1646658 Alberta Ltd.

Errata to Decision 2014-040

Bull Creek Wind Project

March 10, 2014

The Alberta Utilities Commission
Decision 2014-040 (Errata): 1646658 Alberta Ltd.
Bull Creek Wind Project
Application No. 1608556
Proceeding ID No. 1955

March 10, 2014

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The Alberta Utilities Commission
Calgary, Alberta

Decision 2014-040 (Errata)
1646658 Alberta Ltd. **Application No. 1608556**
Bull Creek Wind Project **Proceeding ID No. 1955**

1. On February 20, 2014, the Alberta Utilities Commission (AUC or the Commission) issued Decision 2014-040 to 1646658 Alberta Ltd.

2. Appendix I to Decision 2014-040 included the Alberta Environment Sustainable Resource Development (AESRD) Fish and Wildlife Division Project Sign-off Letter Project Referral Report dated June 5, 2012, instead of the updated version of that report dated June 20, 2012. Also, footnote 350 on page 101 refers to the AESRD Fish and Wildlife Division Project Sign-off Letter Project Referral Report as Exhibit 41 instead of Exhibit 42.

3. Section 48 of AUC Rule 001: *Rules of Practice* indicates that "[t]he Commission may correct typographical errors, errors of calculation and similar errors made in any of its orders, decisions or directions." Accordingly, this errata decision has been issued to correct these errors.

4. In this Decision 2014-040 (Errata), Appendix I of Decision 2014-040 has been amended to reflect the June 20, 2012, AESRD sign-off letter and footnote 350 has been amended to refer to the correct exhibit number.

Dated on March 10, 2014.

The Alberta Utilities Commission

(original signed by)

Tudor Beattie, QC
Panel Chair

(original signed by)

Neil Jamieson
Commission Member

(original signed by)

Kate Coolidge
Acting Commission Member

AUC
Alberta Utilities Commission

1646658 Alberta Ltd.

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Contents

List of figures

List of tables

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Decision 2014-040
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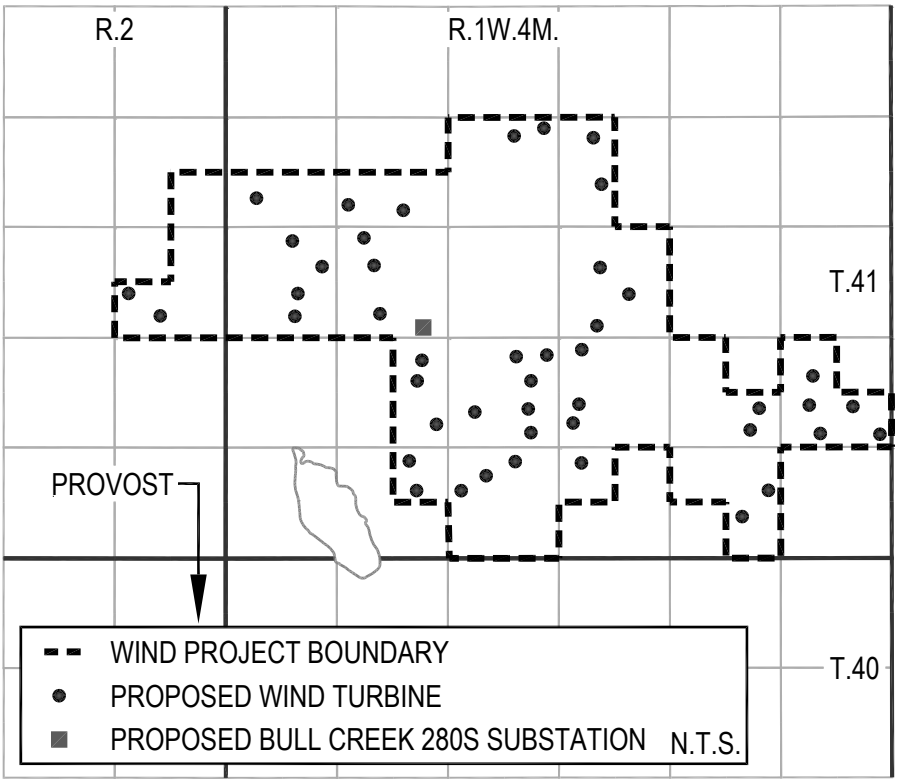
1 Introduction

1. In this decision, the Alberta Utilities Commission (AUC or the Commission) must decide whether to approve an application by 1646658 Alberta Ltd. (the applicant), a wholly owned subsidiary of BluEarth Renewables Inc. (BluEarth) to construct and operate the Bull Creek Wind Project (the project), pursuant to sections 11, 14 and 15 of the *Hydro and Electric Energy Act.* The project would be located in an area north of the town of Provost, in portions of both the Municipal District of Provost No. 52 (MD of Provost) and the Municipal District of Wainwright No. 61 (MD of Wainwright).

2. The location of the project is shown in the following map:

Figure 1 - Bull Creek Wind Project proposed location



3. The applicant stated that it selected the project site based on a number of factors including, the wind resource, its review of the terrain and topography, access to transmission and landowner interests. The applicant explained that once it determined that the area was suitable

for a wind power project, it commenced turbine siting and made routing determinations for the collector system and access roads taking into account the following considerations:

- land use bylaws
- results from wind studies and meteorological data
- potential concerns of nearby residents and landowners
- site access
- existing land use
- environmental and historical resources information including wildlife habitat, vegetation communities, and location of historical resources
- results from the preliminary noise assessment
- interconnection considerations

4. The applicant submitted that all potential siting and land-use restrictions have been avoided or mitigated where appropriate.[1]

1.1 Background

5. On June 18, 2012, the applicant filed an application with the AUC to construct and operate the project. The application was registered as Application No. 1608556 and was assigned Proceeding ID No. 1955. The project would consist of the following components:

- Forty-six 2.5-megawatt (MW) wind turbines with a total capacity of 115 MW located within ranges 1 and 2, Township 41, west of the Fourth Meridian.
- A 34.5-kilovolt (kV) collector system consisting of underground and overhead power lines located within ranges 1 and 2, Township 41, west of the Fourth Meridian.
- The Bull Creek 280S substation for future connection to the Alberta Interconnected Electrical System, located in the southeast quarter of Section 17, Range 1, Township 41, west of the Fourth Meridian.

6. The AUC issued a notice of application on September 28, 2012, for the project. In response to its notice, the AUC received submissions from landowners and other interested stakeholders.

7. The AUC issued a notice of hearing on November 21, 2012. The notice provided details of the application, timing for an AUC information session and a schedule of the remaining process steps for consideration of the application.

8. On February 4, 2013, the Commission revised the process schedule as well as the date and location of the public hearing. A revised notice of hearing was also issued by the Commission on February 4, 2013.

9. By letter dated March 13, 2013, the applicant requested that the hearing be suspended and advised that it would be filing an amendment to its application in the future, including a new noise impact assessment. On March 15, 2013, the Commission granted the applicant's suspension request. The Commission issued a notice advising parties of the cancellation of the oral hearing on March 22, 2013.

[1] Exhibit 1, Application, page 20.

10. On April 12, 2013, the applicant filed a revised noise impact assessment and other associated amendments to its application. To avoid gaps and to provide a history of the application, the previous application and evidence remained on the record of Proceeding ID No. 1955.

11. On May 13, 2013, after reviewing the revised application, the Commission issued a process schedule for consideration of the application. By letter dated, May 21, 2013, the Commission issued an update to the schedule. A revised notice of hearing was also issued on May 22, 2013.

12. On May 27, 2013, the Killarney Lake Group (KLG) submitted a letter to the AUC requesting to change the date and venue of the hearing which the Commission granted on June 5, 2013. The final notice of hearing was issued on June 7, 2013.

13. The hearing commenced on Monday, October 28, 2013, in Provost, Alberta before Commission Member Tudor Beattie, QC (panel chair), Comission Member Neil Jamieson and Acting Commission Member Kate Coolidge. The hearing adjourned in Provost on November 1, 2013, and resumed in Calgary from November 18, 2013 to November 22, 2013.

14. The majority of the hearing was conducted in public session. However, pursuant to a request from the KLG, portions of the evidence were subject to a limited confidentiality order.

1.2 Participants in the proceeding

15. The Commission received objections to the project from the KLG and Allan Riseley. The KLG consisted of the following members:

- Angeltvedt, Ron and Anne
- Beatty, Kevin and Eiri
- Beatty, Robert
- Bonnefoy, Dan and Tracey
- Buck, Doug and Heather
- Dixon, Fern
- Hager, Alan and Charlene
- Hager, Benjamin
- Hager, Christina
- Hager, Lillian
- Hager, Marjorie
- Hager, Rick
- Nickel, Harry and Karen
- Olson, Kim and Laurie
- Read, Martha
- Riseley, Russell J.
- Skinner, Vernon and Lorraine

16. The Commission received written submissions from the following landowners in support of the project:

- Graham Hager Farms Ltd., Graham Hager, Susan Hager, Chris Hager, Amanda Hager, Shelby Hager, Jordan Arbuthnott, Sandy Hager, and Elif Genc
- Mailer, Craig and Tracie
- Merriman, Archie
- Skinner, Brian and Renae Mitchell-Skinner
- Skinner, Mike and Joanne
- Write, Freda

17. The Commission also received written submissions from the following stakeholders:

- Alberta Schools Commodity Purchasing Consortium
- Benign Energy Canada II Inc.
- Buffalo Trail Public Schools
- ConocoPhillips Canada
- MD of Provost
- MD of Wainwright

18. A list of all proceeding participants, including those that submitted written submissions, has been attached to this decision as Appendix A. All submissions were reviewed by the panel and taken into account in coming to their decision.

2 How the decision is structured

19. The structure for this decision is as follows.

20. The decision first lays out the legislative scheme that governs wind power plants. The decision then outlines the pre-hearing and procedural motions that the Commission ruled on.

21. Next, the decision addresses how it treats the evidence in this proceeding including matters such as the burden of proof and its consideration of expert evidence.

22. The decision then takes an overview of the evidence provided in this proceeding. These sections are organized by issue. The significant issues addressed in the decision are: the applicant's consultation and participation involvement program; the project's noise impact assessments and the project's compliance with the AUC regulatory requirements for noise; health impacts arising from noise produced by the project; safety concerns relating to project siting including the project's proximity to oil and gas pipelines; the project's potential impact on property values; environmental issues; the applicant's decommissioning plan; and municipal issues in the MD of Provost and the MD of Wainwright.

23. Finally, the Commission will provide its overall conclusion on the application.

3 Legislative scheme

24. The Commission regulates the construction and operation of power plants in Alberta. The wind farm proposed by the applicant is a "power plant" as that term is defined in subsection 1(K) of the *Hydro and Electric Energy Act.* Section 11 of the *Hydro and Electric Energy Act* states that no person may construct or operate a power plant without prior approval from the Commission. In addition, sections 14 and 15 of the *Hydro and Electric Energy Act*, direct that approval from the Commission is necessary prior to constructing or operating a substation or a transmission line.[2]

25. Accordingly, the applicant has applied to construct the project pursuant to sections 11, 14 and 15 of the *Hydro and Electric Energy Act.*

26. When considering an application for a power plant and associated infrastructure, the Commission is guided by sections 2 and 3 of the *Hydro and Electric Energy Act*, and Section 17 of the *Alberta Utilities Commission Act*.

