

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of Republic)
Wind, LLC, for a Certificate to Site Wind)
Powered Electric Generating Facilities in) Case No. 17-2295-EL-BGN
Seneca and Sandusky Counties, Ohio)

POST HEARING BRIEF OF THE LOCAL RESIDENT INTERVENORS

This Post-Hearing Brief is filed on behalf of Local Resident Intervenors Joseph & Diane Anderson, Denise Bell, Aaron & Carrie Boes, Richard & Linda Bollenbacher, Rob & Mary Chappell, Thomas & Kathleen Fries, Leslie Hackenburg, Jeffrey & DeeAnne Hamilton, Mary and Allen Hassellbach, Duane & Deb Hay, Ethan & Crystal Hoepf, Gary & Dawn Hoepf, Jason & Michelle Hoepf, Taylor Hoepf, David P. Hoover, Jeffrey A. Hoover, Kenneth & Debra Hossler, Greg & Laura Jess, Leonard & Beverly Kubitz, Gary & Michelle Miller, Steven & Kelley Miller, Kim Mitchell, Charles & Linda Morsher, Patricia Motry, Steven & Linda Mulligan, Doug & Jennifer Myers, Linda Niederkohr, Kevin & Jennifer Oney, Nicholas & Michelle Reiter, Tom & Lori Scheele, Elaine Schultz, James & Victoria Seliga, Eugene & JoAnn Smith, James & Elaine Steinmetz, Herman & Patricia Studer, Christine Vogt, Mark Weber & Cindra Riley, Charles & Rhonda Weyer, Ann Wright, and Chris & Danielle Zeman (collectively referred to as the “Residents”).

I. Republic Wind’s Irresponsible Selection Of The Location For Its Wind Project Will Cause Serious Harm To Local Residents And The Natural Environment.

Republic Wind (“Republic”) could hardly have chosen a worse location for its wind project (“Project”):

- As currently designed, the Project will expose at least 3625 nonparticipating “receivers” to turbine noise. Republic Wind (“RW”) Exh. 1E, Notice of Project Modifications of June 28, 2019 (“Notice of Modification”), Attachment B, Table 8, pp. 68-176. A nonparticipating “receiver” as used in this table is a home on land not leased to Republic. Old, Transcript (“Tr.”) 227:14 to 228:6. The maps in Figures 42 through 49 of Republic’s noise report visually illustrate the population density in and near the Project Area. RW Exh. 1E, Notice of Modification, Attachment B, pp. 64-67.

- According to Dr. Ira Sasowsky, a geologist with 40 years of field experience with karst in the area, at least 70% and possibly 100%, of the Project Area is occupied by karst or potential karst. Sasowsky, Tr. 1207:18 to 1209:22. Republic’s plans to build its turbine foundations on karst will threaten to contaminate or cut off the neighbors’ well water supplies.

- As currently designed, the Project will expose at least 568 participating and non-participating properties to shadow flicker. Amd. Applic. of Dec. 26, 2018, (“Amd. Applic.”), Exh. I, p. 6.¹

- The Project Area is close to regional airports whose operations will be impaired by tall turbines in their air space.

- Multitudes of nonparticipating neighbors within 10 miles of the turbines will have unwelcomed views of one or more, or many, wind turbines, whose hideous appearance will spoil the neighbors’ pristine views from their homes, land, roads, and parks.

- The turbines will be located in an area with healthy bat populations, including the endangered Indiana bat, which are necessary for insect control in agricultural and which will be

¹ The application does not provide a breakdown between the number of participating and non-participating receptors.

drawn into and killed by turbine blades.

- The turbines will be located in the midst of a major migratory pathway for migrating birds flying to one of the most important bird sanctuaries in the Western Hemisphere, which will fly into and be crushed by whirling turbine blades.

- The turbines will be located in area with a rapidly growing Bald Eagle population, which will fly into and be killed by the rotating turbine blades.

In short, the Project Area is not a good place to put turbines. For that reason, Republic has been unable to devise a turbine layout that complies with OPSB's rules and the criteria of R.C. 4906.10(A), despite trying 66 layouts over 10 years of development in attempts to reduce adverse impacts on human health and the environment. Carr, Tr. 28:7-11, 31:19 to 32:8, 33:8-14. Consequently, the Board should deny certification for this Project.

II. The Turbines In Their Proposed Locations Are Too Close To Neighboring Homes And Inflict Loud, Abnoxious Noise On Them.

A. Republic's Poor Site Selection Has Incentivized Republic To Follow Deceptive Practices To Disguise The Harmful Noise Impacts Of Its Turbines.

Wind turbines are noisy. They generate "a variety of sources of sound," including mechanical grinding and clanking sounds and "swishing" and "whooshing" sounds from the blades moving through the air. Old, Tr. 145:21 to 147:5.

Because Republic is attempting to shoehorn its turbines into a well-populated area with numerous homes, it is unable to site its turbines far enough from neighboring homes to protect the homes against loud, annoying turbine noise. Originally, Republic's application proposed a 58-turbine array that would achieve its target of 46 dBA only if some turbines were operated in Noise Reduction Operations ("NRO"). Applic., Feb. 18, 2018, Exh. H, § 6.2, pp. 41-42. NRO modes are operational practices that supposedly reduce the turbine sound, typically by slowing

blade rotation. Republic Wind (“RW”) Exh. 1E, Notice of Modification, Attachment B, § 6.2, p. 42, fn. 12. On December 26, 2018, Republic submitted an amended application, with a 50-turbine array and a spare location. Amd. Applic., Exh. H, § 1.0, p. 1. This array was proposed as an alternative and did not supersede the February 2, 2018 proposal. *Id.* Like the previous proposal, this array would achieve its target of 46 dBA only if some turbines were operated in NRO. *Id.*, § 6.2, pp. 42-43. Finally, on June 28, 2019, Republic amended its application to incorporate additional turbine models into its design, with another noise report containing another set of modeled noise results. RW Exh. 1E, Notice of Modification, Attachment B. Like the preceding amended application, the June 2019 turbine array supplemented rather than replaced the prior version. *Id.*, § 1.0, p. 1. And, like prior arrays, this one can achieve Republic’s 46 dBA goal only by utilizing NRO for some turbines. *Id.*, § 6.2, pp. 42-43.

Thus, none of three arrays complies with the 46 dBA standard proposed by Republic, unless some turbines are operated in NRO. However, the Board should not allow Republic to demonstrate compliance by utilizing NRO, because such a condition cannot be enforced effectively. A person cannot tell that a turbine is operating in an NRO mode by looking at it, so no one will be able to prove a turbine was not following required NRO procedures based on visual observations. Old, Tr. 232:22 to 233:1. Mr. Old testified that a person can tell from a wind company’s SCADA data whether its turbines were operating in NRO (Old, Tr. 233:5-8), but nothing in the Application or Staff Report’s proposed conditions requires Republic to preserve this data for the Staff’s review during operation (Bellamy, Tr. 1516:17-21). If OSPB allows Republic to demonstrate compliance by operating in NRO mode, the Board at least should include a condition requiring Republic to record and maintain its SCADA data so that the Staff can monitor compliance with the noise limits.

Adding to the uncertainty about the Project's noise impacts are Republic's caveats that noise levels may vary depending on modifications to turbine locations, the final number of turbines built, and changes in the manufacturers' published sound data. RW Exh. 1E, Notice of Modification, Attachment B, p. 43. With regard to the manufacturers' published sound data, Republic does not possess some of the data necessary to accurately model the noise from the Nordex N149 5.5 and 5.7 megawatt turbines it is considering for the Project but instead used data for other turbine models. *Id.*, § 6.2, p. 42. Accordingly, Republic has not submitted a turbine array that accurately identifies the expected noise levels of its turbines. Thus, Republic's application does not comply with the requirement in OAC 4906-4-08(A)(3)(b), (b)(i), and (c) to identify operational noise levels at the nearest property boundary and at each noise-sensitive receptor.

As explained below, Republic's compulsion to fit its Project into the Project Area has led to additional deceptive practices that violate other provisions of the Board's noise rules.

B. Republic's Proposed 46 dBA Operational Noise Limit Exceeds Republic's Measured Project Area Ambient Nighttime Average Sound Level By Five A-Weighted Decibels, Which Violates The Operational Noise Standard In OAC 4906-4-09(F)(2).

OAC 4906-4-09(F)(2) provides the Board's noise standard for wind turbines:

The facility shall be operated so that the facility noise contribution does not result in noise levels at any non-participating sensitive receptor within one mile of the project boundary that exceed the project area ambient nighttime average sound level (Leq) by five A-weighted decibels (dBA). During daytime operation only (seven a.m. to ten p.m.), the facility may operate at the greater of: the project area ambient nighttime Leq plus five dBA; or the validly measured ambient Leq plus five dBA at the location of the sensitive receptor. After measured ambient Leq plus five dBA at the location of the sensitive receptor [sic]. After commencement of commercial operation, the applicant shall conduct further review of the impact and possible mitigation of all project-related noise complaints through its complaint resolution process. Non-participating, as used in this context, refers to a property for which the owner has not signed a waiver or otherwise agreed to be subject to a higher noise level.

The first sentence of this rule defines the Board’s nighttime noise standard, stating that “[t]he facility shall be operated so that the facility noise contribution does not result in noise levels at any non-participating sensitive receptor within one mile of the project boundary that exceed the project area ambient nighttime average sound level (Leq) by five A-weighted decibels (dBA).”

That is, the turbine noise must not exceed the ambient level by five or more decibels. Yet, Republic asks for permission to do exactly what the rule prohibits – exceed the ambient level by five dBA. Republic represents that the ambient nighttime level in the Project Area is 41 dBA. Even if this ambient level were accurate (which it is not, see below), its noise limit would be lower than 46 dBA, not 46 dBA.

The language for the nighttime limit in the first sentence of OAC 4906-4-09(F)(2) is in stark contrast to that for the more lenient daytime limit in the second sentence, which states that “the facility may operate at the greater of: the project area ambient nighttime Leq plus five dBA; or the validly measured ambient Leq plus five dBA at the location of the sensitive receptor.” Emphasis added. The rationale for that difference is obvious: the stricter nighttime limit is meant to protect the public at night when they are relaxing or sleeping.

Republic has intentionally designed its turbine layout in a manner that exposes many non-participating sensitive receptors to nighttime turbine noise of at least 46 dBA. These non-participating sensitive receptors are homes or other human occupied buildings on land, such as businesses, places of worship, hospitals, and schools, that is not leased to Republic. Old, Tr. 227:14 to 228:6; Bellamy, Tr. 1535:19 to 1536:3; OAC 4906-4-09(A)(3)(c). Republic’s latest modeling results submitted on June 28, 2019 show that at least 36 non-participating sensitive receptors will be exposed to noise levels of 46 dBA or higher from one or more turbine models proposed in the application. RW Exh. 1E, Notice of Modification, Attachment B, Table 8, pp.

68-176. Thus, the Project does not comply with OAC 4906-4-09(F)(2), and the Application must be denied.

If OPSB does issue a certificate for the Project, the certificate must contain a condition that requires Republic to comply with OAC 4906-4-09(F)(2) as written. The Staff's proposed Condition 44 does not comply with this rule, as it would allow Republic's turbines to increase noise levels by five dBA rather than prohibiting noise increases of five dBA or more. The Residents recommend that this condition read as follows:

The facility shall be operated so that the cumulative nighttime sound level at any non-participating sensitive receptor within one mile of the project boundary will not exceed ~~5 dBA over~~ the project area ambient nighttime average sound level (Leq) by five A-weighted decibels (dBA) or more...."

This language would be consistent with OAC 4906-4-09(F)(2).

A similar change should be made to Staff proposed Condition 60, for the same reason.

The Residents recommend that this condition read as follows:

At least 30 days prior to construction, the Applicant shall submit a noise study showing that cumulative noise impacts at any non-participating receptor, for each of the proposed turbines will not exceed the project area ambient nighttime Leq by ~~more than 5 dBA~~ five dBA or more.

This revision is necessary to make this language comply with OAC 4906-4-09(F)(2).

C. **Sound Measurements Outside Of The Project Area Must Not Be Used To Calculate The Ambient Nighttime Average Sound Level Of The Project Area.**

The accurate calculation of the ambient (background) sound level of a project area is important to find out how much environmental sound is consistently present and available in a community to mask or obscure potential noise from a new facility. Amd. Applic., Dec. 26, 2018, p. 62. The adverse impact of new noise from a wind turbine is a function of how much, if at all, the turbine noise exceeds the pre-existing background sound level. *Id.* Consequently, the

comfort and livability of the surrounding community relies on an accurate assessment of the existing ambient sound level.

OAC 4906-4-09(F)(2) provides that turbine noise at non-participating sensitive receptors must not exceed “the project area ambient nighttime average sound level (Leq)” by five dBA. Emphasis added. To calculate the project area ambient nighttime average sound level, an applicant must “[s]ubmit a preconstruction background noise study of the project area.” OAC 4906-4-08(A)(3)(e) (emphasis added). Accordingly, an applicant must measure the ambient sound level inside a project area, not outside of it.

Republic conducted its ambient sound study from February 3-18, 2016. RW Exh. 1E, Notice of Modification, Attachment B, p. 5. Republic’s noise report states that each of its seven monitoring locations was chosen to represent a different landscape or soundscape “in proximity of one or more of the proposed wind turbines.” RW Exh. 1E, Notice of Modification, Attachment B, p. 5; Old, Tr. 153:11-20, 162:8-10. Republic’s noise report states that its seven monitoring locations were “spread across the proposed project area.” RW Exh. 1E, Notice of Modification, Attachment B, p. 5.

These statements are false. Republic’s map of its ambient sound monitoring sites shows that three of its seven sites were neither located in the Project Area nor situated close to turbine sites: Northern Boundary; Agricultural Operations; and Remote Rural. RW Exh. 1E, Notice of Modification, Attachment B, p. 6, Fig. 2; Old, Tr. 162:11 to 163:1, 164:21 to 165:1, 207:17 to 208:4, 221:6-9. The Northern Boundary monitor was located 4400 feet (3/4 mile) from the nearest Project Area boundary. RW Exh. 1E, Notice of Modification, Attachment B, p. 6. Based on the scale on the map in Figure 2 of Republic’s noise report, the Agricultural Operations monitor was approximately the same distance from the Project Area. RW Exh. 1E, Notice of

Modification, Attachment B, p. 6, Fig. 2. Consistent with this scale, Mr. Old stated that this site is “something less than a mile” from the Project Area, and perhaps more than a half mile away. Old, Tr. 208:5-20. Mr. Old also admitted that the Remote Rural site is outside the Project Area, but could not say how far it was from the nearest proposed turbine location. Old, Tr. 221:6-13.

