missouri SOCCs and threatened or endangered species on the
9 Project area and within a buffered distance from the location.

10 (i) Site turbines should be greater than 1,000 ft from known maternity
11 roost trees and capture locations for federally listed species

12 (ii) Avoid tree removal that would fragment the landscape.

13 **2. Construction of High Prairie Project**

14 (a) Avoid tree clearing and fragmentation of habitat where possible. Any tree
15 clearing associated with construction should occur outside the active season
16 for bats (March 15– October 31). No known maternity trees identified
17 during pre-construction surveys or by the NHRR should be cleared during
18 construction of project.

19 **3. Operation of High Prairie Project**

20 (a) Curtailment (cut-in speed) to 6.9 m/s wind speed should be fully
21 implemented during the active season whenever temperatures are above 50
22 degrees Fahrenheit from 30 minutes before sunset until 30 minutes after

1 dawn. This could potentially reduce bat mortality between 73 and 89
2 percent based on data collected in West Virginia.⁶³

3 (b) Turbine blades should be feathered during maternity colony break up and
4 fall migration (August 1 through October 31) in addition to the 6.9 m/s
5 curtailment to further reduce collision risk.

6 **4. Operational Monitoring for High Prairie Project** To date, no wind farm
7 has had multiple Indiana bat maternity colonies within its project area. The
8 monitoring recommended below is in addition to the 6.9 m/s cut-in speed, as
9 the Department needs data to determine if 6.9 m/s is effective in reducing bat
10 mortalities for Indiana and northern long-eared bats in areas with known
11 maternity colonies. Monitoring is critical no matter what operational
12 measures are put in place in order to determine the actual impact of the
13 project for all bat species.

14 (a) For the first year of the Project, conduct carcass persistence study during
15 the active season (March 15-October 31). A carcass persistence study is
16 when carcasses are left on the landscape and monitored daily or at a certain
17 time interval to determine how quickly scavengers will find and remove
18 carcasses. Ameren should search 100 percent of a mowed radius around
19 each turbine daily to estimate carcass persistence and searcher efficiency at
20 each turbine location. The search area should be a mowed 90 m radius

⁶³ Tidhar, D., M. Sonnenburg, and D. Young. 2013. 2012 Post-construction carcass monitoring study for Beech Ridge Wind Farm, Greenbrier County, West Virginia – Final Report, April 1 – October 28, 2012. Prepared for Beech Ridge Wind Farm, Beech Ridge Energy, LLC. 18 January 2013.

1 around the turbine. If carcass persistence is greater than one day, re-
2 evaluate the search interval using adaptive management to determine the
3 most efficient interval for detecting all bat carcasses.

4 (b) For six years following construction, Ameren should conduct operational
5 monitoring by the evidence of absence approach at G-level of 0.3, which
6 means the probability of detecting a killed bat of 30 percent. Monitoring
7 should be conducted during the entire active season (March 15 to October
8 31) as follows:

9 (i) Mow a 90 m radius search area around each turbine every two weeks
10 from April 1 to August 31. All mowing must occur after the plot has
11 been searched that same day.

12 (ii) If additional species are federally listed during the life of the project,
13 an additional 2 years of monitoring should occur from listing date for
14 that species.

15 (c) Identify all dead bats found under turbines and report as described under
16 the Reporting section.

17 (d) Ameren should monitor existing bat colonies within the project area during
18 the life of the project to detect impacts. Monitoring should include radio
19 tracking, migration work, and emergence counts of roost trees during the
20 maternity season (March 15-August 15). Monitoring should rotate
21 throughout the project area with at least one-quarter of the project area
22 with known maternity activity being surveyed annually.

1 (i) For example, monitoring could be to conduct emergence counts at
2 known roost trees. If bats are counted leaving these roost trees, then
3 that would count as the monitoring for that colony. However, if no bats
4 are counted, then do a mist-net survey in the area to see if the colony is
5 still there and to identify their new roost trees.

6 **5. Reporting for High Prairie Project**

7 (a) Report all bat mortalities to MDC as follows:

- 8 ○ Report all current and future bat species of conservation concern
9 (SOCC) carcasses observed within 48 hours on a form provided by the
10 Department. Verify SOCC annually from the MDC checklist.
- 11 ○ Annually, report mortalities for all bat species by December 31 on the
12 same form.

13 (b) Annually, report all monitoring activities and bat mortalities to Public
14 Service Commission by December 31.