27. Section 2 lists the purposes of the *Hydro and Electric Energy Act*. Those purposes include:

- To provide for the economic, orderly and efficient development and operation, in the public interest, of the generation of electric energy in Alberta.
- To secure the observance of safe and efficient practices in the public interest in the generation of electric energy in Alberta.
- To assist the government in controlling pollution and ensuring environment conservation in the generation of electric energy in Alberta.

28. Section 3 of the *Hydro and Electric Energy Act* requires the Commission to have regard for the purposes of the *Electric Utilities Act* when assessing whether a proposed power plant and associated infrastructure is in the public interest under Section 17 of the *Alberta Utilities Commission Act.* The purposes of the *Electric Utilities Act* include the development of an efficient electric industry structure and the development of an electric generation sector guided by competitive market forces.[3]

29. In Alberta, the legislature expressed its clear intention that electric generation is to be developed through the mechanism of a competitive, deregulated electric generation market. Section 3 of the *Hydro and Electric Energy Act* directs that the Commission shall not have regard to whether the proposed power plant "…is an economic source of electric energy in Alberta or to whether there is a need for the electric energy to be produced by such a facility in meeting the requirements for electric energy in Alberta or outside of Alberta." Accordingly, in considering an application before it, the Commission does not take into account the potential need and cost of a project.[4]

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[2] Defined in Section 1(1)(o)(iii) of the *Hydro and Electric Energy Act,* "transmission line" includes substations.

[3] *Electric Utilities Act,* Section 5.

[4] Paragraphs 10 to 15 are substantially reproduced from AUC Decision 2010-493: ENMAX Shepard Inc. Construct and Operate 800-MW Shepard Energy Enter, October 21, 2010 at paragraphs 17-26 *mutatis mutandis.*

30. As such, in the following assessment of whether the project is in the public interest, the Commission has not had regard to whether there is a need for the project as proposed by the applicant. In considering an application the Commission is also mindful of Section 19 of the *Hydro and Electric Energy Act*, which authorizes the Commission to deny an application, approve it, or approve it with conditions.

31. The Commission's public interest mandate is located within Section 17 of the *Alberta Utilities Commission Act*, which states:

> **Public interest**
> **17(1)** Where the Commission conducts a hearing or other proceeding on an application to construct or operate a hydro development, power plant or transmission line under the *Hydro and Electric Energy Act* or a gas utility pipeline under the *Gas Utilities Act*, it shall, in addition to any other matters it may or must consider in conducting the hearing or other proceeding, give consideration to whether construction or operation of the proposed hydro development, power plant, transmission line or gas utility pipeline is in the public interest, having regard to the social and economic effects of the development, plant, line or pipeline and the effects of the development, plant, line or pipeline on the environment.

32. In Decision 2001-111,[5] the Commission's predecessor, the Alberta Energy and Utilities Board, explained its approach to assessing whether the approval of a power plant is in the public interest as follows:

> The determination of whether a project is in the public interest requires the Board to assess and balance the negative and beneficial impacts of the specific project before it. Benefits to the public as well as negative impacts on the public must be acknowledged in this analysis. The existence of regulatory standards and guidelines and a proponent's adherence to these standards are important elements in deciding whether potential adverse impacts are acceptable. Where such thresholds do not exist, the Board must be satisfied that reasonable mitigative measures are in place to address the impacts. In many cases, the Board may also approve an application subject to specific conditions that are designed to enhance the effectiveness of mitigative plans. The conditions become an essential part of the approval, and breach of them may result in suspension or rescission of the approval.
>
> In the Board's view, the public interest will be largely met if applications are shown to be in compliance with existing provincial health, environmental, and other regulatory standards in addition to the public benefits outweighing negative impacts.[6]

33. The Commission is of the view that the above approach to assessing whether a proposed project is in the public interest is consistent with the purpose and intent of the statutory scheme. Further, the Commission considers that this approach provides an effective framework for the assessment of wind energy projects.

34. AUC Rule 007: *Applications for Power Plants, Substations, Transmission Lines and Industrial System Designations* (AUC Rule 007) applies to applications to the AUC for the construction and operation of power plants, substations and transmission lines that are governed

[5] EUB Decision 2001-111*:* EPCOR Generation Inc. and EPCOR Power Development Corporation 490-MW Coal-Fired Power Plant, Application No. 2001173, December 21, 2001.

[6] EUB Decision 2001-111, page 4.

by the *Hydro and Electric Energy Act.* The application must meet the informational and other requirements set out in AUC Rule 007. Specifically, an applicant must provide technical and functional specifications, information on public consultation, environmental and land-use information including a noise assessment, and the project's estimated cost.

35. Further, an applicant must receive all approvals under other applicable provincial or federal legislation.

4 Pre-hearing and procedural motions

4.1 Standing of the MD of Wainwright

36. By letter dated October 25, 2012, the MD of Wainwright requested to participate in the proceeding. Specifically, the MD of Wainwright wanted to ensure that there were no inconsistencies between an approval that may be granted by the Commission and the development permits to be issued by the MD of Wainwright.[7] The MD of Wainwright submitted that it would be the development authority for these project components pursuant to the *Municipal Government Act* because components of the project would be located within its boundaries and it requested certain conditions be placed on the project if approved.

37. On November 15, 2012, the Commission issued a ruling with respect to the standing of various interested parties in the project. In its November 15, 2012 ruling, the Commission determined that the MD of Wainwright had demonstrated its right to standing in the proceeding because 18 of the proposed turbines would be located in that municipal district which, therein, satisfies both parts of the two-part test used to determine standing. A copy of the Commission's ruling on standing is attached as Appendix D.[8]

4.2 KLG: Confidentiality request

38. On January 16, 2013, the KLG requested confidential treatment of the medical records of three of its members: J.B., C.H., and H.B. pursuant to Section 13 of AUC Rule 001: *Rules of Practice* (AUC Rule 001). The KLG argued that making the individual medical records public would remove the records from the realm of protection of privacy legislation. By letter dated February 20, 2013, the Commission ruled on the motion, and granted the KLG's request to submit the medical records of J.B., C.H. and H.B. on a confidential basis.[9] The Commission accepted that the medical records of J.B., C.H. and H.B. satisfied the three-part test set forth in Section 13 of AUC Rule 001 namely, the records are personal in nature, have been consistently treated as confidential and that the parties' interests in keeping this personal medical information confidential outweighs the public interest in the disclosure of this information. A copy of the ruling is attached as Appendix E.[10]

4.3 KLG: Motion to compel the applicant to provide the updated technical noise specifications of the turbines

39. On March 13, 2013, the applicant advised the Commission that it had received updated technical noise specifications for the turbines from General Electric Ltd. (GE). The applicant stated that because of this new information it was necessary to file an amendment to its application and that the new information from GE would be included in the forthcoming amendment to its application. On March 14, 2013, the KLG filed a motion seeking an order from the Commission directing the applicant to immediately file the updated technical specifications of the turbines that it had received from the turbine manufacturer GE.

40. On March 27, 2013, the Commission issued a ruling denying the KLG's motion to direct the applicant to immediately disclose the technical noise specifications for the proposed turbines. The Commission found that the KLG had not demonstrated how it would be prejudiced by

[7] Exhibit 72.01, Municipal District of Wainwright No. 60 letter to AUC.
[8] Exhibit 78.01, AUC letter to Interested Parties-Ruling on Standing-Bull Creek.
[9] Exhibit 126.01, Commission ruling on confidentiality request by the Killarney Lake Group.
[10] Exhibit 126.01, Commission ruling on confidentiality request by the Killarney Lake Group.

having to wait until the applicant filed its amendment before having an opportunity to review the technical noise specifications provided to the applicant by GE in March 2013. A copy of the ruling is attached as Appendix F.[11]

4.4 KLG: Motion for the Commission members to view the project site

41. On September 10, 2013, the KLG submitted a motion pursuant to Section 5 of AUC Rule 001 requesting that the Commission panel members view the project site and the surrounding KLG members' lands prior to the hearing, preferably within the next month and before the onset of the winter season while the area was "green and vibrant". [12]

42. By letter dated September 19, 2013, the Commission issued a ruling indicating that while the Commission members' schedules did not permit them to conduct the site visit within the next month, they would view the project area either before or during the course of the hearing. A copy of the ruling is attached as Appendix G.[13]

4.5 Pre-qualification of expert witnesses

43. By letter dated October 3, 2013, the Commission indicated that it intended to pre-qualify expert witnesses tendered by the parties and directed parties to submit the names of each of their experts and a description of the areas of expertise for which qualification was sought. The Commission also gave parties an opportunity to object to the qualifications proposed and an opportunity to respond to any objections. On October 25, 2013, after reviewing the submissions of the parties, the Commission issued a ruling on the qualification of the expert witnesses proffered by the applicant and the KLG. In its ruling, the Commission qualified the expert witnesses in their respective fields and communicated that should experts give evidence outside their area(s) of expertise that evidence would be afforded the weight of a lay witness. A copy of the ruling is attached as Appendix H.[14]

4.6 KLG: Motion to file additional evidence

44. On November 14, 2013, the Commission received a motion from the KLG to admit additional evidence onto the record of the proceeding pursuant to sections 7 and 27.1 of AUC Rule 001. In its motion, the KLG sought to admit emails between one of its expert witnesses and a representative of GE, a three-page report showing calculations, and forthcoming measurement test results from the turbine manufacturer GE. The KLG also sought to dispense with the requirement of filing an affidavit is support of the motion. The applicant responded to the motion by letter dated November 15, 2013, and indicated that it objected only to the admittance of the forthcoming measurement test results. The applicant submitted that it would be unfair for the KLG to be permitted to file additional new evidence that was not included with its notice of motion and that the forthcoming measurement test results had little relevance to the application.[15]

45. The Commission issued an oral ruling on November 18, 2013, which, in part, granted the KLG's request: the KLG's request to admit the forthcoming measurement test results from GE was denied.

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11 Exhibit 156.01, AUC Ruling on Motion by the Killarney Lake Group-Application 1608556.
12 Exhibit 201.01, KLG Request pursuant to Section 5 of the AUC's Rules of Practice.
13 Exhibit 204.01, AUC letter to interested parties – ruling on motion.
14 Exhibit 224.01, AUC ruling on experts.
15 Exhibit 282.01, Letter to AUC response to KLG Motion dated November 15, 2013.

5 Evidentiary matters

5.1 Admissibility of expert evidence

46. The Supreme Court of Canada set out the test for admissibility of expert evidence in *R. v. Mohan*.[16] To call expert evidence, a party must demonstrate that the evidence is relevant, necessary to assist the decision maker, and is not subject to an exclusionary rule. The party must also demonstrate that the proposed expert is properly qualified.

47. In this proceeding, the Commission heard expert opinion evidence on a host of subjects related to the project. This evidence was presented on behalf of both the applicant and the KLG. While neither party argued that the other's expert evidence was inadmissible under the *R. v. Mohan* criteria, both argued that the Commission should give little weight to the opinion evidence of their adversaries' experts because those experts lacked the necessary independence and objectivity.