Mr. Old explained that these three monitoring sites had been located within the Project’s anticipated boundaries at the time that RSG monitored the ambient sound in February 2016, but then Republic moved the Project Area’s boundaries away from these sites. Old, Tr. 163:2-18. However, Republic could have monitored new sites inside of the current Project Area and substituted them for the three noncompliant sites during the three and a half years that elapsed before Republic submitted its amended application in December 2018.

The Northern Boundary, Agricultural Operations, and Remote Rural monitoring sites do not measure the ambient sound of the Project Area. Consequently, their sound measurements must be excluded from the calculations of the project area ambient nighttime average sound level in order to comply with OAC 4906-4-08(A)(3)(e) and OAC 4906-4-09(F)(2).

D. OPSB Should Exclude Ambient Sound Measurements Collected In Noisy Areas That Skew The Project-Wide Average Sound Level And That Would Allow Republic’s Turbines To Create Large Noise Increases In The Community.

In order to make the existing sound level in the Project Area appear to be louder than it actually is, Republic chose several ambient monitoring sites because they are noisier than the rest of the Project Area.

According to Republic’s noise report, the Mixed Residential monitor was located “in the village of Flat Rock” only 682 feet from County Road 29, 348 feet from the Flat Rock Care Center, 1286 feet from a railroad track, and 1690 feet from a railroad crossing. RW Exh. 1E, Notice of Modification, Attachment B, p. 7. Isaac Old’s testimony revealed that this monitoring

site also was close to other noise-generating sources not disclosed in the noise report, including a second railroad track, a second and a third railroad crossing, and another county road. Old, Tr. 178:21 to 179:4, 183:9-12, 192:7-20. “Rail lines are notorious for ... being audible at a very long distance away” (Old, Tr. 166:4-6), and train horns sounded off near the monitoring site both day and night. RW Exh. 1E, Notice of Modification, Attachment B, p. 22. Both of the nearby roads were “well-traveled.” Old, Tr. 192:7-20.

Mr. Old testified that he considers the Mixed Residential site to represent the “higher-population density” soundscape and landscape. Old, Tr. 169:4-8. But Mr. Old did not know what percentage of the Project Area has a similar soundscape or landscape. Old, Tr. 169:18-21, 170:12. In fact, Mr. Old could not identify any other residential areas of similar density in the Project Area. Old, Tr. 169:9-17. Mr. Bellamy testified that the Project Area contains no other residential community with two train tracks and roads. Bellamy, Tr. 1536:22 to 1537:23. That is, the 51 dBA average sound level at the Mixed Residential monitoring site is not representative of any other location in the Project Area.

Similarly, Republic selected the Agricultural Operations monitoring site, because it was at the intersection of two county roads. RW Exh. 1E, Notice of Modification, Attachment B, p. 7. The Busy Roadway monitoring site was selected because it was located near a county road and State Route 18 “where the traffic is significantly higher” than the rest of the Project Area. RW Exh. 1E, Notice of Modification, Attachment B, pp. 5, 7. This monitor was only 262 feet from State Route 18 and “was exposed to regular high-speed car and truck passbys.” Old, Tr. 215:19 to 216:11; RW Exh. 1E, Notice of Modification, Attachment B, p. 18. The North Boundary site was dominated by train horn blasts. RW Exh. 1E, Notice of Modification,

Attachment B, p. 20. The Remote Rural Area site was chosen, because it is two miles from a train track, and train horns “at nearby crossings” raised the ambient sound level. *Id.*, pp. 8, 30.

Republic’s strategy for selecting noisy monitoring sites had its planned outcome of producing a high ambient sound average for the Project Area. The two noisiest sites inside the Project Area – Mixed Residential and Busy Roadway – produced Leq nighttime averages of 51 dBA and 47 dBA, respectively. *Id.*, p. 19, Table 2. The three monitoring sites outside of the Project Area – Agricultural Operations, Remote Rural, and North Boundary – produced high Leq nighttime averages of 47 dBA, 39 dBA, and 44 dBA, respectively. *Id.* In contrast, the only legitimate monitoring sites used in this study – Southern Boundary and Wooded Area – had average nighttime levels of 34 dBA and 32 dBA, respectively. *Id.* By averaging measurements from five abnormally noisy locations – three of which are not even in the Project Area -- with two normal sites, Republic was able to calculate a high, non-representative ambient level of 41 dBA. *Id.* Republic then concluded that it could add five dBA to this level and thus would be allowed to impose noise at levels of 46 dBA on its neighbors in and near the entire Project Area. *Id.*; Old, Tr. 26:1-5.

Republic attempted to infuse credibility into its 41 dBA average by producing Mr. Old to testify that this level is relatively low. RW Exh. 17, Old Direct Testimony, p. 9, A.20. Mr. Old’s direct testimony claims that an article by some wind company consultants shows that 41 dBA is the average background nighttime Leq in a study of over 100 monitoring locations in rural agricultural land. RW Exh. 17, Old Direct Testimony, p. 9, A.20; Old, Tr. 233:18 to 234:14. However, Mr. Old’s cross-examination revealed that his written testimony inaccurately reported the study’s results. The article actually states that 41 dBA was an average background sound for 102 agricultural, mountainous, forested, and residential areas, of which 69 were agricultural and

rural mountainous areas. Old, Tr. 235:19 to 238:12. Mr. Old had no idea how many turbine projects are operating in the United States, except to observe that there are “a lot” of them. Old, Tr. 238:13-15, 21-22. Nor did Mr. Old know what criteria the article’s authors used to select the sites they included in the paper. Old, Tr. 238:23 to 239:1. Thus, the paper’s pro-wind authors, one of whom is Mr. Old’s co-worker at RSG, may have cherry-picked sites that would support their clients.

Most importantly, the sound at the measured sites ranged between 30 and 58 dBA. Old, Tr. 236:3-8, 239:17-19. Accordingly, the article cited by Mr. Old does nothing to support his view that 41 dBA in Republic’s Project Area is typical of the quiet background sound in agricultural areas. The sound in the areas selected for the article’s analysis fell within a broad range starting as low as 30 dBA, which is close to the 32 dBA and 34 dBA Leq averages found at two of Republic’s quietest monitoring sites. RW Exh. 1E, p. 6, Fig. 2.

Republic’s ploy for including noisy sites in a Project-wide average, if allowed by the Board, would have serious adverse impacts on the community. Because the 46 dBA nighttime limit would apply to the entire Project Area, this limit would apply even where the ambient nighttime level is substantially quieter than the five noisy sites included in the Project-wide average. For example, in a neighboring area like the Wooded Area, the turbines could increase the nighttime noise level to 46 dBA even though the ambient level is only 32 dBA. Old, Tr. 226:14-19. This is an increase of 14 dBA (*id.*), while a 10 dBA increase doubles the sound perceived by the listener (Old, Tr. 151:18 to 152:1) and a five dBA increase may result in complaints (Staff Exh. 1, Staff Report, p. 38). Turbines in areas like the Southern Boundary area would be allowed to increase the nighttime noise level by 12 dBA. RW Exh. 1E, Notice of Modification, Attachment B, p. 19, Table 2. In the western part of the Project Area, turbines

would be allowed to increase the ambient nighttime sound levels of 37 dBA and 35 dBA by 9 dBA or 11 dBA. LR Exh. 12, p. 24, Table 1.

Even Staff witness Mark Bellamy admitted that choosing an abnormally noisy location for ambient sound monitoring does not achieve the purpose of the rules. This principle was illustrated in a prior power siting case that Mr. Bellamy had handled for OPSB. In that case, the applicant had sited one of its ambient monitoring stations in a small town along a road, and Mr. Bellamy instructed the applicant to exclude this station from the project-wide ambient sound average. Bellamy, Tr. 1468:9-21, 1472:25 to 1473:18. Mr. Bellamy took this action, because the site was not very representative of the Project Area due to the lack of other towns in the project area and the station's proximity to the road. Bellamy, Tr. 1473:6-24.

Similarly, the Mixed Residential site is in a noisy residential area with two railroad tracks, three nearby railroad crossings, and two nearby busy roads that generate noise in both day and night. During daytime, a quarry and the traffic in the nearby parking lot of a senior care center add their noise to the site. Old, Tr. 175:18-25; 187:13 to 188:19. Mr. Old could not identify any other location in the Project Area that is similar to the Mixed Residential site. Old, Tr. 169:9-21, 170:12. The Busy Roadway monitoring site was only 262 feet from State Route 18 where, as Mr. Old stated, the traffic volume is significantly higher than the rest of the Project Area and where regular high-speed car and truck passbys occur. Old, Tr. 215:19 to 216:11; RW Exh. 1E, Notice of Modification, Attachment B, pp. 5, 7, 18. Both of these sites are unique in the Project Area. Their data should be excluded from the project area ambient nighttime average sound level for the Project Area, just as Mr. Bellamy excluded the monitoring site in the small town near a road from the other application. Including the non-representative sound data from these stations will skew the project area ambient nighttime average sound level for the Project

Area and result in large noise increases throughout all other areas exposed to turbine noise inside and near the Project Area.

E. The World Health Organization Has Determined That Long-Time Exposure To Turbine Noise At Levels Of 40 dBA Or Higher Causes Harmful Health Effects.

According to the World Health Organization (“WHO”), “[s]leep is a biological necessity and disturbed sleep is associated with a number of adverse impacts on health.” LR Exh. 6, “Night Noise Guidelines for Europe,” World Health Organization 2009 (“WHO Noise Guidelines”), p. XII; Mundt, Tr. 6-15. Long-term exposure to noise of 40 dBA or more leads to a reliance on somnifacient (sleep-inducing) drugs and sedatives. WHO Noise Guidelines, p. XIII; Mundt, Tr. 465:10-13. Self-reported sleep disturbance and environmental insomnia inflict noise victims starting at levels of 42 dBA. WHO Noise Guidelines, p. XIII; Mundt, Tr. 465:4-9, 14-18.

Complaints from persons annoyed by noise begin at 35 dBA. WHO Noise Guidelines, p. XIV; Mundt, Tr. 465:19-25.

Based on its research, WHO recommends that people not be exposed to nighttime noise levels greater than 40 dB of $L_{\text{night, outside}}$. WHO Noise Guidelines, p. XVI. $L_{\text{night, outside}}$ is defined as the one year Leq over eight hours outside at the most exposed façade outside of a person’s house.² *Id.*, p. 8, § 1.3.4.

Similarly, the Staff Report also acknowledges that “[a]nnoyance can lead to stress and stress can lead to adverse health effects.” Staff Exh. 1, Staff Report, p. 38. Therefore, “in non-industrial settings, the ambient noise level at any given receptor should probably not be exceeded by more than 5 dBA, and an increase of 5 dBA may cause complaints.” *Id.*

² WHO also provides an “interim target” of 55 dB $L_{\text{night, outside}}$ where 40 dB is not achievable in the short run. *Id.* However, WHO warns that 55 dB does not protect public health. *Id.*

F. The 2018 Sound Measurements From The Western One-Third Of The Project Area Must Be Individually Incorporated Into The Project Area Ambient Nighttime Average Sound Level In Order To Produce An Average That Is Representative Of The Entire Project Area.

During cross-examination, Isaac Old represented that he had visited the Project Area only once, and that this single visit occurred when he set up the sound monitors described in the Application for this case. Old, Tr. 190:8-12. He also stated that RSG had done no additional background sound measurements in the Project Area after Republic reconfigured the Project Area to its current design. Old, Tr. 195:12-19. These statements were false.

Mr. Old changed his testimony when asked whether he had set up a sound monitoring station on the Beckman Farm on September 16, 2018. Old, Tr. 196:21 to 197:13. Realizing that the Residents knew about his visit, he admitted that he had conducted ambient monitoring for the Republic transmission line in the Project Area in the latter half of 2018. Old, Tr. 197:7-13.

Republic's ambient sound monitoring for the transmission line occurred at three locations inside the Project Area for this case. Carr, Tr. 341:4-11; LR Exh. 12, p. 24, Table 1. The average nighttime LEQ levels at the Middle Monitor, East Monitor, and West Monitor were 35 dBA, 37 dBA, and 37 dBA, respectively. LR Exh. 12, p. 24, Table 1; Carr, Tr. 341:12-25, 342:15-18.

These three monitoring stations are located in the western part of the Project Area. LR Exh. 12, p. 2 & p. 3, Fig. 1. The Application in this case contains no background sound measurement stations in the western area, because Republic added this land to the Project Area after RSG monitored in February 2016. Old, Tr. 195:1-11. Mr. Old could not identify any monitoring stations in the Application that were representative of the sound in the western portion of the Project Area. Old, Tr. 195:20-25. And staff member Mark Bellamy testified that monitoring stations should represent the Project Area geographically. Bellamy, Tr. 1475:11-16.

Consequently, the use of the 2018 ambient sound measurements from the three monitoring stations is essential to fill the gap in the ambient sound data for the Project Area.

Mr. Bellamy stated that these three monitors are located in a “small corridor” in the western area. Bellamy, Tr. 1488:12-16. However, the scale of distance on the map depicting these monitoring locations shows that they cover an area of about five miles from east to west, and ranging from a half mile to about four miles from north to south. LR Exh. 12, p. 7, Fig. 2. Based on the scale of distance on the map of the entire Project Area, the entire Project Area is about 15 miles from east to west. Amd. Applic., Exh. E, Fig. 2. Therefore, the three monitors in the western portion measure the sound in a substantial part of the Project Area that was not included in the average ambient sound level in Republic’s Application in this case. A Project-wide ambient sound average cannot be accurately calculated if a large portion of the Project Area is excluded from the calculation.

Mr. Bellamy’s written direct testimony acknowledges that ambient sound data from the western portion of the Project Area should be incorporated into the Project-wide average to “provide[] a more complete picture of the wind generation project area ambient nighttime Leq.” Staff Exh. 16, p. 2, A.8, lines 16-22. He testified on cross-examination that, due to the absence of data from the western area in the Application, “it made sense to include that data.” Bellamy, Tr. 1490:8-13.

In an attempt to attack Mr. Bellamy’s use of the western sound data, Republic suggested in Mr. Bellamy’s cross-examination that “you have three monitoring locations for three turbines” in the western portion of the Project Area. Tr. 1491:6-8. These three turbine sites are located between two of the monitoring sites. Bellamy, Tr. 1490:20-22. However, as Mr. Bellamy noted, there are another four to seven turbine sites just east of the East Monitor. Bellamy, Tr. 1490:21

to 1491:2. The proximity of additional turbine sites can be further determined by looking at their locations on Figure 2 of the transportation study. Bellamy, Tr. 1530:8 1531:2; Amd. Applic., Exh. E, Fig. 2. The East Monitor is located near the red circle just to the west of the westernmost red number “17” on Figure 2. *Id.*; Bellamy, Tr. 1530:8 1531:2; Amd. Applic., Exh. E, Fig. 2. Using the scale for distance on Figure 2, one can tell that nine turbine sites are within about a mile to the east and southeast of the East Monitor (*id.*), in addition to the three turbines sites that are located between the monitoring sites.