15 **IV. UNITED STATES FISH & WILDLIFE SERVICE HCP PROCESS**

16 **Q. On p. 23, lines 17-22, of his Direct Testimony, Mr. Arora states**
17 **that in order to mitigate risks associated with endangered species**
18 **concerns, Ameren is working with the United States Fish & Wildlife**
19 **Service. Are you familiar with the endangered species process being**
20 **referred to?**

1 A. I believe he is referring to the process under the ESA whereby Ameren,
2 or its contractor, may apply for Incidental Take Permit that allows the “taking”⁶⁴ of
3 endangered species when it is incidental to an otherwise lawful activity. As part of
4 the permit application, the applicant must submit a Habitat Conservation Plan or
5 “HCP” to the Service that describes the anticipated effects of the proposed taking of
6 the endangered, how those impacts will be minimized or mitigated; and how the
7 HCP is to be funded. See ESA, Section 10(a)(2)(B); 16 U.S.C. sec. 1539(a)(2). While
8 an Incidental Take Permit is not required by law, without one an entity could face
9 enforcement under the ESA from the Services for the taking of protected species.

10 It is my understanding from Ameren’s response to MDC’s data request, that
11 Ameren is seeking a short-term HCP, which will cover a six-year period, for
12 protected bat species, and that it will later seek a long-term HCP. It is further my
13 understanding that the while an HCP is not required for construction, Ameren
14 needs one in place prior to operation in order to avoid enforcement under the ESA if
15 there is take of an endangered species. I do not know when the Service will issue
16 the HCP in this instance but have reason to believe it will not be until sometime
17 next year, after the PSC case is decided.

18 **Q. What is the Department’s involvement in the HCP process?**

19 A. The Department has some, but limited, involvement in the HCP
20 process. The Department is involved in the process of providing Ameren with
21 information from the Department’s Natural Heritage Database containing known

⁶⁴ "Take" is defined by the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species.

1 locations of federal and state listed species and SOCCs. We also participate in
2 meetings between Terra-Gen and the Service, when invited, to provide input on pre-
3 construction surveys. The Department has been able to read and comment on the
4 draft HCP for the Project during these joint meetings. However, most of the
5 comments are based on survey locations and the known bat resources within the
6 Project area and surrounding area. MDC does not have an official role to play in the
7 HCP process.

8 **Q. Why should the PSC consider your concerns and**
9 **recommendations when there is a separate federal process to address**
10 **endangered species through the Service?**

11 A. There are several reasons why the Department raises these concerns
12 and makes these recommendations. First, because the HCP is a federal process, it
13 will not address species of state concern (SOCCs) that MDC has identified as being
14 potentially impacted by the Project, such as silver-haired bats, little brown bats, tri-
15 colored bats, and hoary bats (will be listed as SOCC in 2019). The HCP offers no
16 protections or monitoring requirements for these species that are of concern to the
17 state. As explained above, some of these species have been devastated by WNS.
18 Providing high quality summer habitat is one strategy to try to recover WNS
19 affected species. ***

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*** Also discussed above, migratory

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1 tree bats (silver-haired bat, hoary bat, and eastern red bat) are the species with the
2 greatest fatality percentages from turbine strikes. Protecting these species through
3 the offered recommendations is of great importance to their long-term survival.
4 Also, of great importance is intensive monitoring for all bat species, not just those
5 required through the HCP, during post-construction surveys to determine fatalities
6 for this Project area, as fatality rates vary between wind facilities.

7 Second, the HCP has not been issued and will not be issued until after this
8 CCN case is concluded. Consequently, the terms and conditions to be included in
9 the HCP process are unknown. It is also possible that Ameren and the Service will
10 be unable to agree upon terms for the HCP that meet the Service's issuance criteria
11 or that Ameren will decide to not get an HCP, since it is not required by law.

12 Third, it is unclear what would happen if the Project exceeds the take limit.
13 From conversations with the Service regarding the short-term HCP process, my
14 understanding is that if a project exceeds the take limit agreed to in the HCP the
15 project has to practice "full-avoidance" which is a cut-in speed of 6.9 m/s. However,
16 it is unclear whether Ameren would be obligated through the HCP to continue post-
17 construction monitoring at the Project area. The Service's full avoidance measure is
18 based from data collected at Beech Ridge Wind Facility in West Virginia where
19 fatalities were reduced between 73 – 89 percent.⁶⁵ This reduction does not
20 guarantee that no Indiana bats or other bat species will not be killed by turbines at

⁶⁵ Good, R.E., W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana, April 13 – October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. 28 January 2011.