48. The Commission commented on the weighing of expert evidence in Decision 2011-436:[17]

> … When deciding what weight to give to the evidence provided by an expert witness, an important factor the Commission will consider is whether the expert witness provided an independent or objective opinion. The role and duties of an expert witness was considered in an English case known as *The Ikarian Reefer*.[18]That case and its implications were extensively discussed in *1159465 Alberta Ltd. v. Adwood Manufacturing Ltd.*, a recent decision of the Alberta Court of Queen's Bench. The court summarized in part the duties and obligations of an expert witness, as described in *the Ikarian Reefer*, as follows:
>
> 1. Expert evidence presented to the Court should be and should be seen to be the independent product of the expert uninfluenced as to form or content by the exigencies of litigation ...
>
> 2. An expert witness should provide independent assistance to the Court by way of objective unbiased opinion in relation to matters within his expertise ... An expert witness in the High Court should never assume the role of advocate… [Emphasis added in the court's decision.][19]
>
> 90. The court stated that "The duties identified in Ikarian Reefer place a special onus on an expert witness. That witness is less a 'witness for a party' than a 'witness for the court'."[20]
>
> 91. The court went on to consider whether a determination that an expert witness lacked independence is grounds to exclude the evidence, or simply a factor that the court must take into account when weighing the evidence. The court reviewed the law on the topic and concluded as follows:

---

16 *R. v. Mohan*, [1994] 2 S.C.R. 9.

17 Decision 2011-436: AltaLink Management Ltd. and EPCOR Distribution & Transmission Inc. – Heartland Transmission Project, Application No. 1606609, Proceeding ID No. 457, November 1, 2011.

18 *National Justice Compania S.A. v. Prudential Assurance Co. Ltd. (Ikarian Reefer)), [1993] 2 Lloyds Rep. 68 (Comm. Ct. Q.B. Div.) approved [1995] 1 Lloyds Re. 455 (C.A.).*

19 *1159465 Alberta Ltd. v. Adwood Manufacturing Ltd.* [2010] ABQB 133 at paragraph 2.11.

20 *1159465 Alberta Ltd. v. Adwood Manufacturing Ltd.* [2010] ABQB 133 at paragraph 2.13.

> 2.28 While an expert witness is not an officer of the court, any expert witness is expected to be scrupulous, honest, and independent. Courts hold expert witnesses to a high standard, and a part of the expert witness role is to fully disclose the kind of relationships and history that might lead to concerns towards bias. Where those deficiencies are detected only during cross-examination, such as what happened in *Frazer v. Haukioja*, the court may very properly conclude that expert has not discharged his or her duties to the court. That would generally lead to an adverse inference on the impartiality and non-biased character of that expert witness.
>
> 2.29 It is my opinion that the public policy approach taken by the Alberta courts, mandated for Alberta judges by the Alberta Court of Appeal, is a pragmatic one that allows a person the opportunity to present an expert, but that expert may be so weakened by the attachment to one of the parties that every nuance and each element of his report may not survive the trial judge's ruling, especially when the suspect expert is challenged by a more independent expert. In this way, the legal literature has empowered the judiciary to consider these elements as part of the weighing of the evidence of the expert, as opposed to preventing all access to that witness' expertise.[21]

49. In the event that the Commission finds that an expert's evidence extends beyond the limits of his or her expertise, the Commission will take the approach outlined in Decision 2012-303:[22]

> …evidence provided by [an expert] in areas where he was clearly not qualified to opine, will be given the weight of a lay witness rather than the weight of a properly qualified expert in these areas. Where that evidence diverges from the evidence of a properly qualified expert witness, the evidence of the qualified expert witness will be preferred.[23]

50. The Commission has adopted the approach described above when weighing the expert evidence proffered in this proceeding.

51. The applicant argued that the evidence of several KLG expert witnesses should be given little or no weight because of their affiliation with the Society for Wind Vigilance or similar organizations. Likewise, the KLG argued that the Commission should give little or no weight to the evidence of many of the applicant's expert witnesses because those experts have only ever testified on behalf of wind developers.

52. The Commission is not prepared to disregard the evidence provided by the KLG experts solely because they are members of the Society for Wind Vigilance or a similar organization, nor is it prepared to disregard the evidence provided by the applicant's witnesses because they have previously testified on behalf of other wind developers. If the Commission accepted these arguments the result would be the exclusion of much of the evidence filed in this proceeding. While such affiliations are a factor that the Commission may take into account when assessing each expert's objectivity, it must consider a number of other factors when determining the overall weight to give each expert's evidence. In the Commission's view, the best place for this analysis is within the sections of this decision in which the expert's evidence is discussed.

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[21] *1159465 Alberta Ltd. v. Adwood Manufacturing Ltd.* [2010] ABQB 133 at paragraph 2.28 and 2.29.

[22] Decision 2012-303: ATCO Electric Ltd. – Eastern Alberta Transmission Line Project, Applications No. 1607153 and No. 1607736, Proceeding ID No. 1069, November 15, 2012.

[23] Ibid, paragraph 128.

5.2 Burden of proof

53. The KLG argued that the bar to satisfy whether the application is in the public interest is higher in this case than it would be for other types of facility applications where the need has been established or where certificates of public convenience and need have been issued.

54. The KLG provided no authority to support this assertion and the Commission finds that it is inconsistent with the statutory scheme. Like other applications under the *Hydro and Electric Energy Act* for new facilities, the onus is on the applicant to demonstrate, on a balance of probabilities, that approval of its proposed project is in the public interest having regard to its social, economic and environmental effects. This onus is created by Section 17 of the *Alberta Utilities Commission Act*.

6 Consultation

55. The AUC prescribes consultation requirements for applicants in AUC Rule 007. The purpose of a public consultation program is to inform parties whose rights may be directly and adversely affected by a proposed project.

56. AUC Rule 007, Appendix A, Participant Involvement Program Requirements, requires that an applicant include a description of its participant involvement program in its application to the AUC. AUC Rule 007 specifies that a participant involvement program must be conducted before an application is filed, and should include the distribution of a project-specific information package, responses to questions and concerns raised by potentially affected persons, and a discussion of options, alternatives and mitigation measures. The applicant is expected to ensure that information is conveyed in an understandable manner to the public and that the project is discussed with the widest possible audience as early as practical.

57. The participant involvement program should also obtain feedback and suggestions with respect to the project, with a view to modifying the project to reduce impacts on parties whose rights may be directly and adversely affected to the extent practical. The applicant is required to make all reasonable attempts to contact potentially affected persons to discuss the project and address any questions or concerns.

58. The participant involvement program includes both a public notification and a personal consultation component. AUC Rule 007 states that for power plant developments, the applicant must provide public notification to all occupants, residents and landowners within 2,000 metres measured from the edge of the proposed power plant site boundary. The applicant must provide personal consultation to all occupants, residents and landowners within 800 metres from the edge of the proposed power plant site boundary. Furthermore, AUC Rule 007 directs that for major power plant applications, if there are populated areas just outside the 2,000-metre limit, applicants should consider including those areas in the public notification.

59. The Commission and its predecessor, the Alberta Energy and Utilities Board, have previously expressed what is expected of applicants in conducting an effective notification and consultation program. In Decision 2008-006,[24] the Board stated that "…the program should include responding to questions and concerns, discussing options, providing alternatives and potential mitigation measures, and seeking confirmation that potentially affected parties do not object." The Board went on to state that it "…expects applicants to be sensitive to timing constraints the public may have especially when dealing with landowners engaged in agricultural endeavours."

60. Also, in Decision 2011-329, the AUC discussed the role of interveners and applicants when it stated as follows:

> The Commission considers that consultation is a two-way street. The applicant has a duty to consult with landowners and residents in the vicinity of the project in accordance with AUC Rule 007, and make reasonable efforts to ensure that all those, whose rights may be directly and adversely affected by a proposed development, are informed of the application, and have an opportunity to voice their concerns and to be heard.

[24] EUB Decision 2008-006: Montana Alberta Tie Ltd. 230-kV International Merchant Power Line Lethbridge, Alberta to Great Falls Montana, Applications No. 1475724, No. 1458443 and No. 1492150, January 31, 2008, page 36.

> Landowners and residents are entitled to consultation; however, as a practical matter, landowners and residents must make their concerns known to the applicant so that they may be discussed and addressed. …[25]

6.1 Views of the applicant

61. The applicant stated that it conducted a participant involvement program for the project with the public, government agencies, municipalities, operators of oil and gas facilities in the area and various other organizations. The program encompassed a mail out of a project-specific information package, personal consultation, open houses, and follow up meetings to address specific concerns. The applicant fully described its consultation process and its participant involvement program in its application. A brief description of the participant involvement program is set out below.

62. The project was first advanced by Windlab Developments Canada (Windlab) and, as such, initial consultation efforts were undertaken by Windlab in 2008 and 2009. After the applicant purchased the project from Windlab in late 2011, it continued to conduct a participant involvement program for the project.

63. In January 2012, the applicant sent a letter to stakeholders explaining that it had acquired the project from Windlab. In February 2012, the applicant mailed a project information package to all occupants, residents and landowners within a 2,000-metre radius from the edge of the project's site boundary. The applicant stated that its project-specific information was designed to inform stakeholders of the details of the project and to provide clear information to convey the technical details in a manner that the public was able to comprehend. In April 2012, the applicant sent a project update identifying the final layout of the proposed wind turbines and other associated infrastructure.

64. The applicant submitted that all landowners, residents and occupants within 800 metres of the project's site boundary were personally consulted through either face-to-face or telephone conversations throughout March and April of 2012. During these personal consultation meetings or phone calls, the applicant stated that it confirmed that the landowner had received and reviewed the notification package, discussed the project details including facility placement and the proposed schedule, and answered questions and concerns about the project. The applicant explained that stakeholders who declined in-person or telephone consultation were corresponded with in writing in order to address any concerns raised.

65. The applicant stated that open houses were held to engage the community and to provide information about the project beginning in July 2010.[26] The applicant submitted that the open houses communicated information about the project, including initial results from environmental surveys and an initial preliminary layout. The applicant held a second round of open houses in Wainwright in February 2012, and in Provost in March 2012. An additional open house was held on December 11, 2012, in Provost, to address concerns raised by stakeholders during the municipal hearing process.

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[25] AUC Decision 2011-329, NaturEner Energy Canada Inc., 162-MW Wild Rose 2 Wind Power Plant and Associated Eagle Butte Substation issued on August 2, 2011, paragraphs 169-170.

[26] Exhibit 157.03, 1646658 Alberta Ltd. Application re Bull Creek Wind Farm and Associated Substation-black line, page 22.

66. Further, the applicant maintained a website with contact information, project information and project updates.

67. The applicant submitted that its participant involvement program provided stakeholders opportunities to ask questions, express concerns about the project, and have those questions and concerns addressed in a honest and timely manner.

68. The applicant noted that the project is supported by nine families seeking to host turbines on their property.[27] The applicant indicated that it has continued efforts to engage and consult with KLG members.

69. In the event the project is approved by the AUC, the applicant indicated that it would:

> …continue to engage all stakeholders regularly regarding the project, and is willing to establish moderated round table sessions to continue through construction and into operation of the Project to facilitate this information exchange and to address any questions or concerns that may arise.[28]

6.2 Views of the interveners

70. The KLG took issue with the applicant's consultation and participant involvement program.

71. The Commission heard a considerable amount of evidence from members of the KLG expressing concern about the execution of the applicant's participant involvement program. Specifically, KLG members expressed that they were frustrated and disappointed with the applicant's notification and consultation processes. For example, Mr. B. Hager, on behalf of Mr. R. Hager, stated:

> It would be different if the people they sent out had told at least half the truth. They came back again and again. Plainly, they were just bullies trying to get signatures by any means possible. Dealing with [the applicant] has been a huge source of irritation, stress, and feelings of helplessness to have control over my own life.[29]

72. Several KLG members were also concerned with the completeness of the information provided to them by the applicant. For example, Mr. R. and Ms. Hager stated that the material presented to them was inaccurate and incomplete which caused them grave concern.[30] Similarly, Mr. Bonnefoy stated:

> I have to say, I've never experienced so many "I don't knows," "I'm not sure," "I can't recollect," generalities, speculations, "I can't remembers," presumptions, broad-brush statements, question-dodging, and language manipulation and rubber theories, as I did from [the applicant's] reps and some of their experts. They talked a lot, but really didn't say much at all.[31]

[27] Transcript, Volume 9, page 1927, lines 17-18.
[28] Exhibit 203.07, 1646658 Alberta Ltd.Reply Evidence, page 11.
[29] Transcript, Volume 5, page 1250, lines 19-25.
[30] Transcript, Volume 5, page 1242, lines 13-18.
[31] Transcript, Volume 5, pages 1320-1321, lines 24-5.