While Mr. Bellamy correctly recognized the necessity of filling the data gap in the western Project Area, he diluted the impact of this sound data by recommending that Republic’s three monitors in the western area be combined to serve as only one data point in the Project ambient sound average instead of three. Staff Exh. 16, Bellamy Direct Testimony, p. 2, A. 7, lines 8-13 & p. 3, A.9, lines 1-6. He offered two justifications for this act. First, he said that the three monitor sites are “pretty close together.” Bellamy, Tr. 1518:8-15. Second, he reasoned that the three monitors are in just one soundscape (Bellamy, Tr. 1490:14-16), and then he changed his testimony to say that “they represent pretty similar soundscapes.” Bellamy, Tr. 1519:8-16. Both of Mr. Bellamy’s premises for combining the three monitors’ data into one data point are inaccurate.

With regard to the three western monitors’ proximity to each other, Mr. Bellamy at first testified that it is “probably fair to say” that the three western monitoring sites are located closer together than the other monitor sites in the Project Area. Bellamy, Tr. 1489:4-7. But his subsequent testimony revealed otherwise. As explained above, the scale on the map depicting these monitoring locations shows that they cover an area of about five miles from east to west. LR Exh. 12, p. 7, Fig. 2. The proposed transmission line route along which the monitors were

sited is about 4.8 miles long. Bellamy, Tr. 1519:10 to 1520:11. The three monitors were spaced about 2.4 miles apart from each other. *Id.*, 1520:12-20. By comparison, the Wooded Area monitor was located about two miles from East Monitor, and the Wooded Area monitor and the South Boundary monitor were about two miles apart. Bellamy, Tr. 1521:7-17. The use of the scale on Figure 2 of Republic's noise report shows that the spaces between other monitoring sites were about two miles or only slightly larger. RW Exh. 1E, Notice of Modification, Attachment B, p. 6. So the western monitors were at appropriate distances apart, rather than over-representing the western part of the Project Area. Mr. Old would not have placed these monitors at these three locations for the transmission line if he had not believed that three monitors were necessary to accurately characterize the ambient sound in that area. So the space between the western monitors does not justify Mr. Bellamy's recommendation to combine their sound measurements into one data point.

The number or characteristics of the soundscapes in the western part of the Project Area also do not support Mr. Bellamy's position. RSG used three monitors in that area because it found that each site represented a different soundscape. Bellamy, Tr. 1521:18 to 1522:11. Mr. Old would not have done that if he had not believed that three monitors were necessary to accurately characterize the three soundscapes in that area.

Moreover, Mr. Old's technique of measuring different soundscapes and landscapes, and then averaging the results to calculate a Project-wide average, produces a flawed representation of the Project Area's ambient sound level. Calculating an average that gives equal weight to each distinct soundscape in a project area skews the average if one soundscape is larger than another. To illustrate this point by hypothetical, if one soundscape with a sound level of 50 dBA covers 5% of a project area is averaged with another soundscape with 30 dBA that covers 95%

of the project area, the 40 dBA average would grossly misrepresent the ambient sound in 95% of the project area. And, by adding five dBA to the 40 dBA average to establish the nighttime limit, as Republic and the Staff would do, would allow a wind project to increase the noise level in 95% of the project area by 15 dBA.

Yet this is the averaging technique that Republic and the Staff urge the Board to accept. Mr. Old could not say how much of the Project Area was represented by the soundscape in each of his monitoring locations. Old, Tr. 165:15-19, 169:18-21, 169:9-17, 170:12, 173:4-7. And, as explained above, he admitted that the Mixed Residential and Busy Roadway sites are unlike any other location in the Project Area.

Mr. Bellamy asserted that, while data from the western part of the Project Area would provide a “more complete record,” he believed that the seven original monitor locations “would suffice.” Bellamy, Tr. 1544:17 to 1545:7. However, he admitted that including many monitoring sites in a noisy part of the Project Area, or in a quiet part of the Project Area, would skew the average one way or the other. Bellamy, Tr. 1546:16-22. Yet, Republic has significantly skewed the average by selecting mostly noisy sites, some of which are not even inside the Project Area. Out of its seven original monitoring sites, five of them produce high noise levels of 39 to 51 dBA. RW Exh. 1E, Notice of Modification, Attachment B, p. 19, Table 2. The three monitors, with results of 35, 37, and 37, show that the entire western third of the Project Area is much quieter than most of the original sites. By loading up on noisy sites and disregarding quieter site, Republic has purposely skewed the average upwards.

By combining the sound data from the three western monitors into one number and averaging them with the seven monitors in the Application, Mr. Bellamy has diluted the impact of the western monitors on the Project average. His recommended Project Area nighttime

average of 40.5 dBA still fails to accurately reflect the actual ambient sound level in most of the Project Area. This recommendation falls substantially short of the ambient sound reduction necessary to narrow the large gap between the project area ambient nighttime average sound level and the quieter areas represented by the five monitors at the Wooded Area, South Boundary, and western sites. For example, using a nighttime 40.5 dBA average would allow the turbines to increase the existing 32 dBA noise level in the Wooded Area to 45.5 dBA. Bellamy, Tr. 1538:18 to 1539:16. This would increase the existing nighttime noise levels in that area by 13.5 dBA. *Id.*, 13-25. As noted above, a 10 dBA increase doubles the sound perceived by the listener (Old, Tr. 151:18 to 152:1) and a five dBA increase may result in complaints (Staff Exh. 1, Staff Report, p. 38). Thus, Mr. Bellamy's ill-advised recommendation to combine the western monitors into one data point, while accepting all seven of Republic's other monitoring sites, would result in a limit that will destroy the residents' ability to sleep and relax at night in much of the Project Area. Since the daytime limit is five dBA above the nighttime average ambient level (except where the facility measures and uses the ambient level at the receptor's location) under OAC 4906-4-09(F)(2), Republic's skewed nighttime average also will impair the neighbors' quality of life during the daytime. To more accurately quantify the nighttime ambient sound in the Project Area, OPSB should use the data from the three western monitors as three separate data points, and average them with the data from the legitimate monitoring stations elsewhere in the Project Area.

G. Conclusions

As explained above, the evidence demonstrates the following points:

- Even if OPSB accepted 41 dBA (or 40.5 as proposed by Mr. Bellamy) as the nighttime ambient average sound level, Republic's turbine layout would violate the prohibition

in OAC 4906-4-09(F)(2) against increasing noise levels above the nighttime ambient average sound level by five dBA or more. Even in NRO mode, Republic's current turbine layout exceeds that limit by producing noise levels as high as 46 dBA.

- The sound data from the Northern Boundary, Agricultural Operations, and Remote Rural monitoring sites should not be used to calculate the nighttime ambient average sound level, because these sites are located outside of the Project Area.

- The sound data from the Mixed Residential and Busy Roadway Rural monitoring sites should not be used to calculate the nighttime ambient average sound level, because they are uniquely noisy locations that are in no way representative of the Project Area.

- Giving equal weight to the monitoring data for each of the different soundscapes in the Project Area does not produce an accurate average unless each soundscape covers the same amount of territory.

- Even if each soundscape covers the same amount of territory, employing a Project-wide average to set the noise limit for the entire Project Area will not protect the quieter areas from large noise increases above five dBA where one or more noisy monitoring sites raise the average. In this case, Republic's emphasis on monitoring noisy sites has skewed the average so badly that it would allow noise increases of 14 dBA (or 13.5 dBA under Mr. Bellamy's position) in the quietest area of the Project Area even though a 10 dBA increase doubles the sound perceived by the listener and a five dBA increase may result in complaints.

- If OPSB interprets OAC 4906-4-09(F)(2) to require Project-wide averaging even where such averaging would expose the quieter areas to intolerable noise increases, then this rule is arbitrary and capricious and thus unconstitutional.

- The sound measurements from each of the three monitoring stations in the western one-third of the Project Area should be incorporated into the Project-wide average to calculate the nighttime ambient average sound level.
- Republic's and Mr. Bellamy's proposals for the project area ambient nighttime average sound level of 40.5 dBA and 41 dBA, respectively, would result in turbine noise levels up to 45.5 dBA or 46 dBA, respectively.
- The WHO finds that long-term exposure to noise of 40 dBA or more leads to a reliance on somnifacient (sleep-inducing) drugs and sedatives and that levels of 42 dBA or more cause self-reported sleep disturbance and environmental insomnia. WHO finds that complaints from persons annoyed by noise begin at 35 dBA. Exposing the population to turbine noise levels of up to 45.5 dBA or 46 dBA, as proposed by the Staff and Republic, respectively, will harm public health.
- The Staff acknowledges that annoyance with noise and complaints begin once a new noise source increases the noise level by five dBA. Yet the Staff and Republic propose noise limits of 45.5 dBA or 46 dBA, respectively, that will raise the noise levels by 8.5 dBA to 13.5 dBA or 9 dBA to 14 dBA in the portions of the Project Area represented by five of the monitoring sites (Wooded Area at 32 dBA, South Boundary at 34 dBA, Middle Monitor at 35 dBA, East Monitor at 37 dBA, and West Monitor at 37 dBA).
- Turbines that produce 45.5 dBA or 46 dBA of noise or that increase the existing noise level by five dBA or more would not meet the statutory criteria in R.C. 4906.10 for representing the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serving the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). Republic's turbine layout as currently designed will result in an annoyed and sleep-deprived community.

Applying these principles, the Residents request that OPSB calculate the nighttime ambient average sound level by averaging the sound measurements from the following monitoring stations:

Wooded Area	32 dBA
South Boundary	34 dBA
Middle Monitor	35 dBA
East Monitor	37 dBA
<u>West Monitor</u>	<u>37 dBA</u>
Average	35 dBA

This calculation produces a nighttime ambient average sound level of 35 dBA, resulting in a limit that prohibits turbine noise of 40 dBA or higher. In the alternative, OPSB could comply with the criteria in R.C. 4906.10 by establishing a limit that prohibits turbine noise at a level of five dBA or more above the validly measured nighttime ambient Leq at the location of the sensitive receptor.

If OPSB believes that eliminating the other monitoring sites from this calculation results in an inadequate number of monitoring sites to cover the Project Area, then the Board should instruct Republic to supplement its Application by conducting additional sound monitoring at sites inside the Project Area that are more representative of the sound levels in that area. That data should be added to the data from the five monitors listed above to recalculate the nighttime ambient average sound level, and this information should be subject to additional discovery and hearing.

III. OPSB Should Accept The Staff's Proposed Condition 58 To Cure Republic's Failure To Comply With OAC 4906-4-08(A)(3)(c).

The Residents agree with the Staff's proposed Condition 58, which recommends that the installation of certain turbine models not be allowed at turbine location 37 due to Republic's failure to timely inform 10 households about the expected noise impacts on them from these turbine models. The Application did not contain this information prior to the public hearing in October 2019, so the affected citizens were deprived of their right to comment on this information. Bellamy, Tr. 1479:7-20. Although Mr. Old contended that these people could have used the maps in Figures 42 through 49 of the noise report to find the expected noise level at their homes (Old, Tr. 259:11-15), those maps do not label the owners or addresses of the homes. RW Exh. 1E, Notice of Modification, Attachment B, pp. 44-51. These figures lack the detail necessary for the neighbors to find their homes on the maps in order to identify the noise level expected at their homes. *Id.* Moreover, Mark Bellamy testified that these 10 receptors were not even included on the map, so their occupants could not tell if they would experience any noise impacts. Bellamy, Tr. 1479:7-12.

Nor does the fact that these receptors were modeled as receiving 42 dBA or less in turbine noise excuse Republic's failure to timely provide these people with this information as required by OAC 4906-4-08(A)(3)(c). The affected persons in these homes still had a right to comment on the noise level, regardless of what it is. This principle also applies if the noise from this turbine in NRO mode does not exceed Republic's 41 dBA average for the Project Area, as suggested in cross-examination by Republic's counsel. Bellamy, Tr. 1480:14 to 1483:14. The public's right to comment on the noise from this turbine is all the more important in light of the non-representative nature of Republic's 41 dBA average. Since the ambient sound in most of the

Project Area is below 41 dBA, the residents of these 10 homes should have been allowed to comment on the noise from this turbine.

IV. Republic's Plans To Install Turbines On Karst Could Pollute Or Cut Off The Community's Water Supplies.

A. Clean, Uninterrupted Groundwater Is Essential To The Residents In And Around The Project Area.

Republic found that “the majority of residents in the vicinity of the Project Area rely upon private wells for their potable water.” Amd. Applic., p. 73. The majority of residences are supplied by individual private wells, which make use of groundwater from underneath their property. LR Exh. 24, Sasowsky Direct Testimony, p. 16, A.22. The principal source of groundwater in the Project Area is a carbonate limestone bedrock aquifer. Amd. Applic., p. 73; Amd. Applic., Exh. F, p. 4. Some of the groundwater utilized by the area’s residents can be found at shallow depths; a survey of residents in the Project Area found that well water was found as close as eight feet from the ground surface. *Id.*, p. 5.

The availability of suitable water for drinking, agriculture, and other purposes is critical in a rural area such as this one. LR Exh. 24, Sasowsky Direct Testimony, pp. 15-16, A.22. Even Republic witness Shawn McGee acknowledged that changing or contaminating the groundwater flow in the area would have a “significant impact.” McGee, Tr. 849:18-24.

In addition, source water protection areas (“SWPAs”) for three public water systems are located inside the Project Area. *Id.*, p. 4; Amd. Applic., p. 73. SWPAs are recharge areas defined and approved by Ohio EPA to protect drinking water resources from contamination. Amd. Applic., Exh. F, p. 4; Sasowsky, Tr. 1207:4-14. The three SWPAs in the Project Area protect the public water supplies of the City of Clyde, Capital Aluminum and Glass, and the City of Fremont. Amd. Applic., Exh. F, p. 4. Republic wants to site numerous turbines in these

SWPAs, including 21 in the Capital Aluminum and Glass SWPA. *Id.* The Capital Aluminum and Glass draws its water supply from the groundwater, while the other two public water systems use surface water.

Republic notes that no government program has adopted rules to prohibit the siting of wind turbines in SWPAs. Amd. Applic., p. 74; Amd. Applic., Exh. F, p. 5. However, the lack of oversight over turbine installation by other government agencies does not excuse the OPSB from exercising its mandate to protect these essential water supplies from damage by energy facilities. As explained below, Republic's Project threatens to obstruct and contaminate the flow of groundwater that is used by the area's groundwater wells.