1 this cut-in speed as there has not been any documentation of fatality rates for
2 Indiana bats when maternity colonies are present in the project area. In short,
3 there are a number of unknowns associated with the HCP and there is a state
4 interest separate and apart from the interest of the Service and the federal HCP
5 process.

6 Finally, as explained further in my testimony above, the Department has and
7 will continue to invest millions of dollars in the preservation, management, and
8 protection of Missouri's bat species. Conservation desires to be a good steward of
9 taxpayer dollars in protecting the significant investment it has already made in the
10 species as described herein.

11 **Q. With regard to the second point in the previous section, has the**
12 **Service ever issued a take permit for a proposed project in such a high-**
13 **risk area for Indiana bats?**

14 A. To my knowledge, there has never been a take permit issued by the
15 Service where there are known Indiana bat maternity colonies and documented
16 roost trees within the proposed project area. This Project area has at least five
17 maternity colonies with identified roost trees although the entire Project area has
18 not been completely surveyed. ***

19
20 ***As discussed above, MDC has not received any data from Terra-Gen
21 regarding 2018 survey results as state permit reports are due at the end of the
22 calendar year. However, just assuming five colonies for the entire Project area with

1 an average of 50-80 female Indiana bats per colony and potentially 40 juveniles
2 annually, assuming a 50 percent survivorship rate. At a minimum, there would
3 likely be 250 reproductively active female Indiana bats and 125 juveniles per year
4 (assuming 50 females and a 50 percent survivorship rate). ***

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7 *** If a take permit is issued, it will be critical to have
8 rigorous post-construction monitoring to document fatalities at turbine locations for
9 Indiana bats and all bat species.

10 **Q. What happens if a wind farm takes a more individuals of a**
11 **federally protected species under the ESA than the facility is permitted to**
12 **take?**

13 A. That's an important question. The Service has authority over federal
14 laws. It is my understanding that exceeding the take permit could result in
15 renegotiation of the HCP and/or enforcement under the ESA. The USFWS'
16 Columbia Missouri Ecological Services Office (the local office) would be an
17 appropriate source for a direct response to this question.

18 **Q. Does the draft High Prairie Wind Energy Facility HCP include**
19 **take provisions for non-listed (e.g., state SOCC and other) bats?**

20 A. No. According to the responsive document to MDC Data Request No. 6,
21 Attachment-38), ***

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⁶⁶ United States Fish and Wildlife Service (USFWS). 2016. Midwest Wind Energy Multi-Species Habitat Conservation Plan. Public Review Draft. U.S. Fish and Wildlife Service Midwest Region, in collaboration with the states Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, and Wisconsin and the American Wind Energy Association. April 2016. Available at: <https://www.fws.gov/Midwest/endangered/permits/hcp/r3wind/DraftHCPandEIS.html>.

1 **Q.** **Ameren’s draft HCP (Response to MDC Data Request 16,**
2 **Attachment-38) estimates the number of bat fatalities annually based on**
3 **studies from other states as follows: *****

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1 ***** Are you**

2 **comfortable with these estimates? Are the assumptions reasonable given**
3 **the bat resources in this area, and in the referenced study areas?**

4 A. No, I am not comfortable with the estimates. Specifically, I believe they
5 are based on flawed assumptions. ***

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1 My major concern with both assumptions is that the take limit for Indiana
2 bat will be exceeded due to low estimates of fatalities, resulting in a cut-in speed
3 increase to 6.9 m/s or “full avoidance” according to the Service. At this time, it is
4 uncertain if Ameren would still be required to continue post-construction
5 monitoring at the Project area. Post-construction monitoring is critical even at 6.9
6 m/s to document fatalities since this Project would be the first to have multiple
7 known Indiana bat maternity colonies within the Project boundaries.

8 Additionally, these estimates of take for all species are based on studies not
9 in the region and are often based on the specific bat community within or
10 surrounding wind facilities. There are no known wind facilities with the same bat
11 community and numbers of individuals in operation. This Project area is unique
12 and is of great conservation concern for MDC as the stewards of Missouri’s fish,
13 forest, and wildlife.

14 **Q. Does this conclude your testimony?**

15 A. Yes.