73. Ms. Beatty contended that the applicant had "…supplied information about this project's impacts sporadically and only on request."[32]

74. The KLG submitted that the applicant's public consultation with respect to health effects from wind turbines lacked objectivity, transparency and completeness that is required in a public consultation program. In particular, members of the KLG indicated that the applicant did not provide literature that indicated that there were potential adverse health effects associated with being near wind farms and made great efforts to downplay the seriousness of the health concerns raised by members of the KLG through comments that suggested that these concerns were imaginary.[33]

75. Also, members of the KLG indicated that the applicant changed the project layout several times and contended that the applicant should have undertaken additional public consultation whenever the project's layout was revised. For example, Mr. Bonnefoy stated "I'm not totally sure which turbines are where because [the applicant] changed the project layout so many times."[34]

76. Further, Ms. Beatty indicated that the applicant did not foster good relationships with neighbours. Ms. Beatty described an incident where contractors of the applicant did not obtain consent before entering her property to take photos of her residence for a photomontage. Ms. Beatty explained that this was a violation of her right to privacy. Mr. Bonnefoy described a similar situation.

77. Based on the concerns raised above, the KLG reasoned that the Commission should not approve the current application due to the unsatisfactory consultation process.

6.2.1 The applicant's response to interveners' consultation concerns

78. The applicant explained the timing of its consultation program in relation to the municipal hearing. On September 28, 2012, when the AUC's notice of application for the project was issued, the municipal hearings were underway. At that time, the applicant was working to understand and respond to new concerns and new concerned individuals who came forward during those hearings. The applicant submitted that it worked diligently to address concerns raised during the municipal hearings by responding to information requests, conducting additional studies, and holding an additional public information session in December 2012.

79. Specifically, in response to the KLG's submission that its consultation lacked completeness, the applicant stated that:

> Many of the broad concerns now held by the KLG as well as many of the individual KLG members themselves, were first identified … either during municipal hearings held in the MD or Provost in September and October 2012, or in the February, 2013 submissions of the KLG to the AUC under this hearing process.[35]

[32] Transcript, Volume 5, page 1264, lines 15-18.
[33] Transcript, Volume 9, page 2002, lines 11-20.
[34] Transcript, Volume 5, page 1309, lines 10-11.
[35] Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, page 14.

80. The applicant explained that concerns regarding groundwater and pipeline integrity were not raised prior to the February and June 2013 KLG submissions.[36]

81. With respect to the availability of health information, the applicant submitted that it had retained Dr. Ollson to review the literature with respect to health effects associated with wind turbines.[37] In consultation with Dr. Ollson, the applicant stated that it made a decision not to provide copies of anecdotal case reports to interested parties. The applicant explained that only literature that was either peer reviewed or from a governmental authority was provided to stakeholders. In the applicant's view, it was not a prudent practice to distribute unverified or unverifiable information relating to scientific issues, particularly those that were found on anonymous blog postings on the Internet, when a wealth of peer-reviewed information existed on the subject matter.[38]

82. According to the applicant, the allegation made by members of the KLG that it did not present information regarding the adverse health effects of wind turbines to stakeholders is unfounded.[39] The applicant stated that it provided, or offered to provide, peer-reviewed scientific literature as well as syntheses of the peer-reviewed literature, such as the Massachusetts Departments of Public Health and Environment Protection study on wind turbines to interested parties including, the Bonnefoys and Ms. Hager. The applicant indicated that some KLG members, including Ms. Hager, refused to meet with its representatives to discuss concerns regarding health and refused its offer to provide peer-reviewed and governmental literature on the effects of wind turbines on health.

83. With respect to the allegation of trespass, the applicant stated that the photomontages were initially requested by the landowners. At the hearing, Ms. Matheson-King, vice-president of regulatory and communications of BluEarth, explained that the photomontage crew was reprimanded for entering the Beatty property without express consent and that Mr. Jans, on behalf of the applicant, called Ms. Beatty and explained that the incident was "regrettable".[40]

84. The applicant stated that there had been a lack of communication between Mr. and Ms. Hager and the applicant. Specifically, the applicant stated:

> Mr. and Mrs. Hager have conveyed many misunderstandings about the Project over the last two years, to [the applicant's] frustration, they have not provided [the applicant] with an opportunity to meet with them to discuss, or address any of their concerns in person.[41]

6.3 Commission findings

85. AUC Rule 007 states that a participant involvement program must be conducted before a facility application is filed with the Commission. A participant involvement program is a fundamental component of any facility application; the responsibility of the applicant to meet its consultation requirements under AUC Rule 007 must be satisfied before the Commission can consider the various components of a facility application. In other words, an applicant must discharge its mandatory public notification and personal consultation obligations in order for the

[36] Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, page 14.
[37] Transcript, Volume 4, page 115, line 25, Transcript, Volume 10, pages 2218-2219, lines 9-13, and Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, page 14.
[38] Transcript, Volume 10, pages 2218-2219, lines 9-13.
[39] Transcript 10, pages 2218-2219, lines 9-13.
[40] Transcript, Volume 4, page 115, line 25 and Transcript, Volume 9, page 2010, line 25.
[41] Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, page 14.

Commission to be satisfied that the consultation process provided a reasonable opportunity for the Commission to have before it sufficient information to properly carry out its public interest mandate.

86. The Commission finds that the nature and scope of the project requires a participant involvement plan that meets the requirements for consultation and notification set out in AUC Rule 007. Accordingly, in assessing whether the participant involvement plan meets the requirements of AUC Rule 007, the Commission will consider whether landowners were consulted at important decision making steps of the process. The Commission will consider the applicant's efforts to contact those landowners, including the refusal of landowners to engage in consultation.

87. The Commission finds that the participant involvement plan designed by the applicant met the requirements of AUC Rule 007 in the following ways:

- mail out of project information packages to all stakeholders
- personal consultation to stakeholders within the project area
- open houses
- project website
- ongoing efforts made to address landowner concerns as they arose

88. The Commission acknowledges that even an effective consultation program may not resolve all landowner concerns. There may be situations where individual stakeholders may feel that the consultation effort as it pertained to their interests specifically was insufficient or superficial. The perceptions of the applicant and some interveners about the quality and effectiveness of the public consultation can be quite different. This is not the fault of the applicant or the intervener; it merely reflects the fact that the parties do not agree.

89. The Commission finds that the efforts that were made by the applicant to ensure that there were multiple avenues for landowners to obtain information or contact the applicant met the requirements of AUC Rule 007.

90. The Commission has determined that the applicant provided access for potentially affected landowners to make further inquiries, that the open houses and publicly distributed information contained clear contact information, and that those individuals who were required to be consulted personally also had contact information to reach the applicant if they had additional questions or concerns. The Commission finds that the applicant demonstrated willingness to meet with stakeholders to discuss concerns. The Commission also finds that the applicant appears to have been receptive and responsive when dealing with new concerns raised by landowners after its application was submitted to the Commission.

91. With regard to the allegation of trespass, the Commission understands that the applicant's intention to prepare the photomontages was to help the landowners visualize the project from their properties. However, in the Commission's view, the applicant failed to adequately notify the landowners in question that it would be completing the photomontages and when it required access to their lands. The applicant's failure to properly instruct its contractors and obtain express permission to enter the landowners' lands contributed to the decline in the relationship between certain KLG members and the applicant.

92. The Commission observes that efforts were made by the applicant to provide health information to interested stakeholders after requests were made. The Commission recognizes that the applicant attempted to research the health effects associated with wind turbines and that Dr. Ollson was retained for this purpose. The Commission finds that the approach adopted by the applicant of providing information that was peer reviewed or prepared by government organizations to be reasonable in the circumstances. The Commission recognizes that the health literature on this topic is complex and can be challenging to explain and convey to stakeholders. However, the applicant could have been more effective at listening to the health concerns raised by interveners, which may have reduced the perception by the affected landowners that the applicant perceived their health concerns to be imaginary.

93. In Decision 2011-436, the Commission made the following comments with respect to effective consultation under AUC Rule 007:

> … In the Commission's view, effective consultation achieves three purposes. First, it allows parties to understand the nature of a proposed project. Second, it allows the applicant and the intervener to identify areas of concern. Third, it provides a reasonable opportunity for the parties to engage in meaningful dialogue and discussion with the goal of eliminating or mitigating to an acceptable degree the affected parties concerns about the project. If done well, a consultation program will improve the application and help to resolve disputes between the applicant and affected parties outside of the context of the hearing room.[42]

94. The Commission finds that the applicant's participant program met the three objectives described above. Notwithstanding the concerns expressed by interveners, the Commission finds that the applicant made reasonable efforts to engage in a two-way dialogue with landowners, based on the evidence presented by the applicant on the depth and diversity of the public consultation process. Accordingly, the Commission concludes that the applicant's consultation and participant involvement program met the regulatory requirements of AUC Rule 007.

[42] Decision 2011-436, page 57, paragraph 283.

7 Noise

7.1 Introduction

95. The applicant filed two noise impact assessments in support of the application. The first noise impact assessment was dated and filed in 2012, and used sound measurement data gathered in 2010. The second noise impact assessment was dated and filed in 2013, and primarily used sound measurement data gathered in 2013, with the exception of 15 facilities for which 2010 data was used.[43] In both of its noise impact assessments, the applicant predicted that the project would comply with the permissible sound levels (50 dBA L_{eq} daytime and 40 dBA L_{eq} nighttime) in AUC Rule 012: *Noise Control* (AUC Rule 012).

96. The applicant retained three experts to provide evidence on the project's noise impact and wind turbine noise. The three experts were Mr. Danny Da Silva from Golder Associates Ltd. (Golder), Mr. Payam Ashtiani from Aercoustics Engineering Ltd. (Aercoustics) and Dr. Geoffrey Leventhall.

97. The KLG contested the validity of the noise impact assessments on a number of grounds including: sound source identification, predicted sound level and compliance determination, noise control measures, the applicant's use of models and standards, and the potential for a low frequency noise conditions. The KLG retained two experts to provide evidence with respect to the noise impact assessments and wind turbine noise. The two experts were FDI Acoustics Inc. (FDI Acoustics), Mr. James Farquharson and E-Coustic Solutions, Mr. Rick James.

98. In this section, the Commission makes findings about the noise impact that the proposed turbines and associated infrastructure will likely generate at nearby residences. This section is organized into a number of subsections. First, the Commission provides a brief review of some basic concepts that are necessary to understand the science of sound measurement. Second, is an overview of AUC Rule 012, which describes the Commission's noise impact assessment and noise measurement requirements. Third, the Commission briefly describes the activities undertaken by the applicant in preparation of its two noise impact assessments it filed with the application. Fourth, the Commission summarizes the parties' views on whether the applicant's noise impact assessment complies with AUC Rule 012. Fifth, the Commission summarizes the views of the parties about the low frequency noise and infrasound that may be produced by the project. In the last subsection, the Commission provides its findings with respect to the project's compliance with AUC Rule 012 and the project's expected low frequency noise and infrasound.