B. Republic And The Staff, In The Absence Of A Groundwater Investigation, Have Mistakenly Opined That The Turbines Cannot Damage The Community's Water Supply Wells Simply Because The Turbines Are About 1371 Feet From The Wells.

Republic opines that these essential groundwater resources will be protected from damage simply because the setback in OAC 4906-4-08(C)(2)(b) will keep the turbines at least 1371 feet away from neighboring homes. Amd. Applic., p. 74. The Staff Report repeats this assertion without any analysis or independent research to demonstrate that the water supply wells cannot be damaged at this distance. Staff Exh. 1, Staff Report, p. 25; Collins, Tr. 1414:19-21. This position betrays Republic's and the Staff's fundamental lack of understanding about the karst geology and the hydrogeology of this area, as explained below.

Perhaps Republic and the Staff would have better understood the Project's risk to groundwater if Republic had satisfied its obligation under OAC 4906-4-08(A)(4)(a) to evaluate the impact to public and private water supplies due to the construction and operation of the wind project. However, no field investigation of the groundwater or the area's geology has been conducted, with Republic promising to drill borings for that purpose only after Project

certification. Amd. Applic., pp. 81-82. Republic has not drilled a single boring to examine the geology of the Project Area. Carr, Tr. 313:8-12; McGee, Tr. 824:23 to 825:3. In the absence of this information, Republic and the Staff have failed to appreciate and inform the Board about the turbines' potential threats to groundwater in karst geology, as described below.

Republic's ignorance about its Project's threats to the area's karst features and groundwater supplies stems from its failure to meaningfully study these issues. Instead, Republic, and the Staff, have concentrated primarily on the civil engineering challenges from building heavy turbines on karst. That is, they have focused mostly on what it will take to keep the turbines standing if they are constructed on karst.

This was evident not only in the Amended Application, but also in the karst testimony of Republic witness Shawn McGee of Hull & Associates. Mr. McGee is a civil engineer, not a hydrogeologist. RW Exh. 27, McGee Direct Testimony, p. 2, A.2; McGee, Tr. 839:10-14. His work experience has concentrated on engineering tasks designed to provide stable foundations in the construction of structures, not to evaluate risks to groundwater. RW Exh. 27, McGee Direct Testimony, p. 2, A.3. With regard to risk to groundwater, his direct testimony stated only that Hull's report (Amd. Applic., Exh. F) concluded that turbine construction will not harm the neighbors' water supply wells. RW Exh. 27, McGee Direct Testimony, p. 5, A.11. His testimony offers no evidence or analysis to support this barebones conclusion. *Id.* Nor does he have any qualifications to express expert opinions on hydrogeological issues, as shown by his lack of education and experience in these issues. *Id.*, p.2, A.2, A.3. Not surprisingly, then, Republic has offered no expert hydrogeology opinions to identify the turbines' effects on groundwater supplies. This is a critical omission for a Project located in a karst area.

C. **The Protection Of The Karst Geology That Dominates The Project Area Is Necessary To Protect The Community's Groundwater Supplies.**

Republic admits that about 50% of the Project Area is located within the Bellevue-Castalia Karst Plain, which is characterized by numerous sinkholes, large solution features, springs, and caves. Amd. Applic., p. 77; McGee, Tr. 823:16-23. A total of 21 turbines sites are located in the karst plain as delineated by Republic. Amd. Applic., p. 78; Amd. Applic., Exh. F, p. 3. Dr. Ira Sasowsky estimates that at least 70%, and possibly 100%, of the Project Area is occupied by karst or potential karst based on the geologic data on Exhibit D of his direct testimony. Sasowsky, Tr. 1207:18 to 1209:22.

Karst is a type of topography that is formed on limestone, gypsum, and other rocks, primarily by dissolution, and that is characterized by sinkholes, caves, and underground drainage. LR Exh. 24, Direct Testimony of Ira Sasowsky, pp. 3-4, A.9. Karst regions are those, usually underlain by limestone or dolostone, which are types of carbonate-rich bedrock where dissolution of the rocks has produced a characteristic set of features and behaviors. *Id.*, p. 4, A.9. Karst forms on, and in, these particular rocks because they are easier to dissolve than many other rocks. *Id.* The primary features of karst regions are sinkholes and caves, along with disappearing streams. *Id.* These features originate by the movement of naturally acidic water through the bedrock, which wears away the rock. *Id.* This can create relatively large, and laterally extensive, routes for water to move through the rock. *Id.* When these pathways are large enough for humans to traverse, they are called caves. *Id.*

To understand the basic process by which karst features form, it is useful to consider them in the context of the water cycle. *Id.* One pathway in this cycle is for the rainwater to infiltrate, or soak into, the soil. *Id.*, p. 5, A.9. When this occurs, the water can make its way downward to join with the groundwater flow system. *Id.* This is called groundwater recharge. *Id.* Along this pathway, which is typically quite slow in non-karst areas, water is driven by

hydraulic gradients in downward, lateral, or even upward directions. *Id.* It eventually makes its way back to the surface, emerging as springs or seeps, or as base flow in streams. *Id.* In those cases where the bedrock is a carbonate material, such as limestone or dolomite, the water traveling along the path can act to dissolve away the rock creating larger pathways. *Id.* This process is known as karstification, which develops extensive pathways and large features. *Id.* In some cases the openings within the bedrock can become in filled with loose geological materials, which may be called soil, or regolith. *Id.* This material may partially or fully block water movement through the bedrock openings, at least temporarily. *Id.*

Karst pathways allow the very rapid and focused movement of water. *Id.*, p. 4, A.9. For example, Republic's application recounts that "Ohio EPA delineated the entire region contributing water via the karst system as a SWPA" for the Capital Aluminum and Glass water supply, because the groundwater flows at a rapid rate of 3,500 to 8,600 feet per day, the bedrock is at a shallow depth, and sinkholes are present. Amd. Applic., p. 75; Amd. Applic., Exh. F, p. 4. Republic's interview of a district manager for the Ohio Department of Transportation revealed that an "underground river" associated with the cave system in the area flows between Bellevue and Bloomville, Ohio. Amd. Applic., p. 79; Amd. Applic., Exh. F, p. 6. Mr. McGee admitted that he knows that underground groundwater pathways are present at turbine sites, even though no hydrogeological study or bedrock borings have been done. McGee, Tr. 851:18 to 852:2. These underground groundwater pathways lead to significant challenges for the safe development of any infrastructure in these settings, even in the absence of large sized openings. LR Exh. 24, Sasowsky Direct Testimony, p. 4, A.9.

The foregoing information is in marked contrast to Republic's sole basis for opining that the turbines cannot damage water wells that are at 1371 feet away. Groundwater travels much

faster in karst. At a travel rate of 3,500 to 8,600 feet per day, as found by Ohio EPA, groundwater from the vicinity of a turbine could travel 1371 feet in four to nine hours. That means that contaminants drawn into the bedrock from the turbine's construction could reach a neighboring well in four to nine hours. If the turbine is blocking groundwater recharge supplying the well, the well could lose all or part of its water supply in four to nine hours. These threats are analyzed in more detail below.

D. As Confirmed By Dr. Ira Sasowsky's Extensive Field Experience With Karst In And Near The Project Area, The Groundwater Flows Rapidly Throughout The Bedrock In The Area Whether Or Not Karst Features Are Noticeable On The Land Surface.

The Residents retained Dr. Ira Sasowsky to analyze the turbines' threat to the community groundwater supplies. Dr. Sasowsky is a geoscientist who holds bachelor, masters, and doctorate degrees in geology. LR Exh. 24, Sasowsky Direct Testimony, p. 1, A.2 & A.3. He is a principal in Sasowsky Earth Science Consultants, Ltd. ("SESC"), a professional services company providing geologic, hydrologic, and soils consulting and is a Professor of Geosciences at the University of Akron. *Id.*, p. 1, A.3. He has advised a wide variety of clients on geologic issues, much of which has involved karst. *Id.*, p. 2, A.4.

Dr. Sasowsky has extensive experience with karst, including extensive experience in Northwest Ohio. Over his career, he has specialized in research on karst (cave and sinkhole) development. *Id.*, p. 5, A.10. He has been examining and working in karst terrains for about 40 years. *Id.* This work has included academic research, as well as consulting for technical concerns. *Id.* The technical subfields within which he has worked in karst settings include geomorphology, hydrogeology, geochemistry, and environmental chemistry. *Id.*

Dr. Sasowsky has had field experience in karst areas in more than 25 U.S. states, South America, the Caribbean, and Europe. *Id.*, p. 6, A.10. He has entered and examined over 500

caves throughout the world. *Id.* In Ohio, he has directed several research projects in various karst areas. *Id.* He has edited 11 scientific books on karst, has been an author of numerous technical reports, and has published close to 50 scientific articles that have appeared in scientific journals. *Id.* He has presented the results of scientific work and published more than 100 abstracts at national and international meetings, as well as giving invited lectures at universities in North America and Europe. *Id.* His knowledge has been shared with hundreds of students, colleagues, professionals, and the public through classes, field trips, sessions, and conferences. *Id.* During his 15-year tenure as the earth sciences editor of the Journal of Cave and Karst Studies, he has overseen the publication of cutting-edge research in this discipline. *Id.*

Dr. Sasowsky's expertise in karst has led to research contracts with environmental agencies of the federal and state governments. In one such study, the U.S. Department of Agriculture commissioned him to examine methods and make recommendations for handling storm water in karst terrains. *Id.*, pp. 6-7, A. 11. In a research project of particular application to the Republic case, he was retained by Ohio EPA with U.S. Environmental Protection Agency funding to research a source water protection plan for the Bellevue - Castalia Karst Plain, which significantly overlaps the proposed Republic Project Area. *Id.*, pp. 6-7, A.11 & A.12. This undertaking involved an extensive desktop study which developed a lengthy annotated bibliography for the area. *Id.*, p. 7, A.12. Following that, his investigations in the the Bellevue - Castalia Karst Plain included field mapping, dye tracing, well video, statistical analysis of drilling records, geophysical investigations, and geochemical modeling. *Id.*

Dr. Sasowsky has made many other visits to areas within or near the Project Area to examine the karst features and conduct research. *Id.* These visits started 20 years ago with

colleagues from the geology department at Oberlin College. *Id.* Since that time he has made many other visits to examine the karst features and conduct research.

Based on his personal observations, Dr. Sasowsky found that karst is pervasive throughout the Republic Project Area. *Id.*, pp. 7-9, A.13. He also discovered that, even in certain areas that did not appear to be karst due to the absence of known sinkholes or caves on the land surface, the bedrock had openings that allow the fast movement of water. *Id.*, p. 7, A.12. The Bellevue – Castalia Karst Plain is characterized by loose sedimentary material such as sand and silt that hides the underground sinkholes, caves, and groundwater conduits. *Id.*, p. 9, A.14; Sasowsky, Tr. 1204:1 to 1205:19.

Dr. Sasowsky further found that the absence or rarity of surficial karst features such as sinkholes does not indicate that karst is absent. LR 24, Sasowsky Direct Testimony, p. 11, A.17. For example, in Bloom Township, just south of the Republic Wind project area, he found three indications of substantial karst groundwater flow even though there are few sinkholes in the area. *Id.*, p. 12, A.17. This confirms that groundwater flows rapidly in this area, even in portions of this region that are not traditionally considered to be karst. *Id.*

E. Karst Openings Can Develop Under And Collapse Wind Turbines.

Dr. Sasowsky also observed that karstification (the creation of holes and pathways) in the Project Area is occurring via two processes. *Id.*, p. 11, A.17. There is evidence of the typical top-down karstification that occurs when water moves down into the ground. *Id.* This is seen, for example, in sinkholes and sinking stream points in much of the region. *Id.* However, there is another significant process at work. Relatively deep groundwater circulation, moving in a generally north direction, is dissolving certain beds in the underlying Salina Group. *Id.* This is causing upwards collapses which in some cases reach the land surface, creating very large

sinkholes in the overlying carbonate rocks. *Id.* For example, a collapse sinkhole opened up under a man's bedroom in Florida in 2013 and killed him. *Id.*, pp. 9-10, A.14.

Wind turbines are equally susceptible to this hazard, which can result from either slow land subsidence, or rapid collapse. *Id.*, p. 13, A.20. Additional weight on the land surface can create a hole by compressing sedimentary material, by breaking the bedrock, or by eroding sedimentary fill from existing karst cavities by directing water into them. *Id.*

Republic realizes that karst areas may have sinkholes, solution cavities, and cave systems. Amd. Applic., Exh. F, p. 8. Recognizing the threat of subsidence or collapse, Republic's geotechnical consultant, Hull & Associates advises Republic to pump grout into the karst openings to provide adequate foundation support. Amd. Applic., p. 80. Mr. Carr and Mr. McGee testified that grout may be used to fill the voids (cavities) in the karst formations under the turbine foundations. McGee, Tr. 840:6-16; RW Exh. 13, Carr Direct Testimony, p. 14, A.26. In fact, Mr. Carr stated that mitigation measures such as grouting "is likely to be the recommended course of action" where a turbine site is found to be on karst. *Id.*, p. 14, A.26. Grout is a bentonite or cement bentonite mixture that is pumped into the ground and sets up like concrete. McGee, Tr. 840:17-22. It seals areas. *Id.*, Tr. 840:22-23. Grout can seal karst cavities to a depth of either 20 feet, or 30 feet, below the surface, depending on which of Mr. McGee's conflicting answers about this depth is accurate. *Id.*, Tr. 842:22 to 843:7, 848:12-21.

Ironically, Republic's proposal to grout the karst cavities under its turbine foundations to promote foundation stability actually may increase karst collapses elsewhere in the area. The grout would block the natural drainage of surface water into the cavities, thereby rerouting the water flow elsewhere where it could erode sediments in the subsurface and induce surface collapses. *Id.*, p. 21, A.31.

To prevent the subsidence problems described above, the subsurface must be thoroughly explored with borings or other methods. *Id.* However, Republic's amended application contains only a general promise to conduct subsurface exploration after certification and a vague assurance that Republic will stabilize the turbines' foundations if problematic karst features are found. Given Republic's complete failure to look for karst features at the turbine sites, the Board lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). OPSB cannot issue a certificate for this Project without knowing whether the turbines can be safely built in this karst terrain.

F. Constructing Turbines In A Karst Area Can Pollute The Water Supply, But Republic Has Conducted No Studies To Determine Whether Its Project Will Pollute The Neighbors' Water Supplies.

Groundwater contamination occurs in karst areas because there may be open and quick pathways that connect surface water to the groundwater. LR Exh. 24, Sasowsky Direct Testimony, p. 14, A.21. This rapid water movement is in contrast to what happens in non-karst areas, where the slow movement of water through tiny openings usually filters and cleans surface water before it can reach the groundwater. *Id.* Risks of groundwater contamination primarily result from changes to the surface that facilitate the rapid movement of surface water into the ground. *Id.*

This is a well-known problem in the Bellevue Castalia Karst Plain area. *Id.* For example, there was severe and widespread damage to drinking water supplies in the Bellevue area just north of the Republic Wind Project from the early 1900s through the early 1960s. *Id.* This occurred due to contaminated water making its way in to wells and sinkholes. *Id.*

When changes are made to the land surface from activities like constructing turbines, contaminated water from fields, ditches, and constructed areas may be directed into sinkholes or other openings that provide a direct connection to the aquifer. *Id.* This water is generally of lesser quality than existing groundwater, and can be unhealthy for human consumption. *Id.*

Republic's Amended Application contains information confirming these facts. An article in Exhibit F of the Amended Application explains:

The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table. These passageways permit water to bypass soil and rock layers that filter out contaminants. Consequently, when compounds such as fertilizers, pesticides, and water enter sinkholes, they are rapidly transported to the water table and quickly pollute water wells, streams, and rivers.

Amd. Applic., Exh. F, "Karst of the Fireside Quadrangle and Portions of the Flat Rock and Clyde Quadrangles, Ohio," by Douglas J. Aden, et al., p. 1 (found online at Exh. F., Pt. 4 of 6, p. 39 of 85).

This is why it is important to have a specific understanding of the movement of water at each site. LR Exh. 24, Sasowsky Direct Testimony, p. 14, A.21. This can be accomplished in a number of ways, but almost always requires more than simple visual inspection. *Id.* Dye tracing is a common approach to identifying flow directions and recharge zones. *Id.* This has been carried out in some parts of Ohio by ODNR and other entities. *Id.*

Republic's Amended Application identifies three SWPAs overlapped by the Republic Wind Project. *Id.*, p. 15, A.21. The largest of these areas is a groundwater SWPA for Capital Aluminum and Glass, where 21 turbines are proposed. *Id.* This area is noted to have a high vulnerability to contamination. *Id.* Republic's Amended Application recounts that "Ohio EPA delineated the entire region contributing water via the karst system as a SWPA" for the Capital Aluminum and Glass water supply, because the groundwater flows at a rapid rate of 3,500 to

8,600 feet per day, the bedrock is at a shallow depth, and sinkholes are present. Amd. Applic., p. 75; Amd. Applic., Exh. F, p. 4. In such an aquifer, contaminants can travel rapidly and destroy this important water resource.

Republic's proposal to grout the karst cavities under the turbine foundations also will threaten the groundwater supplies with contamination. The grout will block the natural drainage of surface water into the cavities. LR Exh. 24, Sasowsky Direct Testimony, p. 21, A.31. Since the surface water has to go somewhere, it will open new pathways for surface water movement into the groundwater system that may convey contaminants into the water supply. *Id.*

Republic has conducted no field work to determine whether its turbine construction could contaminate the area's water supplies. Given Republic's complete failure to look for karst features and underground water conduits at the turbine sites, the Board lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). OPSB cannot issue a certificate for this Project without knowing whether the turbines will contaminate the water supplies on which the community depends.

G. The Project May Increase Flooding Hazards In The Area.

The Project Area has few streams available to remove stormwater from the land surface. LR Exh. 24, p. 13, A.20 & its Exh. G. This means it can be challenging to safely deal with stormwater. *Id.* In such an area, sinkholes can be an important means of surface water drainage.

However, sinkholes can flood if plugged up with sediment. *Id.*, p. 16, A.23. This plugging can result from erosion at the surface, and changes to surface drainage due to

construction of structures such as turbines. *Id.* If flooding can result from filling sinkholes with sediment, then filling them with grout as proposed by Republic also can cause flooding.

In addition, what may be more hazardous is underground water that floods upwards from the sinkholes under certain conditions. *Id.* In this case, the sinkholes act as groundwater discharge points, instead of groundwater recharge points. *Id.* It is well documented in this region that occasionally intense rain falls result in severe flooding from upward movement of groundwater. *Id.* This last occurred in 2008, and was explained in a report and detailed map prepared by the Ohio Department of Natural Resources that was published in 2009. *Id.* These sorts of upward movements of water can be extremely disruptive of turbine foundation stability. *Id.*

Republic's Amended Application acknowledges this flooding problem in the Project Area. According to the Amended Application, the district manager for the Ohio Department of Transportation and the Sandusky County engineer's office both noted that the most common geotechnical issue encountered in the Project Area is sinkholes from karst features. Amd. Applic., Exh. F, pp. 6-7. Sinkholes have been associated with flooding in the area, including one instance in which sinkhole-related flooding did not subside for about three months. Amd. Applic., Exh. F, p. 7. The Amended Application also stated that, "in the Bellevue region, low-lying karst features may be subject to flooding during periods of unusually high precipitation when the water table rises above the land surface." Amd. Applic., Exh. F, p. 3. In recognition of these potential flooding conditions, the Amended Application notes that site dewatering may be necessary during construction if significant precipitation events occur when the foundation excavations are exposed. Amd. Applic., Exh. F, p. 7.

While Republic's Amended Application acknowledges these flooding risks, it proposes nothing to prevent its turbine construction from worsening the flooding. Even more, its proposal to grout the karst openings under the turbine foundations will block the natural surface water drainage into the sinkholes and increase flooding. LR Exh. 24, Sasowsky Direct Testimony, p. 21, A.31. Thus, the Board lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). OPSB cannot issue a certificate for this Project without knowing whether the turbines will cause flooding that will harm the community.

H. Republic's Plans To Install Turbine Foundations In Shallow Bedrock And To Grout Karst Openings May Obstruct The Groundwater Flow Necessary To Recharge The Community's Water Supply Wells.

In karst areas, groundwater moves through bedrock via passages that are colloquially called underground streams or rivers. Sasowsky, Tr. 1202:12-14. Bedrock in the Project Areas can be found at depths as shallow as four feet below the surface. Amd. Applic., p. 3. Republic's survey of residents in the Project Area found that well water was found as shallow as eight feet from the ground surface. Amd. Applic., Exh. F, p. 5. Turbine foundations typically are 10 feet deep and 60 feet wide. McGee, Tr. 816:2-7.

Republic may need to excavate the shallow bedrock to install turbine foundations. Amd. Applic., p. 80; McGee, Tr. 825:19 to 826:1. Blasting may even be necessary to install the turbine foundations. Amd. Applic., p. 65. By digging or blasting away the bedrock to install the foundations, Republic may construct its turbine foundations in karst openings that transmit surface water to and replenish the groundwater table and in karst pathways that convey groundwater through the bedrock to people's wells. Republic tacitly admits this problem when it

predicts that site dewatering may be necessary during construction if excavations extend below the water table. Amd. Applic., Exh. F, p. 7.

The installation of concrete turbine bases and grouting the karst openings under the foundations can limit the water recharge to an underlying aquifer, and these practices need to be avoided or managed to preserve the recharge. LR Exh. 24, Sasowsky Direct Testimony, p. 16, A.22. Otherwise, the proposed Project could disrupt residential or other water supplies. *Id.*

For this reason, it is necessary to understand the source of water for each neighborhood well. *Id.*, p. 16, A.22. This includes identifying the aquifer, as well as the recharge zone for the well which is extracting the water. *Id.* Republic and the Staff must identify the aquifers present, the groundwater flow directions, the recharge and discharge areas, the water users, and the capture zone for the users' water extraction. *Id.*, p. 18, A.26. This information could then guide the design and construction of the Facility to avoid the disruption of recharge to the wells. *Id.*, p. 16, A.22.

The availability of suitable water for drinking, agriculture, and other purposes is critical in a rural area such as this. *Id.*, pp. 15-16, A.22. The majority of residences are supplied by individual private wells, which make use of groundwater from underneath their property. *Id.*, p. 16, A.22. If such supply were to be lost, it would be devastating for the residents. *Id.* Yet Republic has done nothing to investigate the Project's potential threat to the community water supplies and even promises to grout the natural karst features necessary to replenish these water supplies. Thus, the Board lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). OPSB cannot issue a

certificate for this Project without knowing whether the turbines will impair the area's water supplies.

I. The Certificate, If Issued, Should Prohibit Turbine Construction On Karst Geology And Should Prohibit The Grouting Of Karst Openings.

The Staff Report states that Republic will not site turbines on karst formations. Staff Exh. 1, Staff Report, p. 26. Staff member Collins testified that this statement was based on conversations in which Republic said that the company probably would avoid construction of turbines on karst features "in the most severe cases." Collins, Tr. 1416:3-20. However, Republic disputes the Staff Report's conclusion, stating that Republic most likely will employ grout or other means to construct turbine foundations on karst. RW Exh. 27, McGee Direct Testimony, p. 6, A.15. The Staff Report contains no conditions that would prohibit Republic from constructing turbines on karst, or from filling karst openings with grout. Mr. Collins acknowledged that the statement in the Staff Report was not meant to prevent turbine construction on karst. Collins, Tr. 1417:2-6. Nevertheless, the Staff has not offered a single condition to prevent damage to karst formations or the groundwater supplies that flow through them.

As explained above, the construction of turbines on karst could destabilize the land surface elsewhere, increase flooding, contaminate the community's vital water supplies, and cut off the flow of groundwater to neighboring wells. This is especially the case if grout is used to fill karst openings to stabilize the foundations. Before OPSB acts on Republic's Amended Application, the Board should require Republic to conduct a thorough field investigation of each proposed turbine site to identify karst features and to evaluate the turbines' potential impacts on groundwater supplies. This investigation should be performed by a hydrogeologist with meaningful experience with karst.

Republic undoubtedly will argue that OAC 4906-4-09(A)(2)(b) excuses it from drilling borings or conducting a geologic investigation until after certification. However, this provision, by its own terms, applies only to “geotechnical exploration and evaluation.” According to its dictionary meaning, a geotechnical evaluation pertains to the application of geology to engineering, which in this case pertains to the design of turbine foundations to keep the turbines standing. On the other hand, OAC 4906-4-08(A)(4)(a) requires Republic to evaluate the impact of its Project on public and private water supplies due to the construction and operation of the wind project before a certificate is issued so that the Board can determine whether the Project meets the statutory criteria in R.C. 4906.10(A).

Following this required investigation, OPSB should prohibit turbine construction on any site found to possess karst features or found to threaten groundwater supplies. Above all, any certificate issued for the Project should ban the use of grout in karst openings. Absent such an investigation, the Board lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). Under this statute, it cannot defer that decision until after certification. In an investigation is not ordered prior to certification, then the Board should deny the certificate.

V. Blade Shear Can Throw Blade Parts As Far As 1640 Feet.

A. The Setback Between Turbines And Neighboring Properties And Roads Should Be At Least 1640 Feet To Prevent Injuries And Property Damage From Flying Blade Parts.

One of the many threats to human health and the environment posed by wind turbines is blade shear. Blade shear occurs when a wind turbine blade, or segment, separates from the rotor and is thrown or dropped from the tower. Staff Exh. 1, Staff Report, p. 36.

Mr. Carr admitted that blade shear has occurred at other wind projects. Carr, Tr. 93:2-13. Even though he is the Project's development manager, and even though his written testimony opined that blade throw is rare, his cross-examination revealed his ignorance about this important topic. RW Exh. 13, Carr Direct Testimony, p. 14, A.26. He was not aware of a blade throw incident at the Timber Road II wind project, which is located only a few hours' drive from the Project Area. Carr, Tr. 94:22 to 95:14. He said that he has "very likely seen specific reports" supporting his opinion on blade throw rarity, but he could not identify a single report or author supporting his opinion nor could he say with certainty that any such report even exists. Carr, Tr. 95:23 to 97:3. Mr. Carr also could not say how far turbine parts will travel as a consequence of blade shear. Carr, Tr. 139:23 to 140:3.

In contrast, Staff member Andrew Conway was able to identify three incidents of blade throw that have occurred in Ohio alone. Conway, Tr. 1300:23 to 1301:14. Blade shear is a dangerous turbine habit that the Board should address in certification cases.

Turbine blade parts can fly for long distances. A Nordex safety manual for the Nordex N149 turbine model warns that employees and the public must stay at least 500 meters (1640 feet) away from a burning turbine to avoid flying turbine parts, stating:

DANGER

Life-threatening injuries due to falling turbine parts

In case of a fire in the tower, in the nacelle or on the rotor, parts may fall off the WT.
Keep a safety distance of 500 m around the WT.

Amd. Applic., Exhibit W, "Safety Manual, Rules of conduct on, in and around wind turbines, Wind turbine class Delta4000," p. 47, § 9.3 (emphasis in original); Staff Exh. 5a, Conway Direct Testimony, p. 10, A.13; Carr, Tr. 137:10 to 139:22. Other turbine manufacturers also recommend safety zones of 1640 feet. Conway, Tr. 1309:7-14. The purpose of this 1640-foot safety zone is to make sure no one is struck by flying blade pieces. Conway, Tr. 1306:2-13.

Mr. Conway found that a fire at turbine location 46 alone would force the evacuation of about 11 residences, two other wind turbines, and seven commercial buildings. Staff Exh. 5a, Conway Direct Testimony, p. 7, A.11. At least two other turbines, and possibly more, are closer than 1640 feet from residences. Conway, Tr. 1306:22 to 1307:11. Republic's Amended Application notes that the turbine sites are as close as 1471 feet from neighboring nonparticipating homes. Amd. Applic., p. 84. The properties of three testifying Residents are less than 1640 feet from two turbine sites: Aaron Boes; Robert Chappell; and Dawn Hoepf. LR Exh. 22, Boes Direct Testimony, Exh. A; LR Exh. 17, Chappell Direct Testimony, Exh. A; LR Exh. 19, D. Hoepf Direct Testimony, Exh. A.

Mr. Conway also found that three turbine sites are less than 1640 feet from State Highway 18 or State Highway 19. Staff Exh. 5a, Conway Direct Testimony, pp. 9-10, A.13. This would require a halt in traffic on these highways during a turbine fire in any of these turbines. *Id.* In fact, the Staff has discovered that these three turbine sites do not even achieve the 1371-foot setback advocated by Republic and the Staff. *Id.* Consequently, the Staff has proposed Condition 42 to eliminate these three sites. *Id.* The Residents agree with this condition.

Because blade shear can send blade parts flying for 1640 feet, a 1640-foot setback between turbines and neighboring properties, including roads, is necessary to protect public safety. The Residents request that OPSB mandate such a 1640-foot setback in this case.