7.2 Sound and noise

99. Sound is produced by vibrations that travel through the air or another medium. Noise can be defined as the unwanted portion of sound.

100. Sound propagates as a wave. A sound wave has the same physical properties associated with other waves, including an amplitude and a frequency. What a person hears is dependent on the sound pressure level and the frequency of a sound wave.

101. The sound pressure level of a sound wave is a function of the wave's amplitude. The sound pressure level is the intensity of the vibrations of the wave and is measured in

[43] The 2013 field measurement program report was provided with the 2013 NIA. Exhibit 157.12, NIA Appendix E, Golder Associates Report, page 94.

microPascals (μPa). A logarithmic conversion is used to convert μPa to decibels because sound pressure levels extend over a wide range of magnitudes.

102. Frequency is the number of vibrations that occur in one second and is measured in cycles of vibrations per second. The unit of frequency is hertz (Hz). The pitch of a sound is dependent on the frequency.

103. Lower frequency sounds can be characterized as a hum (low pitch), while higher frequency sounds can be characterized as a whine (high pitch). Typically, most people hear sounds at frequencies between 20 Hz to 20,000 Hz; however, there is variation between people in their ability to hear sound. Frequencies below 250 Hz are commonly referred to as low frequency sound. Frequencies below 20 Hz are commonly referred to as infrasound. There is some overlap between these frequency ranges and the cut-offs are not firm. As an example of typical frequencies, normal speech is between the range of 100 Hz and 4,000 Hz.

104. The subjective or perceived loudness of a sound is determined by several factors, including that the human ear is not equally sensitive to all frequencies. The human ear is less sensitive to low and high frequency sounds and more sensitive to mid-frequency sounds. Because of this range of sensitivity of the ear to various frequencies, weighting scales are applied to the measured sound level to more appropriately account for human hearing. Some commonly used scales are linear-weighted, A-weighted and C-weighted.

105. The linear weighted scale (dB (Lin) or dB), is the sound level, in decibels, without any adjustment.

106. The scale commonly used for noise impact assessments is the A-weighted decibel scale (dB(A) or dBA). The A-weighted decibel scale is designed to reflect human hearing by approximating the ear's frequency response. The A-weighted decibel scale gradually reduces the contributions of sound in the lower frequencies below about 800 Hz.

107. On the linear weighted scale, a low frequency sound must have a higher decibel level than a high frequency sound to be perceived as being equally loud to the ear. If a low frequency sound and a high frequency sound are perceived to be equally loud by the ear, each would have the same dBA (A-weighted) value, but the low frequency sound would have a higher dB (linear weighted) value than the high frequency sound.

108. Another common scale is the C-weighted decibel scale (dB(C) or dBC). The C-weighted decibel scale does not follow the same gradual cut-off for low frequencies sounds as the A-weighted decibel scale. The C-weighted decibel scale filters the levels at frequencies below about 30 Hz and above 4,000 Hz. The C-weighted decibel scale is therefore useful for capturing noise with low frequency components.

109. The table below shows typical noise levels of everyday sources in dBA.

Table 1. Typical noise levels[44]

Noise source	dBA
pneumatic chipper at one metre	115
hand-held circular saw at one metre	115
textile room	103
newspaper press	95
power lawn mower at one metre	92
diesel truck 50 km per hour at 20 metres	85
passenger car 60 km per hour at 20 metres	65
conversation at one metre	55
quiet room	40

110. An important parameter for understanding sound is the sound power level. The sound power level is a physical property of a sound source that represents the rate of energy (or power) emitted in the form of sound. This is often measured in watts and converted to a decibel equivalent value. The sound power level of a source is a parameter used for rating and comparing sound sources. Sound power levels for specific equipment, including wind turbines, may be obtained by performing measurements and calculations.

111. A good way to understand the difference between sound pressure levels and sound power levels is to use the example of an electric heater radiating heat into a room. The heater provides heat, which is measured in watts, and is analogous to sound power. The resultant temperature in the room is measured in degrees and is analogous to sound pressure level measured in dBA. As the distance from the heater increases, the temperature decreases in the same way as when the distance from the sound source increases, the sound pressure level decreases. However, like the wattage of the heater, the sound power level of the source does not change.

112. When a sound is measured, the sound pressure level and the frequency distribution are recorded. The measurement can typically be expressed as a broadband sound pressure level, in octave band frequency ranges, or in one-third octave bands frequency ranges. A broadband sound pressure level is the amplitude of all sound at all frequencies and is expressed as single numerical value. The frequency distribution of a broadband sound level can be broken down into specific frequency ranges, defined as octave bands. The one-third octave band provides a finer breakdown of the octave band frequency distribution.

113. A sound measurement can be completed by taking an instantaneous measurement or by taking a series of measurements and averaging them over a set period of time. Some frequently used sound level metrics include:

- L_{eq} which is generally considered an average of a fluctuating sound (or sound pressure) level over a period of time such as a daytime or nighttime period.
- L_{max} which is the maximum sound level over the duration of the measurement period.
- $L_{night,\ outside}$ which is used by the European Commission and the World Health Organization (WHO) and is the sound level over an eight-hour nighttime period outside at the façade of a building.

[44] Canadian Centre for Occupational Health and Safety, Noise - Basic Information, Table 2 Typical Noise Levels, http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html.

7.3 AUC Rule 012: Noise Control

114. AUC Rule 012 applies to noise from the construction and operation of electric and natural gas utility facilities, including wind turbines. AUC Rule 007 requires an applicant to provide a noise impact assessment as part of a new power plant application.

115. AUC Rule 012 is designed to ensure that the noise from a proposed facility, measured cumulatively with noise from other nearby energy-related facilities, will not exceed the AUC's permissible sound levels (PSL). The PSL is the maximum daytime or nighttime sound level, measured at a point 15 metres from a dwelling(s), in the direction of the facility. As mentioned earlier in this decision, for this project, the PSL values determined in accordance with AUC Rule 012 are 50 dBA L_{eq} daytime and 40 dBA L_{eq} nighttime. The daytime period is defined as the hours from 7 a.m. to 10 p.m. and the nighttime period is defined as the hours from 10 p.m. to 7 a.m.

116. The cumulative sound level, which is compared to the PSL for compliance determination, includes the assumed or measured ambient sound level, any existing and approved, but not yet constructed energy-related facilities, and the predicted sound level from the applicant's proposed facility.

117. AUC Rule 012 sets out the requirements for preparing a noise impact assessment. Section 3.2(5) specifies that the following factors must be considered and included in the noise impact assessment report:

- meteorological parameters
- noise source identification
- sound power level and/or sound pressure level spectral data
- type of noise propagation model used
- standards followed
- ground conditions and ground attenuation factor
- terrain parameters
- reflection parameters
- any adjustments made

118. There are a number of sound and noise-related standards that were discussed by the applicant and the interveners in the proceeding, including parts of the IEC 61400 series and ISO 9613-2.[45]

119. The IEC 61400 series is produced by the International Electrotechnical Commission and is titled IEC 61400 – Wind Turbines. The IEC 61400 standard addresses most aspects of a wind turbine's life, from site conditions before construction to turbine components being tested, assembled and operated. In this proceeding, IEC 61400-11[46] and IEC 61400-14[47] were discussed. IEC 61400-11 specifies how the sound power levels are to be calculated for an individual wind turbine. IEC 61400-14 outlines the methodology used to determine the sound power level of a wind turbine when more than one turbine is evaluated.

[45] ISO 9613-2, Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.
[46] IEC 61400-11, Wind Turbines – Part 11: Acoustic noise measurement techniques.
[47] IEC 61400-14, Wind Turbines – Part 14: Declaration of apparent sound power level and tonality values.

120. ISO 9613-2 is a standard produced by the International Organization for Standardization, that outlines a methodology used to determine the attenuation of sound propagation outdoors using factors such as ground effects, temperature, humidity and foliage.

121. AUC Rule 012 requires the use of computer models that meet accepted protocols and international standards for predicting a project's cumulative sound level. AUC Rule 012 identifies the CONCAWE protocol[48] and ISO 9613 standard as accepted protocols and international standards.

122. AUC Rule 012 defines the low frequency noise range to be from 20 Hz to 250 Hz. If a project's dBC sound pressure value is available, the Commission requires the applicant to calculate the dBC sound pressure value minus the dBA sound pressure value to identify the potential for a low frequency noise condition. In accordance with AUC Rule 012, a low frequency noise condition may exist when the dBC minus dBA value is equal to or greater than 20 dB and a clear tonal component exists between the frequencies 20 to 250 Hz.

7.4 Wind turbine sound and noise

123. Operating wind turbines create noise. In January 2012, an independent panel of seven experts prepared a report on wind turbine health impacts on behalf of the Massachusetts Department of Public Health and Environmental Protection. In that report, the independent panel described noise produced by wind turbines as follows:

> A turbine produces noise mechanically and aerodynamically. Mechanical noise sources include the gearbox, generator, yaw drives, cooling fans, and auxiliary equipment such as hydraulics. Because the emitted sound is associated with the rotation of mechanical and electrical equipment, it is often tonal. […]
>
> The transmission of mechanical noise can be either airborne or structure-borne as the associated vibrations can be transmitted into the hub and tower and then radiated into the surrounding space.
>
> …
>
> Aerodynamic sound is generated due to complex fluid-structure interactions occurring on the blades. […]
>
> Of these mechanisms, the most persistent and often strongest source of aerodynamic sound from modern wind turbines is the trailing edge noise. It is also the amplitude modulation of this noise source due to the presence of atmospheric effects and directional propagation effects that result in the whooshing or beating sound often reported (van den Berg, 2004). As a turbine blade rotates through a changing wind stream, the aerodynamics change, leading to differences in the boundary layer and thus to differences in the trailing edge noise (Oerlemans, 2009). Also, the direction in which the blade is pointing changes as it rotates, leading to differences in the directivity of the noise from the trailing edge. This noise source leads to what some people call the "whooshing" sound.[49]

[48] CONCAWE stands for CONservation of Clean Air and Water in Europe.

[49] Exhibit 110.20, Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, Wind Turbine Health Impact Study: Report of Independent Expert Panel, January 2012, pages 6-8.

7.5 Views of the applicant

124. The project was first advanced by Windlab. Windlab retained the services of Golder Associates Ltd. (Golder) to conduct field noise measurements of third-party facilities in 2010. The applicant acquired the project from Windlab in late 2011.

125. The applicant retained Golder to prepare its initial noise impact assessment using the 2010 field noise measurements. The applicant submitted its initial noise impact assessment to the Commission with the project application on June 18, 2012 (the 2012 NIA).

126. On March 13, 2013, the applicant advised the Commission that it had received updated technical noise specifications from GE, the manufacturer of the project's turbines. The applicant stated that because of this new information it was necessary to file an updated noise impact assessment and other consequential amendments to their application.[50]

127. On April 12, 2013, the applicant submitted a revised application, including an updated noise impact assessment (the 2013 NIA) that had been prepared by Aercoustics Engineering Ltd. (Aercoustics).

128. The applicant had Mr. Danny Da Silva, a professional engineer with expertise in noise acoustics and vibrations with Golder, testify at the hearing regarding the noise documents prepared by Golder. Mr. Payam Ashtiani, from Aercoustics, is a professional engineer with expertise in noise acoustics and vibrations who also testified on behalf of the applicant regarding the 2013 NIA.

7.5.1 Sound source identification

129. The 2013 NIA identified the project's forty-six (46) GE model 2.5-103 wind turbines with hub heights of 85 metres and a rotor diameter of 103 metres. The sound data for the proposed wind turbines were provided by GE.[51] The 2013 NIA also included the project substation, which would consist of two transformer units, each rated at 50 megavolt-ampere (MVA). The sound data for the proposed transformer units were also provided by GE.[52]

130. The 2013 NIA identified and included the sound level contribution of 438 third-party facilities. The sound level contribution of 423 of the third-party facilities in the project area were provided by Golder following field noise measurements in March 2013.[53] For the remaining 15 facilities, the 2013 NIA used Golder's 2010 field noise measurements. The 15 facilities were:

- Three batteries (Killarney north, Killarney south and Hayter south) operated by Harvest Operations Corp. (Harvest).
- Nine progressive cavity pumps.
- A battery and a maintenance shack operated by Husky Energy Inc. (Husky).
- The Hayter 277S substation operated by AltaLink Management Ltd.

[50] Exhibit 150.01, Letter re Revised Noise Impact Assessment.
[51] Exhibit 157.12, NIA Appendix B, Manufacturers Data, page 32.
[52] Exhibit 157.12, NIA Appendix B, Manufacturers Data, page 37.
[53] The 2013 field measurement program report was provided with the 2013 NIA. Exhibit 157.12, NIA Appendix E, Golder Associates Report, page 94.

131. Golder explained that it used the 2010 field noise measurements for the Killarney north and south batteries because they were slightly higher than the 2013 field measurements for those facilities and thus were more conservative.[54] Golder stated that it used the 2010 field noise measurement values for the Harvest Hayter South Battery and the nine progressive cavity pumps because these sources could not be re-measured in 2013 due to snow-related accessibility restrictions.[55] Golder stated that it had to use the 2010 field noise measurements for the Husky battery and maintenance shack because Husky denied Golder's staff access to the site. Finally, Golder stated that it used the 2010 field noise measurements for the AltaLink substation because it was comfortable with the 2010 data and it did not find it necessary to re-measure the same source again in 2013.[56]

132. One issue raised with respect to the 2010 field noise measurements was the calibration of the sound level meter used by Golder. Specifically, Golder's calibrator had not been recalibrated by the manufacture within a year prior to its use for the 2010 field noise measurements, as required by Section 4.7.4 (1) of AUC Rule 012. The applicant argued that any concerns regarding the accuracy of the instrumentation used to gather the 2010 field noise measurements data was unfounded because the instrument was tested and shown to be in calibration in the 2013 field noise measurements.[57] The applicant also stressed that a total of 3 per cent of the measurements used in the 2013 NIA were from the 2010 field noise measurements.[58]

7.5.2 2013 NIA results and noise control measures

133. The applicant stated that:

> [t]he results of the 2013 NIA indicate that the project will comply with the permissible sound level as specified in [AUC Rule 012], which sets a cumulative maximum nighttime noise level at dwellings in the vicinity of the project at 40 dBA. The cumulative level of 40 dBA includes the ambient level and third party facilities, as well as the contribution from the project.[59]

134. The 2013 NIA noise study area was defined as the area within two kilometres of any project component, including wind turbines and the project substation. The 2013 NIA identified thirty-seven receptor locations within its noise study area. In response to AUC information requests, the applicant considered the cumulative noise impact at five additional receptor locations located beyond two kilometres from a project component. These five receptor locations were receptors R008, R009, R010, R011 and R012, and were included in the 2012 NIA.

135. The applicant stated that at receptors R010, R011 and R012, the predicted cumulative sound level of the project complies with the nighttime PSL.

136. At receptors R008 and R009, the applicant stated the predicted pre-project cumulative noise from the existing third-party facilities and the assumed ambient sound level, would be above the nighttime permissible sound level. At receptor R008 where the predicted sound level increase would be by 0.1 dBA to a predicted cumulative sound level of 41.2 dBA L_{eq} nighttime, the nearest wind turbine is located 2,500 metres away. At receptor R009, where the predicted

[54] Exhibit 157.12, NIA Appendix, PDF page 104.
[55] Exhibit 157.12, NIA Appendix, PDF page 105.
[56] Transcript, Volume 4, page 1017, line 13-19.
[57] Transcript, Volume 10, page 2213, lines 2-6.
[58] Transcript, Volume 10, page 2212, lines 19-24.
[59] Transcript, Volume 9, Page 1870, line 8 to 14.

sound level increase would be by 0.3 dBA to a predicted cumulative sound level of 40.6 dBA L_{eq} nighttime, the nearest wind turbine is located 2,752 metres away. The applicant maintained that the increases in the cumulative sound level at these receptors would be insignificant.

137. The applicant stated that to achieve a cumulative sound level impact below the permissible sound level, noise attenuation measures would be required for several third-party facility noise sources and for some of the proposed wind turbines.

138. The applicant proposed to construct eight acoustic barriers near third-party facilities to attenuate the noise from those facilities. The barriers would be constructed at a distance of no further than 10 metres away, or as practically feasible, from the edge of the third-party facility noise sources. The applicant stated that the operators of these facilities raised no concerns regarding the placement of seven of the barriers. For one of the barriers, the applicant was working with the operator of the facility regarding the possibility of installing temporary or movable barriers.[60] The applicant confirmed that the proposed barriers would be maintained to provided adequate noise attenuation on an ongoing basis.[61]

139. The applicant stated that each of the forty-six wind turbines would operate at their maximum sound power level of 104 dBA during the daytime period. The applicant maintained that the project would comply with the daytime permissible sound level of 50 dBA L_{eq}.

140. The applicant proposed to operate some wind turbines in Noise Reduced Operation (NRO) modes during the nighttime period. Specifically, the applicant proposed that during the nighttime period turbine T37 would operate in NRO 102 mode, with a maximum sound power level of 102 dBA and turbines T08, T09, T10, T11, T14, T23 and T26 would each operate in NRO 100 mode, with a maximum sound power level of 100 dBA per turbine. The applicant also stated that it would not operate turbine T12 during the nighttime period.

141. Mr. Ashtiani stated that barriers for the third-party facilities and the NRO operating modes for the wind turbines as proposed in the 2013 NIA were both viable and proven noise mitigation measures. Mr. Ashtiani further stated that in the event that post-construction monitoring reveals the need for further noise mitigation measures, additional mitigation measures could include: NRO modes on more turbines, additional acoustic barriers for third-party facility noise sources, source-based noise mitigation for third-party facility noise sources (such as acoustic enclosures, equipment replacement and silenced building openings), and condition-based curtailment of turbine operations.[62]

142. The applicant committed to conducting post-construction noise monitoring at four residences to ensure compliance with AUC Rule 012. These receptors were identified as receptors R004, R062, R064 and R065.[63] The applicant also committed to conduct pre-construction noise monitoring at receptor R086.[64]

[60] Transcript, Volume 4, page 1057.
[61] Exhibit 180.02, 1646658 Alberta Ltd. Information Request Responses to the Alberta Utilities Commission, AUC-1646658 AB-41, PDF page 10.
[62] Exhibit 202.22, Aercoustics Engineering Limited Reply Evidence, page 14.
[63] Exhibit 157.05, Environmental Noise Impact Assessment, Section 7, Conclusion, Exhibit 157.13, IR AUC-1646658 AB-31 and Transcript, Volume 1, pages 34–35, lines 24-1.
[64] Transcript, Volume 4, pages 1092-1093, lines 22-7.

7.5.3 Noise modelling and standards

143. The applicant stated the noise modelling for the 2013 NIA was performed using the CadnaA model, version 3 environmental noise prediction software, which uses the methodology of ISO 9613-2.[65] The KLG took issue with GE's implementation of the IEC 61400 series when determining the sound power level of the wind turbines. The KLG also questioned the applicant's use of ISO 9613-2 in its CadnaA model.

144. The applicant explained that GE provided the wind turbine sound emission data used in the 2013 NIA. The applicant explained that this data was measured using the IEC 61400-11 standard, which defines the method for measuring, analysing and reporting acoustic noise from wind turbines. With respect to the use of IEC 61400-11, the applicant stated that there are no weather condition restrictions on the acoustic noise testing of wind turbines outside of those for which the instrumentation is valid. It further stated that measurements can be carried out in accordance with IEC 61400-11 in high or low shear conditions, during the day or night.[66]

145. Mr. Ashtiani testified that the expected wind turbine sound power levels, based on measurements taken in accordance with IEC 61400-11, are consistently confirmed by turbine manufacturers during field measurements and compliance testing. Mr. Ashtiani further testified that "… these noise levels are guaranteed by the manufacturer, and so we don't expect them to be outside of those guarantees."[67]

146. When questioned on how the guarantee of the wind turbine noise levels would work, Mr. Da Silva stated:

> From my experience, measurements are performed on on-site delivered turbines that are suspected of having noise emissions above those that have been warranted, and those would have to be done by parties that have been agreed to by both sides including GE and the developer in question. If the measurements are outside of the levels, then I believe there's a contractual obligation to meet those levels. The way they could do that is either by, first of all, ensuring that the units are calibrated and operating as intended; and, secondly, there are mitigation measures they could enable which could result in reduced power output and reduced noise emission. But that depends on a case-by-case basis. I've seen both conditions on it.[68]

147. In response to the KLG's concerns that the wind turbines would generate higher sound levels when the blades are not at an optimal angle, Mr. Ashtiani stated that the turbines for the project are variable pitch, variable RPM turbines that can maintain optimal angle of attack throughout the wind speed range of operation and this should not be an issue.

148. The applicant also commented on the KLG concerns with the CadnaA model it used in the 2013 NIA. The applicant stated that the noise prediction calculations for the 2013 NIA were based on the established prediction methods in accordance with ISO 9613-2. Mr. Ashtiani stated that the ISO 9613-2 modelling standard has been accepted internationally for modelling various noise sources; including manufacturing facilities, power plants, processing plants, mining operations, road and rail traffic, and wind turbine noise.

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65 Exhibit 157.05, Environmental Noise Impact Assessment, Section 6 Noise Assessment Results, page 14.
66 Exhibit 202.22, Aercoustics Engineering Ltd. Reply Evidence in support of AUC Hearing, page 5.
67 Transcript, Volume 4, page 1042, lines 15-17.
68 Transcript, Volume 4, page 1136, lines 2-16.

149. Mr. Ashtiani stated that while the ISO 9613-2 modelling standard requires analysis to be carried out between the frequencies of 63 Hz to 8,000 Hz, Aercoustics extended the analysis in the 2013 NIA to include the frequency of 31.5 Hz for the wind turbines. He stated that the 31.5 Hz frequency band was included for the sound emissions of all sound sources in the 2013 NIA to predict the sound levels at all receptor locations in the study and to assess the potential for a low frequency noise condition as per AUC Rule 012.

150. Mr Ashtiani stated that the 2013 NIA incorporated a number of conservative assumptions. First, the 2013 NIA used a ground attenuation factor (G) to be G = 0.5. Mr. Ashtiani explained that rural farmland, such as that in the project area, is generally considered fully absorptive and modelled at G = 1. Mr Ashtiani submitted that the predicted levels for the wind project resulted in a higher predicted noise contribution at the receptor locations by using G = 0.5, compared to G = 1.

151. Mr. Ashtiani stated that another conservative assumption in the 2013 NIA was that the model assumed that all of the wind turbines would be emitting their maximum noise emissions with the wind blowing from each noise source towards the receptor locations. Mr. Ashtiani stated this was conservative because the wind typically blows from only one direction to a receptor location at a time during actual operations. Mr. Ashtiani explained that this was expected to result in higher predicted noise levels than are likely to be produced by the operating project.