B. A Certificate, If Issued, Should Require Republic To Install The Latest Safety Equipment On Its Turbines.

The Amended Application recounts that past blade throw incidents in the wind industry have been caused by manufacturing defects in the blades, lightning strikes, and control system failures leading to over-speed. Amd. Applic., p. 83. To assure OPSB that blade throw risks will

be minimized for the Project, the Amended Application describes braking systems that can be installed on turbines to stop their rotation in the event of blade shear, quality certifications by manufacturers, and other technological advances designed to improve turbine safety. *Id.*, pp. 83-84. Similarly, Dalton Carr claims that technological improvements and mandate safety standards during turbine design, manufacture, and installation have significantly reduced the instances of blade throw. RW Exh. 13, Carr Direct Testimony, p. 14, A.26.

Remarkably, the Amended Application does not promise to use these technological safeguards in the Project. For instance, it states only that “[i]t is anticipated that the wind turbines” will be equipped with braking systems and that “it is anticipated” that the turbines will be automatically shut down in high wind conditions. *Id.*, p. 84. This equivocal language fails to make the enforceable commitments required by OAC 4906-4-09((G)).

Nor does the Staff Report contain any proposed conditions to make these certifications and safety equipment. Mr. Bellamy thought that the Amended Application promises to obtain certifications for the turbines (Bellamy, Tr. 1504:22 to 1508:8), but he is mistaken. The Amended Application only states:

The reduction in blade failures coincides with the widespread introduction of wind turbine design certification and type approval. The certification bodies perform quality control audits of the blade manufacturing facilities and perform strength testing of construction materials. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade (Garrad Hassan, 2010).

Stating that certification bodies exist to conduct audits is not a promise to obtain its turbines from a manufacturer that submits to the audits. This language does not represent that all turbines on the market are certified. Nor does this language commit Republic to buy certified turbines. In fact, Republic has not yet even made a commitment as to what country will produce the turbines

it will eventually select. Rice, Tr. 122:2-8. The commitment to purchase certified turbine models is required by OAC 4906-4-09((G)(3)).

If OPSB issues a certificate, it should incorporate a condition to mandate state-of-the-art safety equipment and the most stringent certification available.

VI. The Project Will Delay Life-Saving Air Ambulance Transportation.

LifeFlight is an air ambulance service that operates in and around the Project Area. Staff Exh. 1, Staff Report, p. 40. LifeFlight has expressed two concerns to the Staff about the Project. *Id.* One, wind project would require LifeFlight’s helicopters to fly higher to avoid the wind turbines. *Id.* Two, there will be reduced and limited landing zones within the Project Area to pick up patients. *Id.*

With respect to LifeFlight’s first concern, the turbines’ height can prevent air flight helicopters from flying over the Project Area to reach critically ill or injured patients if a low cloud ceiling prevents them from flying above the turbines. Chappell, Tr. 977:17-23. If a helicopter cannot fly over turbines, it may be forced to go around the turbines to reach the patients, losing precious time in the process. Redirecting or altering a helicopter’s direct flight path can add minutes to the time it would take to reach an ill or injured patient, as well as to add time to the flight to the hospital. *Id.*, p. 981:1-11. In a rescue operation, “every minute that we can save that patient matters.” *Id.*, p. 983:3-6. Every minute in the delay of a patient’s transportation to a hospital impairs critical treatments, such as stopping a trauma victim’s internal bleeding or providing an angioplasty or stents to a heart attack victim. *Id.*, pp. 982:5 to 983:2.

With respect to LifeFlight’s second concern, the Staff Report recommends that Republic “explore construct one predesignated landing zone within the project area to mitigate impacts to

LifeFlight and other air ambulatory services.” *Id.*, p. 41. The Residents support the Staff’s proposed Condition 49 to mandate the establishment of this landing zone.

However, the establishment of this landing zone, by itself, is inadequate to protect public safety. This inadequacy was explained by Resident Robert Chappell, an experienced paramedic and emergency medical technician (“EMT”) in the Tiffen Fire/Rescue Division who often utilizes LifeFlight and other ambulance services to transport patients in his rescue operations. Chappell, Tr. 975:1-4; LR Exh. 17, Direct Testimony of Robert Chappell, pp. 1-3, A.4 & p. 7, A.16; . Establishing a landing zone in the Project Area will not prevent delays in transporting patients to the hospital. *Id.*, pp. 7-9, A.18. A major problem with this plan is that it fails to address a situation in which there are multiple patients and limited EMS resources, such as a two car accident with more than one injured patient. *Id.*, p. 8, A.18 The EMTs in the first ambulance arriving at the accident scene will determine upon arriving at the scene whether any of the patients is in critical condition and requires transport by air ambulance helicopter. *Id.* In this event, the two EMTs in that ambulance would triage the patients according to protocol and request a helicopter to transport the critical patient or patients to a medical facility that is qualified to treat their injuries. *Id.* Ordinarily, this helicopter would land next to the accident scene, so that the critical patients could be loaded directly onto the helicopter. *Id.* However, if the helicopter cannot land next to the accident scene due to the presence of a nearby wind turbine, the EMTs would have to transport the critical patient or patients to the pre-determined landing zone. *Id.* Ohio law requires both of the EMTs to accompany that patient in the ambulance. *Id.*, pp. 8-9, A.18. If any other persons have sustained critical or minor injuries, the EMTs are not allowed to leave the other patients at the accident scene without EMT care in order to transport the first critical patient to the pre-determined landing zone. *Id.*, p. 9, A.18 This

means that they cannot transport the first critical patient to the helicopter until another ambulance with EMTs arrives from a more distant village. *Id.* If the ambulance from the next closest village is available, waiting for this ambulance to arrive would result in a 10 to 15 minute delay in transporting the first critical patient(s) to the pre-determined landing zone, or any other landing area that is not next to the accident scene. *Id.* The delay would be even longer if the ambulance from the next closest village is not available due to staffing issues. *Id.*, pp. 7, 9, A.18. The critical patient(s) would be treated but EMT's would be required by law to remain at the scene until additional EMT's arrive to transfer patient care. *Id.*, p. 9, A.18. Time is the most valuable asset to a trauma victim or person having a heart attack. *Id.* Any added delay in their care may decrease their ability to recover. *Id.*

Many of the roadways in the Project Area are two-lane, non-divided highways with 55 mph speed limits, and traffic accidents in and near the Project Area are not uncommon occurrences on these roads. *Id.*, p. 8, A.18. For example, there have been several severe accidents at the corner of County Road 38 and State Route 19, which is located next to the border of the Project Area, and which required the use of one or more air ambulance helicopters to transport victims to definitive care in Toledo. *Id.* The inability to use this type of rapid transport may have resulted in great detriment to these trauma victims. *Id.*

Thus, the Project could impair the provision of necessary medical response for trauma and critically ill patients in and near the Project Area. Since just minutes of delay can make the difference between a patient's survival or death, this is a critical problem. Consequently, the Project does not serve the public interest, convenience, and necessity under R.C. § 4906.10(A)(6) and the certificate should be denied.

VII. The Turbines Will Cast Unlawful Amounts Of Shadow Flicker On Neighboring Properties.

Shadow flicker refers to the moving shadows that an operating wind turbine casts at times of the day when the turbine rotor is between the sun and a receptor's position. Amd. Applic., Exh. I, p. 1. During intervals of sunshine, turbines will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect. *Id.* Shadow flicker is the flickering of alternating light and shadow resulting from wind turbine blades intercepting sunlight. Carr, Tr. 346:2 to 347:1. Shadow flicker can go through windows. Carr, Tr. 347:4-12. They can cast flickering shadows on neighbors in their homes. Carr, Tr. 347:20-24.

Shadow flicker is a particular concern to the residents. For example, Dawn and Gary Hoepf fear that installing a turbine or turbines between the setting sun and their backyard, where they entertain their children, grandchildren, and friends at the pool, will spoil their ability to enjoy that yard during times of shadow flicker. LR Exh. 19, D. Hoepf Direct Testimony, p. 2, A.4-A.5 & Exh. B. Since nine turbines are sited between 1417 feet and 1.35 mile from their house, shadow flicker is a grim prospect for them. *Id.*, p. 2, A.3 & Exh. A.

OAC 4906-4-09(H)(1) prohibits a wind facility from casting more than 30 hours of shadow flicker on a nonparticipating receptor per year. A "non-participating receptor" is a property whose owner has not signed an agreement waiving this standard. OAC 4906-4-08(H)(1).

Republic has conducted its shadow flicker model three times in a vain attempt to comply with the 30-hour standard. In the second attempt, the flicker model submitted in the Amended Application of December 26, 2018 showed noncompliance at 46 non-participating receptors for the Vestas V150 turbine model, which has the largest rotor diameter of the turbine models under consideration. Carr, Tr. 362:12-19; Amd. Applic., p. 89; Amd. Applic., Exh. I, pp. 6-8 & Table

1. The shadow flicker model submitted on June 25, 2019 for just the smaller Vestas V136 turbine model showed noncompliance at 27 non-participating receptors. RW Exh. 1E, Notice of Project Modifications, Attachment A, pp. 3-4 & Table 1; Carr, Tr. 351:11-16. However, Republic does not plan to use the Vestas V136 turbine model at more than 10 of its turbine locations. RW Exh. 1E, Notice of Project Modifications, p. 1 (the second page of the pdf document); Carr, Tr. 351:17-24. So the latter shadow flicker model does not truly reflect the amount of flicker that the facility will produce.

Therefore, Republic has not submitted a facility design that complies with this standard. Bellamy, Tr. 1512:22 to 1513:2. Nevertheless, the Staff proposes to give Republic a certificate on the general promise that Republic in the future will take actions to bring the facility into compliance. *Id.*, Tr. 1512:14-21; Staff Exh. 1, Staff Report, p. 67, Condition 45. A future promise to design its facility in a manner that complies with legal requirements does not satisfy Republic's burden to demonstrate that its Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6). As currently designed, the Project does not satisfy these criteria due to its shadow flicker problem. OPSB may not approve a certificate unless the applicant produces a Project design that demonstrates compliance with the Board's requirements.

The Residents also note that Republic's shadow flicker modeling uses an input that makes its results inaccurate. This model assumes that each property receiving shadow flicker is only one square meter in size located one meter above the ground. Carr, Tr. 379:25 to 380:6, 380:20-24; Amd. Applic., p. 88. The actual dimensions of a home were not used in the model. Carr, Tr. 380:4-6. But no house or yard is one square meter in size. This assumption unfairly underestimates the time in which the shadows are hitting the receptor. In its future modeling,

Republic should be directed to use accurate assumptions to calculate compliance with the 30-hour standard.

Moreover, Republic states that, in order to meet the 30-hour limit, it could adopt mitigation measures such as vegetative screening, window treatments, or curtailment of certain turbines' operation during select times. Amd. Applic., p. 91. Republic's revelation that it could curtail its turbines' operation to reduce shadow flicker suggests that all shadow flicker can be easily prevented simply by turning off the turbines at times when they otherwise would cast annoying shadow flicker on their neighbors. Because Republic's shadow flicker model reveals the times of the day that each turbine casts shadow flicker on its neighbors, Republic knows when to shut off these turbines to prevent shadow flicker altogether. Amd. Applic., Exh. I, p.9, Table 2. Even if a turbine is guilty of casting shadow flicker on a neighbor for 30 hours per year, the curtailment of operation for 30 of the year's 8760 hours would reduce its annual operation by only 0.003%. Republic has no right to annoy any of its non-participating neighbors with shadow flicker that can easily be prevented with such an insignificant loss of income. Therefore, if a certificate is granted, the Residents request that Republic be directed to eliminate shadow flicker on non-participating neighbors.

VIII. The Wind Turbines Will Be A Visual Blight On The Community.

The wind turbines can be seen from 10 miles away. LR 21, Robinson Direct Testimony, p. 11, A.22, lines 24-25. Turbines will be visible to the citizens in more than half of that 10-mile radius. Amd. Applic., Exh. AA, p. 27. The tallest turbine model being considered by Republic, at 602 feet tall, will tower above the mature 50-foot tall trees in the area. Robinson, Tr. 561:10-17. The residents will see the turbines from their homes, yards, fields, roads, parks, and businesses. The turbines will mar the night sky with blinking red lights. *Id.*, p. 56.

As nearby neighbors of the wind project, the Residents will suffer from close and imposing views of the turbines. Some of them will be inflicted with views of many turbines. For example, Aaron Boes will be able to see 17 turbines from his home. LR Exh. 22, Boes Direct Testimony, p. 2, A.3 & Exh. A. Robert Chappell will be able to see five turbines. LR Exh. 17, Chappell Direct Testimony, pp. 3-4, A.6 & Exh. A. Nine turbines are sited between 1417 feet and 1.35 mile from Dawn Hoepf's land. LR Exh. 19, D. Hoepf Direct Testimony, p. 2, A.3 & Exh. A. Ann Wright will be able to see six turbines within 1.15 miles. LR 20, Wright Direct Testimony, p. 2, A.3 & Exh. A. Chris Zeman will be able to see seven turbines from his residence. LR 21, Zeman Direct Testimony, p. 2, A.4.

Republic's towering machines will inflict a visual blight on the Residents and the rest of the community. This Project does not represent the minimum adverse environmental impact under R.C. 4906.10(A)(3) or serve the public interest, convenience, and necessity under R.C. § 4906.10(A)(6).

IX. OPSB Should Preserve The Safety And Economic Viability Of Local Airports Whose Airspace Is Threatened By Republic's Proposed Turbines.

Air flight to and from the region's local airports is important to the Residents. Republic wishes to infringe on these airports' airspace for Republic's profit. This would make air approaches to the airports more difficult and less safe, and discourage pilots from landing there to their economic detriment.

Therefore, the Residents support the proposals that the Staff and the Ohio Department of Transportation have made thus far in this case to require Republic to reduce the height of some of its turbines to protect the airports' air space. The Residents also agree with and incorporate by reference the arguments made in Section III of the post-hearing brief filed by Seneca County and the townships on aviation issues.

X. Republic's Past Bat Surveys Are Faulty And Outdated, And OPSB Should Require The Submission Of New, Accurate Bat Surveys Before Acting On Republic's Application.

Bats are an important component of the environment. Leftwich, Tr. 476:20-21. As insectivores, they eat insect pests that otherwise would consume the farmers' crops. *Id.*, 476:22 to 477:15. They consume mosquitos. *Id.*, 481:19-20. Bats pollinate plants. *Id.*, 481:14-15.

As an added benefit, the Residents enjoy watching bats in their yards. LR Exh. 22, Boes Direct Testimony, p. 2, A.5; LR Exh. 17, Chappell Direct Testimony, p. 5, A.9; LR Exh. 19, D. Hoepf Direct Testimony, p. 2, A.4.