152. The applicant identified two types of uncertainty associated with predicted noise levels in the 2013 NIA: the uncertainty incorporated into the CadnaA model, which uses the methodology of the ISO 9613-2, and the uncertainty incorporated into GE's sound emission data used in the model.

153. Mr. Ashtiani noted that the ISO 9613-2 model prediction accuracy is plus or minus three dB for a source to receiver distance of up to 1,000 metres and to a source height up to 30 metres. Mr. Ashtiani stated that the ISO 9613-2 standard does not provide uncertainty values for source to receiver distances greater than 1,000 metres or source heights above 30 metres. However, Mr. Ashtiani stated that the standard does not discount the validity of its use beyond the distance of 1,000 metres and heights above 30 metres and explained that many attenuation factors are provided in ISO 9613-2, with ranges outside the 1,000 metre range. He asserted that ISO 9613-2 is commonly used and has been verified.[69] Mr. Ashtiani stated:

> … My firm and I have done over 6,000 hours of measurements of noise from wind farms in Ontario and it is our observation that modelling protocols that use 9613-2, provided they're done correctly, comply with measurements in the field, generally speaking.[70]

154. Regarding the uncertainty in GE's sound emission data, Mr. Ashtiani stated that the sound power levels used in the noise model had an uncertainty of two dB (95 per cent confidence interval).

155. Mr. Ashtiani reported that the uncertainty of the CadnaA acoustic model combined with the uncertainty of the sound power level for the project wind turbines resulted in an overall uncertainty level of plus or minus 3.6 dB. Mr. Ashtiani stated that to obtain this value, he

[69] Transcript, Volume 4, page 1060-1068, lines 19-23.
[70] Transcript, Volume 4, page 1067-1068, lines 22-1.

calculated the combined uncertainty by taking the square root of the sum of the squares, because these two uncertainty components are independent.[71]

156. Mr. Ashtiani maintained that the addition of appropriate uncertainty values to a modelling prediction would not be a suitable way to consider predicted compliance with applicable limits. Mr. Ashtiani stated that the comparison of noise level in the 2013 NIA to the permissible sound levels was calculated correctly.

157. The applicant also addressed a concern raised by Mr. James regarding the declared sound power level. Mr. James stated that the uncertainty of the measured apparent sound power level should be used in sound models, with the uncertainty added to the emission levels. Mr. Ashtiani stated that this presumption is inappropriate because IEC 61400-11 does not indicate how the declared sound power level should be used in sound models. He explained that IEC 61400-11 simply standardizes the reporting of uncertainty levels in the sound power level.[72]

7.5.4 Low frequency noise and infrasound

158. In the 2013 NIA, the applicant evaluated the potential for a low frequency noise contribution from the project. The applicant included octave band data between 31.5 Hz and 8,000 Hz in the 2013 NIA for its assessment of low frequency noise, including dBC minus dBA calculations. Further, the applicant reviewed the one-third octave band data provided by GE for tonal components. The applicant also retained Dr. Leventhall, an expert in the field of noise, acoustics, vibrations, infrasound and human response to noise to provide evidence on this matter.

159. Dr. Leventhall submitted that the dBC minus dBA calculation and 20-dB threshold in AUC Rule 012 would generally identify the potential for low frequency noise impacts from a project.[73] The dBC minus dBA calculations in the 2013 NIA showed the majority of receptors contained values above the 20 dB threshold.

160. Aercoustics and Dr. Leventhall noted that upon review of surveys conducted by Golder, the existing dBC minus dBA calculations would already exceed the 20-dB threshold due to presently occurring sound at some locations, without taking into account the impact of the project.[74]

161. Aercoustics stated that the one-third octave band data provided by GE showed that there are no tonal components between 20 Hz and 250 Hz.[75] Dr. Leventhall also commented on the expected tonal component of the project. Dr. Leventhall stated that "[t]he only tones which are produced by wind turbines are from the decomposition of a small blade passing pulse, and these tones there ... are far below the hearing threshold. They're not audible."[76]

162. Aercoustics stated that it did not expect the project to result in a low frequency noise impact in comparison to existing conditions.[77] The applicant concluded that in considering GE's data in conjunction with the existing predicted dBC minus dBA values, there was no indication that operation of the project would result in a low frequency noise condition at the receptors.

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71 Exhibit 202.22, Aercoustics Engineering Ltd. Reply Evidence in support of AUC Hearing, page 13.
72 Exhibit 202.22, Aercoustics Engineering Ltd. Reply Evidence in support of AUC Hearing, page 8.
73 Transcript, Volume 4, page 1148, line 2-11.
74 Transcript, Volume 4, page 1148, line 2-11.
75 Exhibit 157.05, Environmental Noise Impact Assessment, page 16.
76 Transcript, Volume 4, pages 1150-1151, lines 24-2.
77 Exhibit 157.05, Environmental Noise Impact Assessment, page 16.

163. In an article written by Dr. Leventhall, he outlined that there are many natural sources of infrasound, including volcanic eruptions, ocean waves, wind, meteors and any effect which leads to slow oscillations of the air. He stated that man-made sources of infrasound include large combustion processes, slow speed fans and machinery, and explosions. He observed that much of the natural infrasound is lower than one Hz and below the hearing threshold.[78]

164. Dr. Leventhall expressed that there are widespread misunderstandings about infrasound and low frequency noise in relation to wind turbines. He explained that some of the misunderstandings may, in part, arise from concentration on frequencies, while ignoring the overriding importance of levels.[79]

165. Dr. Leventhall recognized that wind farms produce infrasound down to very low frequencies. However, Dr. Leventhall stated:

> Wind turbines do not normally produce audible tones at infrasonic or low frequencies. Their low frequency noise does not exceed the hearing threshold at normal separation distances until frequencies greater than 40 – 50Hz are reached. Their noise is continuous and falling at 4dB to 6dB per octave, which is recognised in the air conditioning industry as a fairly bland and unobtrusive noise.[80]

166. Dr. Leventhall explained that there have been a number of measurements of infrasound from wind turbines.[81] Dr. Leventhall stated that measurements at proposed wind farm sites have shown that one-third octave background low frequency sound levels increase when hub height wind speeds are at the turbine design value. Dr. Leventhall stated that studies have shown that at distances of 1.8 kilometres and 2.7 kilometres from the Macarthur wind farm in Australia, which has 145 turbines, there is no difference in infrasound levels from before construction to when the wind farm is operating.[82]

167. The applicant stated that there is currently no evidence to suggest that the sound coming from wind turbines is fundamentally or physically different from other sources of sound. The applicant referenced a peer-reviewed study conducted by Turnbull et al. in 2012,[83] which measured levels of infrasound at different locations in Australia including at two wind farms,[84] near a beach, a coastal cliff, a city and a gas-fired power station. The Turnbull et al. study measured as close as 85 metres and 100 metres from the base of a wind turbine at each of the respective wind farms. The study concluded "… that wind turbines generate infrasound and that close to wind turbines, the level of infrasound is well below the audibility threshold of 85 dB(G)."[85]

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78 Exhibit 110.12, Dr. Geoff Leventhall, Canadian Acoustics Volume 34, No.2 (2006), Infrasound From Wind Turbines – Fact, Fiction or Deception, page 30.

79 Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 6, paragraph 21.

80 Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 5, paragraph 23.

81 Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 17, paragraph 68.

82 Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 7, paragraph 29.

83 Exhibit 110.13, Measurement and Level of Infrasound from Wind Farms and Other Sources, Chris Turnbull, Jason Turner and Daniel Walsh, Acoustics Australia 40(1), page 45-49.

84 The wind farms measured were Clements Gap Wind Farm which has 27, 2.1-MW, Suzlon S88 wind turbines and Cape Bridgewater Wind Farm which has 29, 2.0-MW, REpower MM82 wind turbines.

85 Exhibit 110.13, Measurement and Level of Infrasound from Wind Farms and Other Sources, Chris Turnbull, Jason Turner and Daniel Walsh, Acoustics Australia 40(1), page 47.

168. The applicant summarized the Turnbull et al. in 2012 study as follows:

> The authors stated that "Infrasound is generated by a range of natural sources, including waves on the coastline, waterfalls and wind. It is also generated by a wide range of engineered sources such as industrial processes, vehicles, air conditioning and wind farms." Based on their findings Turnbull et al. (2012) concluded that "Infrasound is prevalent in urban and coastal environments at similar levels to the level of infrasound measured close to a wind turbine."[86]

169. The applicant also referenced a paper published in 2011 by O'Neal et al. titled *Low frequency noise and infrasound from wind turbines*.[87] The study measured low frequency sound and infrasound levels of two types of wind turbines at the Horse Hollow Wind Farm in Texas.[88] The study included field measurements of wind turbine noise levels outside and inside of four houses.

170. O'Neal et al. concluded that in both cases, the results showed that infrasound from the two types of wind turbines measured were inaudible to even the most sensitive people at a distance of 305 metres from the wind turbines, both indoors and outdoors and that the infrasound produced was more than 20 dB below the median thresholds of hearing. It also concluded that the wind farms might have slightly audible low frequency noise at frequencies at 50 Hz and above.[89]

171. O'Neal et al. also noted that sound levels from the 2.3-MW and l.5-MW wind turbines under maximum noise conditions, at a distance 305 metres, meet the low frequency and infrasound standards and criteria published by several independent agencies and organizations including:

- ANSI/ASA S12.2 indoor levels for low frequency sound for bedrooms, classrooms and hospitals.
- ANSI/ASA S12.2 indoor levels for moderately perceptible vibrations in light-weight walls and ceilings.
- ANSI/ASA S12.2 criteria for balanced spectrum from low frequency sounds.
- ANSI S 12.9/Part 4 thresholds for annoyance from low frequency sound and beginning of rattles.
- United Kingdom Department for Environment Food & Rural Affairs disturbance based guidelines for low frequency sound.
- Japan Ministry of Environment Guidance for evaluating complaints of rattling from low frequency noise.

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[86] Exhibit. 110.29, 1646658 Alberta Ltd. Information Request Responses to KLG IR Round 3, page 82.

[87] Exhibit 110.14, Low frequency noise and infrasound from wind turbines, Robert D. O'Neal, Robert D. Hellweg Jr. and Richard M. Lampeter, Engineering Noise Control Journal, March-April, 2011, Volume 59, Number 2, page 135 to 157.

[88] The two wind turbines measured were a 2.3-MW, Siemens SWT-2.3-93 wind turbine and a 1.5-MW, GE 1.5 sle wind turbine.

[89] Exhibit 110.14, Low frequency noise and infrasound from wind turbines, Robert D. O'Neal, Robert D. Hellweg Jr. and Richard M. Lampeter, Engineering Noise Control Journal, March-April, 2011, Volume 59, Number 2, page 135 to 157.