Turbines kill bats. Leftwich, Tr. 480:10-12. This occurs when bats and blades collide, or when the bats suffer barotrauma. *Id.*, 480:13-18. Barotrauma builds up air pressure in a bat's lungs and causes death. *Id.*, 480:15 to 481:3. The Amended Application does nothing to protect these important creatures from harm, since Republic's bat monitoring data is faulty and/or outdated.

A bat acoustic monitoring survey is employed to record the ultrasound calls produced by flying bats. Leftwich, Tr. 487:1-4, 490:18-24. Such a survey was conducted in 2011, and therefore it is outdated. LR Exh. 23, Shieldcastle Direct Testimony, A.17, p. 21. The survey detected calls from 44 bats of the genus *Myotis*, a genus of which the Indiana bat is a member. Leftwich, Tr. 490:18-24. A person cannot tell from these recordings whether a *Myotis* is an Indiana bat or not, so one or more of the 44 bats could have been Indiana bats. *Id.*, p. 490:25 to 491:3; LR Exh. 23, Shieldcastle Direct Testimony, A.17, p. 21, lines 19-21. Nevertheless, Republic still used the acoustics monitoring to justify its opinion that this was not an important bat activity area. *Id.*, lines 14-16.

The survey used a meteorological tower as a recording site that was not near notable bat habitat. *Id.*, A.17, p. 21, lines 13-14. The acoustic recorder had a measuring range of 30 meters, while the tower was 670 meters from the closest woods where bats were likely to be observed by the recorder. *Id.*, lines 15-18. Therefore, the survey likely undercounted the area's bats. The study also indicated an increase in migratory bat activity but did not address these results. *Id.*, lines 18-19.

Bat mist-netting was conducted in 2011 and again in 2015-2016. *Id.*, line 22. The 2011 data is severely outdated and of little usefulness for risk assessment. *Id.*, lines 22-23. The mist net results do not compare well with acoustic results for many potential reasons. *Id.*, pp. 21, line 23 to p. 22, line 1. For one thing, the Indiana bat was encountered, negating the acoustic monitoring conclusions. *Id.*, p. 22, lines 1-2. Additional data in 2015-2016 was requested to look for Indiana bats and Long-eared Bats. *Id.*, lines 5-6. This work involved occurred only two short periods of monitoring that were insufficient to determine risk to bats or to support the Republic's conclusions that risk to bats is low. *Id.*, lines 6-8.

Therefore, the bat data on which Republic depends is outdated. Most of it, from 2011, is eight years old. The rest of it is almost four or five years old. None of the data was collected in accordance with good wildlife survey methods. Consequently, OPSB should require Republic to perform new acoustics and mist netting studies.

XI. Republic's Flawed, Outdated Bird Surveys Do Not Provide The Board With Sufficient Information To Issue A Certificate.

A. Project Area Is Located In An Important Migratory Pathway That Must Be Kept Free Of Dangerous Obstacles, Such As Wind Turbines, To Avoid Bird Mortalities.

The Project Area is situated in the midst of a broad-front migratory pathway used by birds to fly from southern regions to Lake Erie before continuing on to Canada. Kerlinger, Tr.

576:7-25. Multitudes of birds stop over on the shores of Lake Erie in Magee Marsh and its environs, in an area that is designated by the National Audubon Society as one of the greatest bird concentration areas in the Western Hemisphere (*i.e.*, a “Globally Important Area”). LR 23, Shieldcastle Direct Testimony, A.11, p. 11, lines 15-18. The Project Area lies directly south of this area, only 10 miles from Lake Erie. *Id.*; Kerlinger, Tr. 578:10-19. All of Seneca County is occupied with this broad-front migration. *Id.*, 578:20-24.

Birdwatching is a multimillion dollar industry that benefits local communities.

Kerlinger, Tr. 575:12-19. The Residents enjoy watching the birds, including Bald Eagles, in their yards and in the community and parks. LR Exh. 22, Boes Direct Testimony, pp. 2-4, A.6-A.7; LR Exh. 17, Chappell Direct Testimony, pp. 5-7, A.10-A.15; LR Exh. 18, C. Hoepf Direct Testimony, pp. 2-3, A.4-A.5; LR Exh. 19, D. Hoepf Direct Testimony, pp. 2-6, A.3, A6-A.9; LR 20, Wright Direct Testimony, pp. 2-3, A.5A.6. Protecting this natural resource is important for the environment and the economy.

B. Republic’s Bird Surveys Were Designed To Avoid The Detection Of Most Birds, Not To Find Them.

OAC 4906-4-08(B)(3) requires Republic to “provide information regarding potential impacts to ecological resources during operation and maintenance of the facility.” This information is necessary, not only to determine compliance with the statutory criteria of R.C. 4906.10(A)(3) and (6), but also to identify the “procedures to be utilized to avoid, minimize, and mitigate both the short- and long-term impacts of operation and maintenance” as required by OAC 4906-4-08(B)(3)(b) and to develop “plans for post-construction monitoring of wildlife impacts” as required by OAC 4906-4-08(B)(3)(c).

Republic has not complied with these rules in a manner designed to minimize the Project’s destruction of bird populations. The company has intentionally designed its field

surveys of birds so as to avoid detections of birds using or flying over the Project Area. Most of Republic's bird data is out-of-date and of no present utility.

The Residents' bird expert, Mark Shieldcastle, has identified enough errors made in the techniques used in Republic's bird surveys to fill 18 pages of written testimony. LR Exh. 23, Shieldcastle Direct Testimony, pp. 3-21, A.3, A.6, A.8-A.16. All of these errors are designed to reduce the sightings of birds in the Project Area in attempts to disguise the Project's harm to avian life. *Id.*

Mr. Shieldcastle is a wildlife biologist with a Bachelor of Science degree in Wildlife Management from Ohio State University. *Id.*, p. 2, A.3-A.4. After working as a wildlife research for Ohio State University for two years, he joined the Division of Wildlife of the Ohio Department of Natural Resources in 1976. *Id.*, p. 2, A.5. He was a wildlife official in the Ohio Division of Wildlife for 33 years from 1976 to 2009. *Id.*, p. 2, A.5 & Exh. A (resume), 1st and 2nd pages. From 1992 to the present, he has been the research director for the Black Swamp Bird Observatory. *Id.*, Exh. A, 1st page.

Mr. Shieldcastle's 43-year career has been devoted to the research and protection of birds and mammals, including field surveys to study and count them. *Id.*, Exh. A, 1st and 2nd pages. He was the leader of Ohio's Bald Eagle recovery program for the Ohio Division of Wildlife, entailing the development of eagle recovery plans and nest monitoring. *Id.*, p. 2, A.5 & Exh. A, 2nd page; Shieldcastle, Tr. 1018:13-21. He has authored and published numerous scientific papers on bird surveys and other bird-related topics. *Id.*, Exh. A, 5th through 12th pages. While with the Ohio Division of Wildlife, he developed the original Avian Concern Zones related to wind projects' risks to wildlife. *Id.*, A.5, p. 2, line 22 to p. 3, line 1. He is the Black Swamp Bird Observatory's technical lead on wind power issues related to wildlife. *Id.*, Exh. A, 1st page.

He has banded or has been in charge of operations that have banded almost a million birds over 41 years. *Id.*, Exh. A, 2nd and 3rd pages.

For much of Mr. Shieldcastle's career, he has been stationed at and conducted his work in Northwest Ohio. This includes his employment at the Black Swamp Bird Observatory, headquartered in Oak Harbor, Ohio and his positions with the Ohio Division of Wildlife at Crane Creek, which is next door to Magee Marsh. *Id.*, Exh. A, 1st and 2nd pages. This has provided him with comprehensive knowledge about bird life in the western basin of Lake Erie and Northwest Ohio. *Id.* He has conducted extensive research on birds in that area, including many field surveys of migrating and breeding passerines, raptors, shorebirds, waterfowl, and Bald Eagles. *Id.*

Mr. Shieldcastle's personal experience with bird surveys has informed his critique of Republic's bird surveys. Because Republic's bird surveys fail to accurately characterize the bird populations in the Project Area, OPSB should direct Republic to conduct new surveys that use techniques designed to actually find the birds.

C. Republic Did Not Conduct The Survey Necessary To Quantify Passerine Migration At Night, When Most Of The Passerines Are Flying Over The Project Area.

The species of greatest risk from the Project's impacts are nocturnal migrating landbirds. LR Exh. 23, Shieldcastle Direct Testimony, p. 4, A.9, line 19. These birds do most of their flying at night during migration. *Id.*, line 20; Kerlinger, Tr. 593:1-16. Republic's bird survey consultant has observed that one category of landbirds - songbirds and other small birds that are known as passerines - appears to be especially vulnerable to collision with wind turbines. Amd. Applic., Exh. N, "Passerine Migration Survey," p. 2; Kerlinger, Tr. 579:15-22. To address nocturnal migration risk, studies must be conducted at night when the birds are actively moving

through the air column habitat. LR Exh. 23, Shieldcastle Direct Testimony, A.10, p. 6, lines 5-6. Yet Republic has not performed a field survey of birds flying over the Project Area at night. *Id.*, A.9, p. 4, lines 20-21. Without this information, it is not possible to accurately determine the Project's probable environmental impact. *Id.*, lines 21-23.

Republic did a migration survey of part of the present footprint of the Project Area in 2011, but it was not a nocturnal migration survey. *Id.*, p. 7, lines 11-17. The study should have, but did not, used radar to detect migrating birds during darkness. *Id.*, A.11, p. 7, lines 16-17. Radar can be used to count night migrants. Kerlinger, Tr. 597:3-9. Instead, Republic counted only the migratory birds that had landed in the Project Area and were seen during daylight. *Id.*; LR Exh. 23, Shieldcastle Direct Testimony, A.11, p. 7, lines 13-15.

Republic also presented a report on passerine migration conducted for the Emerson West Wind Project in 2017. LR Exh. 24, "Passerine Migration Surveys of the Emerson West Wind Project," August 16, 2016 – May 31, 2017. This study also failed to survey the migrating passerines at night. LR Exh. 23, Shieldcastle Direct Testimony, A.11, p. 8, lines 8-10.

Republic also presented a 2011 report labeled as the "Diurnal Bird/Raptor Migration Survey," which used a protocol designed to find only hawks. *Id.*, A.11, p. 9, lines 15-18; Amd. Applic., Exh. K, p. 1. It too did not count birds at night. LR Exh. 23, Shieldcastle Direct Testimony, A.11, p. 9, lines 15-16.

Republic argues that counting birds in the Project Area during the daytime in migratory seasons is a satisfactory method for counting migratory birds. However, migratory birds tend to stop in areas that contain ample habitat for feeding and resting, consisting of forest and brush. Kerlinger, Tr. 579:23 to 580:3. The Project Area has little of that habitat. Kerlinger, Tr. 582:7 to 583:5. Consequently, few birds stop there during migration. Kerlinger, Tr. 583:6-10. Thus,

counting birds during daytime stopovers will greatly undercount the birds migrating through the Project Area.

Therefore, Republic has omitted to survey the category of birds most at risk of colliding with wind turbines, passerines, during migration at night when they are the most vulnerable to flying into the turbines. OPSB should not issue a certificate for this Project without requiring Republic to first conduct three years of nighttime radar monitoring to evaluate the turbines' threat to migrating birds in this important migratory area.

D. All Of Republic's Bird Surveys For Migrating And Breeding Passerines And Raptors Are Fatally Flawed And Need To Be Redone.

Mr. Shieldcastle's analysis revealed a myriad of ways in which Republic's bird surveys were so flawed that they failed to accurately portray the bird species and populations that use or travel through the Project Area. Some of the many flaws include the following mistakes:

The daytime migrating bird studies were conducted during only one year. While Republic did not survey migratory birds at night, it did survey migratory birds in daylight. However, these surveys counted birds during only one year. Amd. Applic., Exh. K, p. 1 (Republic Wind raptors surveyed in spring and fall 2011); Amd. Applic., Exh. N, p. 2 (Republic Wind passerines surveyed in spring and fall 2011); LR Exh. 14, p. i (Emerson West passerines surveyed in fall 2016 and spring 2017). Counting migratory birds during only one year is adequate, because migration is highly variable. LR Exh. 23, Shieldcastle Direct Testimony, A.10, p. 5, line 2. No single year of observation can be assumed to be representative of migration in any given area. *Id.*, lines 2-3. At least three years of studies are necessary to begin quantifying average migratory patterns at any location. *Id.*, lines 3-4. Local research along Lake Erie demonstrates differences in bird volume as high as 50% from one year to the next. *Id.*, lines

4-5. Any shorter time frame for studies is substandard and will not provide scientific validity or support for any conclusions. *Id.*, lines 5-7.

The studies did not encompass enough days, seasons, or weather conditions to provide complete and representative results. Republic habitually used survey periods that were too short.

The following are examples of this flaw:

- Its daytime migration surveys were conducted only in fair weather when favorable tail winds and warm temperatures are conducive to flying over the Project Area without stopping to be seen, whereas in inclement weather more birds would stop to rest in the Project Area where they could be seen in daylight. *Id.*, A.11, p. 5, line 21 to p. 6, line 2. In Northwest Ohio, birds approaching Lake Erie in cold weather are known to reverse direction and move further south to rest temporarily. *Id.*, A.11, p. 7, lines 2-7. Consequently, Republic's limitation of migration surveys to pleasant weather undercounted the migratory birds that stopped in the Project Area. *Id.*, lines 6-7.

- The daytime Passerine Migration Survey (Amd. Applic., Exh. N) consisted of only 15 days of surveys during the spring which represents less than 15% of the migration season, while in fall only 13 days of surveys were conducted representing about 10% of the migration season. *Id.*, A.11, p. 6, lines 16-18. Therefore, sampling volume was inadequate to address movement during migration within a year and in no way could address the variability from year-to-year that can be extreme in avian migration. *Id.*, lines 18-20.

- The diurnal bird/raptor survey did not encompass the entire migration season for many species of raptors. *Id.*, p. 11, lines 7-8.

- The raptor nest survey in the Republic Project Area did not cover time periods when nests of species other than Bald Eagles and Red-Tailed Hawks were likely to be found.

Id., p. 15, line 13 to p. 16, line 1. Its timing was wrong to find nests for other raptors such as owls, Cooper's Hawks, Northern Harriers, and Red-Shouldered Hawks. *Id.* Nor was the survey likely to find the area's sensitive or listed raptor species that nest on the ground or in concealed areas. *Id.*, p. 16, lines 3-4. The Emerson West raptor study suffered from the same deficiency. *Id.*, A.15, p. 16, lines 6-10.

- No field surveys were conducted during winter, when considerable winter bird populations are present. *Id.*, A.12, p. 12, lines 3-7.

The studies evaluated only part of the Project Area. The daytime passerine migration study was not conducted over the present footprint of the Project provided in the Application. *Id.*, A.11, p. 6, lines 20-21. The breeding bird survey covered only part of the Project Area. *Id.*, A.14, p. 12, lines 18-19. The raptor nest survey covered only part of the Project Area. *Id.*, A.15, p. 15, lines 9-11.

Some studies on which Republic relies were conducted outside of the Project Area. Because Republic's bird studies in the Project Area are old and outdated, Republic added more recent bird studies from the Emerson West Wind Project to Republic Wind's Amended Application. Republic contends that the birds found in Emerson West more recently are similar to the birds found in the Republic Project Area in 2011, and concludes that this must mean that the 2011 bird surveys in the Project Area are still valid. RW Exh. 23, p. 6. Conducting bird surveys within the wrong footprint does not produce valid results. LR Exh. 23, Shieldcastle Direct Testimony, A.8, p. 4, lines 2-3; A.11, p. 6, lines 20-21; A.11, p. 9, lines 6-8.

The studies did not look for species diversity, but instead were biased towards finding common species. Republic's studies were biased towards finding common species rather than detecting a wide variety of less common species. The following are examples of this bias:

- The daytime passerine migration study concentrated on blackbirds rather than sensitive bird species due to its low effort (the rarer the species, the higher the sample effort required). *Id.*, A.11, p. 7, lines 17-21.
- Much of the surveying depended on the surveyors' ability to see birds at long distances. *Id.*, A.11, p. 8, lines 10-19. This means that large flocks of common birds such as blackbirds or large soaring raptors are more likely to be seen, while birds flying alone or small raptors are less likely to be noticed. *Id.*, lines 11-14; A.11, p. 9, line 19 to p. 10, line 4; A.11, p. 10, line 21 to p. 11, line 4; A.11, p. 11, lines 13-15.
- The diurnal bird/raptor study was conducted from 9 AM to 4 PM. *Id.*, A.11, p. 9, lines 15-16. This time window is reasonable for soaring raptors but fails to address important time of day movements of non-raptors and non-soaring raptors (primarily Accipiters). *Id.*, lines 16-18. This design flaw turned this study into exclusively a soaring raptor survey. *Id.*, line 18. The fact that the Sharp-Shinned Hawk was not recorded (possibly the most common migrating raptor) raises considerable suspicion of the observers' level of expertise and the study design. *Id.*, A.11, p. 11, lines 10-12.
- Waterfowl are most likely observed in diurnal feeding flocks near dawn and dusk, but the diurnal bird/raptor study meant to find them was conducted from 9 AM to 4 PM. *Id.*, A.11, p. 11, lines 18-20.

The studies are too old to represent current conditions. Amd. Applic., Exh. K, p. 1 (Republic Wind raptors surveyed in 2011); Amd. Applic., Exh. L, p. 1 (Republic Wind raptor nests surveyed in 2011)³; Amd. Applic., Exh. N, p. 2 (Republic Wind passerines surveyed in 2011); Amd. Applic., Exh. O, p. 2 (Republic Wind breeding birds surveyed in 2011). The

³ RW Exh. 23, p. 5 lists raptor nest surveying in 2012 and 2017, but no such surveys appear on Paul Kerlinger's list of all bird surveys used to support Republic's application. RW Exh. 22, pp. 4-5.

Emerson Creek surveys were conducted more recently, but each one of them covered only a small percentage, if any, of the Republic Wind Project area. *See* the slight overlap in territory between the two projects as depicted in Figure 1 of RW Exh. 23. For example, only two of the 18 bird counting points in the Emerson West passerine migration survey were located in the Republic Project Area. RW Exh. 23, p. 5 (showing 13 points in the Project Area, with 11 of them being from Republic's study).

The foregoing deficiencies in Republic's bird surveys demonstrate that they do not present an accurate portrayal of the bird life living or stopping in the Project Area. OPSB should require Republic to conduct new studies using accurate survey methods as replacements of the outdated studies that used faulty methodology. Without such accurate data, OPSB will not be able to tell whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6).

E. Republic's Flawed And Outdated Bald Eagle Studies Do Not Provide The Board With The Information Necessary To Issue A Certificate.

1. Republic's Eagle Data Is Incomplete And Outdated, And A New Eagle Survey Should Be Conducted Before OPSB Acts On Republic's Application.

For a 12-month period in 2011-2012, Republic performed a study of Bald Eagles in and near the Project Area as it existed at that time. Amd. Applic., Exh. M, "Bald Eagle Survey." Three Bald Eagle nests were found outside of the Project Area. *Id.*, p. 3. Point count surveys were held on 25 days between August 2011 and July 2012. *Id.*, Appx. A. Bald Eagles were seen on four occasions for a total of seven minutes. *Id.*, p. 7.

This study was woefully inadequate in all of its facets. The nests were checked only once per month from January to June of 2012, whereas they should have been checked once per week

according to Ohio Division of Wildlife protocol. LR Exh. 23, Shieldcastle Direct Testimony, A.16, p. 17, lines 2-15. Only a small number of point count sites were employed.

Republic also has advocated the use of an Emerson West eagle nest survey to support the Republic application. RW Exh. 22, Kerlinger Direct Testimony, A.7, p. 6; Amd. Applic., Exh. J, “Eagle Nest Monitoring Surveys for the Emerson West Wind Project in Seneca County, Ohio,” dated Jan. 25, 2017 (found online at Exh. J, Pt. 8 of 33, at the 102nd page of the pdf). This study observed three eagle nests in the Emerson West footprint during June 2016. RW Exh. 22, Kerlinger Direct Testimony, A.7, p. 6. However, June is a totally inadequate time to make any conclusions on eagle activity in order to find out what direction from the nest the eagles fly or to see how they use the area. LR Exh. 23, Shieldcastle Direct Testimony, A.16, p. 17, lines 17-19. June observations can reveal what time the nestlings fledged, but they fail to provide any information on the other 11 months of the life cycle that would be extremely different than the month of June. *Id.*, lines 19-21.

In addition, one Bald Eagle nest located a half mile east of the Project Area was watched from June 21 to July 27, 2017. LR Exh. 16; RW Exh. 22, Kerlinger Direct Testimony, A.7, p. 7. Some eagle activity was observed. *Id.* However, eagles are difficult to find once the trees leaf out, even if they are present in the searched area. LR Exh. 23, Shieldcastle Direct Testimony, A.16, p. 18, lines 1-6. So this survey undoubtedly undercounted the eagle activity.

Republic also advocates the use of another Emerson West study on eagles to inform decisions about the Republic Project. RW Exh. 22, Kerlinger Direct Testimony, A.7, pp. 6-7; Amd. Applic., Exh. J, “Large Bird and Eagle Use Surveys for the Emerson West Wind Project,” Seneca County, Ohio, Final Report, May 13, 2016 – April 20, 2017,” dated Jan. 8, 2018, (found online at Exh. J, Pt. 8 of 33, at the 133rd page of the pdf). Only four of the 29 point count

stations were located in the Republic Project Area, with others being close. RW Exh. 22, Kerlinger Direct Testimony, A.7, p. 7. Since the point counts occurred on only a fraction of the Project footprint, they were not representative of the Project Area. LR Exh. 23, Shieldcastle Direct Testimony, p. 19, lines 21-22.

Notably, however, this survey found considerable Bald Eagle activity, including eagle nests. Amd. Applic., Exh. J, “Large Bird and Eagle Use Surveys for the Emerson West Wind Project, Seneca County, Ohio, Final Report, May 13, 2016 – April 20, 2017,” dated Jan. 8, 2018, p. 12 (1st page found online at Exh. J, Pt. 8 of 33, at the 133rd page of the pdf). The eagles were flying at an altitude below 656 feet, well within the blade zone of wind turbines. *Id.* The report stated that the presence of one eagle nest in the Emerson Wind project area and two eagle nests nearby “may warrant management consideration such as avoiding siting turbines in close proximity to the nests to reduce risk associated with these higher use areas.” *Id.*

In sum, Republic’s eagle data in the Project Area consists of an outdated 2011 report and a scant four 2016-2017 monitoring points from an Emerson West report located within the Project’s footprint. That is, its application contains hardly any current eagle data for the Project Area. The eagle data in the rest of the Emerson West footprint is irrelevant, since it is too far from the Project Area to reflect eagle activity within the Project Area. LR Exh. 23, Shieldcastle Direct Testimony, p. 19, lines 21-22. A person reading the eagle information in the Amended Application would think that no eagles visit or live in the Project Area.

This is decidedly not the case, as the direct testimonies of Aaron Boes, Robert Chappell, Crystal Hoepf, Dawn Hoepf, Ann Wright, and Chris Zeman reveal. LR Exhs. 22, 17, 18, 19, 20, and 21, respectively. Exhibit H to Crystal Hoepf’s direct testimony is a map of the Project Area showing where these Residents recently have seen Bald Eagles as described in the Residents’

direct testimonies. LR Exh. 18, C. Hoepf Direct Testimony, p. 3, A. 6, lines 15-20. The black dots on Exhibit H are locations of sightings of individual Bald Eagles. *Id.*, pp. 3-4, A.7. Circles mark areas in which multiple Bald Eagles sightings have occurred. *Id.* The Bald Eagle population in this area has exploded in this region, especially in the last decade. Shieldcastle, Tr.1016:24 to 1017:7.

A Republic answer to one of the Staff's data requests of March 22, 2019 declares that "[t]here are no documented bald eagle nests within the project area." LR Exh. 1, Answer 15; Carr, Tr. 57:2-22. That information also is outdated and wrong. The Residents are aware of an active Bald Eagle nest located in the center of the Project Area. LR 19, Dawn Hoepf Direct Testimony, p. 3, A.7, lines 9-15 & Exhibit D; LR 23, Shieldcastle Direct Testimony, A.16, p. 18, lines 7-9. See Exhibit H of Crystal Hoepf's Direct Testimony, which shows this nest's location as a circle with a black dot in it. LR Exh. 18.

The Residents also have catalogued the presence of other Bald Eagle nests outside of the Project Area. LR 19, Dawn Hoepf Direct Testimony, A.7, p. 3, line 5 to p. 4, line 9; LR 17, Chappell Direct Testimony, A.12-A.14, p. 6, lines 13-21 & Exh. E. Mark Shieldcastle knows about a Bald Eagle nest located just to the east of the Project Area. LR 23, Shieldcastle Direct Testimony, A.16, p. 18, lines 20-22 & Exh. B. These eagle nests are important if their occupants fly into the Project Area.

Republic was not aware of any eagle nests inside the current Project Area until it read Mark Shieldcastle's testimony. Carr, Tr. 41:21 to 42:3, 43:16-20. Republic has confirmed that this eagle nest is located in the Project Area. Carr, Tr. 42:4-5. Republic would have known about this nest before the hearing had its avian studies been current, which demonstrates that its eagle study is outdated and must be replaced to provide OPSB with current information.

Additional activity in the northeast quadrant of the Project Area indicates that another eagle nest exists there in an unidentified location. LR Exh. 22, Shieldcastle Direct Testimony, A.16, p. 19, lines 1-3. Republic has the responsibility to find all eagle nests within and near the Project Area so these nesting eagles can be protected against turbine collisions. OPSB should not act on Republic's Amended Application until a new, accurate eagle survey shows the Board where all of these nests are located and demonstrates whether or not the Project will harm the area's Bald Eagles. Without that information, OPSB lacks the information necessary to determine whether the Project represents the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serves the public interest, convenience, and necessity under R.C. § 4906.10(A)(6).

2. OPSB Should Establish A 2.5-Mile Buffer Around The Eagle Nest In The Project Area For The Eagles' Safety.

Based on his extensive experience with Ohio's Bald Eagles, Mark Shieldcastle has concluded that the Bald Eagles in possession of the eagle nest in the center of the Project Area appear to be flying for about two to three miles outside of their nest to forage for food. LR 22, Shieldcastle Direct Testimony, A.16, p. 18, lines 9-19. There are known multiple sightings of adult eagles about two to three miles to the west of the nest site and a potential feeding site to the southeast about three miles. *Id.*, lines 13-14. It is highly likely these sighting clusters are related to this nest territory. *Id.*, lines 14-15. Mr. Shieldcastle's considerable nest study over 30 years has indicated that inland nesting Bald Eagles in Ohio have a larger territory size than their counterparts along Lake Erie. *Id.*, lines 15-17. This is likely due to the fact that inland eagles need a larger area to find food. *Id.*, lines 17-18. At minimum, a 2.5 mile buffer radius or a 25 square mile polygon would be needed to cover most inland breeding pairs. *Id.*, lines 18-19. The Residents request that Republic's certificate, if issued, prohibit Republic from constructing any turbine within 2.5 miles of this Bald Eagle.

Once an updated and complete eagle survey has been performed, the Residents request the same buffer zone around any other Bald Eagle nest found in or near the Project Area. For this purpose, a complete survey, with a study design accounting for each pair's life cycle, needs to be conducted to determine primary feeding areas and areas of use. OPSB should set a buffer zone between turbines and any Bald Eagle nest found in and near the Project Area, once a proper study is performed to identify the locations of all Bald Eagle nests in and near the Project Area. LR 22, Shieldcastle Direct Testimony, A.16, p. 18, lines 9-11. Without these buffer zones, the Project will not represent the minimum adverse environmental impact under R.C. 4906.10(A)(3) and serve the public interest, convenience, and necessity under R.C. § 4906.10(A)(6).

Respectfully submitted,

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CERTIFICATE OF SERVICE

On December 23 2019, the docketing division's e-filing system will electronically serve notice of the filing of this document on the following counsel for the parties: Sally W. Bloomfield (sbloomfield@bricker.com), Dylan Borchers (dborchers@bricker.com), Joshua D. Clark (jclark@senecapros.org), Leah F. Curtis (lcurtis@ofbf.org), Chad A. Endsley (cendsley@ofbf.org), Miranda Leppla (mleppla@theoec.org), Amy M. Milam (amilam@ofbf.org), Mark Mulligan (mulligan_mark@co.sandusky.oh.us), Devin D. Parram (dparram@bricker.com), Chris Tavenor (ctavenor@theoec.org), Trent Dougherty (theoec.org), Dane Stinson (dstinson@bricker.com), Derek Devine (dwd@senecapros.org), Jodi Bair (jodi.bair@ohioattorneygeneral.gov), and William Cody. On the same date, I served a copy of this filing by electronic mail on the above-listed counsel, Dennis Hackenburg at Dennyh7@frontier.com, and Mike and Tiffany Kessler at mkessler7@gmail.com.

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Summary: Brief (Post-Hearing) electronically filed by Mr. Jack A Van Kley on behalf of Local Resident Intervenors