- Japan Ministry of Environment Guidance for evaluating complaints of mental and physical discomfort from low frequency noise.[90]

172. Dr. Leventhall stated that low frequency noise from wind turbines is normally not a problem, except under conditions of unusually turbulent inflow air.[91] In his report, he concluded that the low frequency noise from wind turbines at frequencies above about 40 Hz may exceed the hearing threshold and become audible outside a residence for those closest to the wind turbine. However, Dr. Leventhall stated that audibility inside or outside of a residence is not necessarily a problem.[92] Dr. Leventhall further concluded that infrasound from wind turbines is below the audible threshold.[93]

173. In the 2013 NIA, Aercoustics stated:

> Measurements at 200 metres from typical wind turbine units have shown that the infrasound levels are well below the level of perceptibility. The nearest receptor (R004) for this project is 698 metres away from the nearest turbine, thus infrasound levels are expected to be inaudible.[94]

174. The applicant argued that infrasound generated by wind turbines noise has consistently been measured to be below the threshold of perception at the distances proposed for the project. It further argued that low frequency noise caused by wind turbines does not exceed the hearing threshold at normal separation distances until frequencies are greater than 40, 50 or 60 Hz, depending on level, are reached.[95]

7.6 Views of the interveners

175. The KLG retained FDI Acoustics Inc. (FDI Acoustics) to review of the 2012 NIA and the 2013 NIA, and related noise documents for the project. Mr. Farquharson, an expert in the field of noise, noise impacts and noise impact assessments, prepared the FDI Acoustics reports for the KLG in this proceeding and testified before the Commission.

176. The KLG also retained Mr. James, the owner and principal consultant of E-Coustic Solutions. Mr. James is an acoustical engineer and acoustician with expertise in the field of sound including noise, low frequency noise, sounds emitted from industrial wind turbines and human response to noise. Mr. James was also a founder and board member of the Society for Wind Vigilance. Mr. James has previously testified for wind project opponents in other jurisdictions.

7.6.1 Sound source identification

177. Mr. Farquharson expressed concern about Aercoustics decision to use Golder's 2010 field noise measurements for 15 of the third-party facilities in the 2013 NIA. His concerns about the 2010 field noise measurements included the measurement techniques, technician training,

[90] Exhibit 110.14, Low frequency noise and infrasound from wind turbines, Robert D. O'Neal, Robert D. Hellweg Jr. and Richard M. Lampeter, Engineering Noise Control Journal, March-April, 2011, Volume 59, Number 2, pages 154-155.
[91] Transcript, Volume 2, page 254, lines 5-9.
[92] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 26, paragraph 97.
[93] Transcript, Volume 2, page 253, lines 23-25.
[94] Exhibit 157.05, Environmental Noise Impact Assessment, page 10.
[95] Transcript, Volume 8, page 1876, lines 16-19 and Exhibit 110.12, Infrasound from Wind Turbines – Fact, Fiction Or Deception, Geoff Leventhall, page 34.

technician experience, instrumentation, third-party equipment operating conditions and the meteorological conditions under which the measurements were completed.[96]

178. Mr. Farquharson stated that the field notes regarding measurement positions of the third-party facilities in the 2010 field noise measurements were confusing and it appeared that no proper distance measuring devices were employed. Mr. Farquharson indicated that facility operational information was also lacking in the information on the sheets. Mr. Farquharson also stated that the 2010 field noise measurements did not adhere to good measurement practices, and emphasized that Golder's field calibrator was beyond the required calibration date as specified by AUC Rule 012.[97]

179. Mr. Farquharson concluded that, given the concerns identified, the sound pressure level data from the 2010 field noise measurements should be disregarded and not relied upon at all.[98] He also submitted that this shortcoming casts doubt on the validity of the 2013 NIA.

7.6.2 2013 NIA results and noise control measures

180. Mr. Farquharson stated that the 2013 NIA indicated that the nighttime cumulative sound levels for receptors R008 and R009 would exceed the nighttime PSL of AUC Rule 012.[99] Mr. Farquharson stated that the addition from the project at receptors R008 and R009 would be minor and he doubted that the project would be discernible at these receptors. However, he added that someone at receptors R008 and R009 may hear the characteristic sounds associated with a wind turbine.[100] Mr. James agreed with Mr. Farquharson and stated that he would not expect the project contribution to have any practical impact or effect at those two receptors from an audible noise perspective.[101]

181. Mr. Farquharson noted that, to comply with AUC Rule 012, the project would require the implementation of noise attenuation barriers and the use of NRO modes for some turbines. Mr. Farquharson testified there is a lack of details regarding placement and design of the barriers.[102] He stated that barrier design and performance is dependent on the location of the barrier and how it is constructed. Mr. Farquharson observed that no firm modelling was presented to reflect actual barrier placement and that this placed doubt on the mitigation. Mr. Farquharson concluded that the barrier mitigation being proposed by the applicant was impractical and brings into doubt the applicant's entire modelling exercise and predicted compliance with the PSL.[103]

182. Mr. James also expressed concerns with respect to the applicant's use of the turbine NRO modes during nighttime. He stated that using NRO modes for mitigation is very limited because NRO modes can only reduce the sounds emitted by each wind turbine, at most, by about three dBA.[104] Mr. James submitted that the only mitigation method that makes sense for the project is to ensure the turbines are properly located in the first place.[105] Mr. James stated that NRO modes

96 Exhibit 185.02, Mr. Farquharson's Updated Expert Report, page 3.
97 Exhibit 295.01, James Farquharson Opening Statement, page 1.
98 Exhibit 295.01, James Farquharson Opening Statement, page 1.
99 Exhibit 185.02, Mr. Farquharson's Updated Expert Report, page 4.
100 Transcript, Volume 7, pages 1637-1638, lines 13-2.
101 Transcript, Volume 8, page 1797, lines 11-14.
102 Transcript, Volume 7, page 1581.
103 Transcript, Volume 9, page 1967, lines 10-13.
104 Exhibit 140.02, Mr. James expert report, page 13.
105 Exhibit 140.02, Mr. James expert report, page 13.

are normally reserved for post-construction mitigation. He submitted that if NRO modes are relied upon for mitigation for normal operation, there would remain no reasonable mitigation methods to accommodate post-construction findings.[106]

183. When questioned about using NRO modes for nine turbines during the nighttime period to ensure compliance, Mr. Farquharson stated that this may be feasible with the technology today. He further stated that his main concern was ensuring implementation of the NRO modes for the turbines identified by the applicant. Mr. Farquharson suggested that this could be a condition of the licence.[107]

7.6.3 Noise modelling and standards

184. Mr. James outlined a number of concerns with the noise modelling and standards used by the applicant in the 2012 NIA and 2013 NIA. Mr. James took issue with the confidence limits presented by the applicant, how the applicant's model inputs were determined and the applicant's assumptions about atmospheric conditions. Mr. James stated the project would exceed the PSL at some residences under nighttime conditions due to the limitations of the noise modelling and standards used by the applicant, namely the ISO 9613-2 standard and the IEC 61400 standard.

185. Mr. James took issue with the 2013 NIA's confidence limits for the predicted sound pressure levels near the proposed wind turbines. Mr. James disagreed with the applicant's use of ISO 9613-2, used by the CadnaA model to predict the sound levels at the receptor locations in the study area. Mr. James submitted that the 2013 NIA improperly used a plus or minus three dB tolerance because it cannot apply to situations that are not within the ISO 9613-2's assumptions.

186. Mr. James pointed out that the ISO 9613-2 standard does not provide uncertainty values for source to receiver distances greater than 1,000 metres or source heights above 30 metres. Mr. James stated that the combination of the elevated height of the noise source (i.e. 85 metres) and sound propagation distances beyond 1,000 metres would put the applicant's model outside of the valid range for use of the ISO 9613-2 standard. He therefore argued that the applicant's accuracy of plus or minus three dB would no longer be valid.[108]

187. Mr. James also took issue with the how the IEC 61400-11 and IEC 61400-14 standards were used by GE to calculate the sound power levels of turbines and, in turn, how those values were used by the applicant. He claimed that the mean apparent sound power level of 104 dBA for the project's wind turbines operating in NRO mode 104 was not the proper value to input into the CadnaA model. He stated that to convert the mean apparent sound power level of 104 dBA to apparent sound power level, a correction of approximately two dB must be added.[109]

188. Mr. James argued the applicant improperly calculated the uncertainty associated with its noise predictions. He submitted that the ISO 9613-2 uncertainties should be added to the IEC 61400 uncertainties to properly calculate the uncertainty of the predictions. Mr. James stated that the confidence limits are independent and the sum should result in an uncertainty of plus or minus five dB.[110] Mr. James stated that this would result in the sound power for the wind turbines

[106] Exhibit 188.02, Rick James Updated Expert Report, page 5.
[107] Transcript, Volume 7, pages 1638-1639, lines 8-10.
[108] Exhibit 188.02, Rick James Updated Expert Report, page 2.
[109] Exhibit 188.02, Rick James Updated Expert Report, page 2.
[110] Mr. James explained that if the uncertainty of the ISO 9613 standard of plus or minus three dB was assumed to be valid and if the IEC 61400 sound power level of 2 dB was also assumed to be necessary, the sound power in the applicant's CadnaA model would add to be an uncertainty of plus or minus five dB.

in NRO 104 mode to increase by five dBA to 109 dBA, with similar adjustments made to other NRO modes.[111] Mr. James concluded that the applicant's use of 3.6 dB rather than five dB would under-predict sound pressure levels in the 2013 NIA by 1.4 dB.

189. Mr. James also contested the applicant's chosen ground attenuation factor. He stated that applicant's use of ground factor of G = 0.5 rather than G = 0 had the effect of reducing the sound pressure levels at most receptor sites by about one dB. Mr. James stated that it would have been more conservative to use a ground attenuation factor of G = 0.

190. Mr. James stated that when adding the one dB from using ground attenuation factor G = 0 with the 1.4 dB error due to improper calculation of combined uncertainties, there would be a total error of almost 2.5 dB in the 2013 NIA model.[112]

191. Mr. James also expressed concerns with the effects of meteorological conditions on noise produced by a wind turbine. He had concerns that the wind shear coefficient used for determining sound power levels in the 2013 NIA would cause the model to under-predict the results. He argued that the measurements for the determined sound power levels were conducted during daytime weather conditions with low in-flow wind turbulence and a smooth wind shear profile coefficient. Mr. James stated that this sound emission value would represent daytime weather conditions and would not consider the higher wind shear and turbulence that occurred during nighttime operation. He stated that higher wind shear and turbulence would result in increased sound power emissions, and therefore, the project would not meet the nighttime PSL at some residences by five dBA or more, independent of his other modelling uncertainty concerns.[113]

192. Mr. Farquharson also raised issues in regard to noise modelling and the limitations of the applicant's model because it used the ISO standard 9613-2. He noted that the ISO 9613-2 standard does not have a specific calculation method for the 31.5 Hertz band.[114] When asked if the CadnaA model used in the 2013 NIA was an acceptable model, Mr. Farquharson responded that the CadnaA model standard has been accepted for wind farms and "… it allows you to predict the sound in all directions at once and that's important."[115] Mr. Farquharson stated he has used the ISO 9613 standard in two other models, and although he has leaned toward the use of the CONCAWE protocol algorithms, he has used the ISO 9613 method successfully in the past.[116]

193. When questioned about the use of the ISO 9613 standard with source elevations above 30 metres, Mr. Farquharson stated:

> … we've used the model on sources higher than 30 metres on many occasions. There's many, you know, stacks on compressor stations that are of a certain height, or power plants. We've used it on power plant stacks of great elevation. So, yes, it has been used. Is it the best? I would say the jury is still out.[117]

[111] Exhibit 188.02, Rick James Updated Expert Report, page 3.
[112] Exhibit 188.02, Rick James Updated Expert Report, page 3.
[113] Exhibit 188.02, Rick James Updated Expert Report, page 4.
[114] Transcript, Volume 7, pages 1643-1644, lines 24-2.
[115] Transcript, Volume 7, page 1645, lines 5-8.
[116] Transcript, Volume 7, pages 1645-1646, line 5-4.
[117] Transcript, Volume 7, pages 1646-1647, line 12-3.

194. When questioned as to whether Mr. Farquharson had any substantial significant differences between their predicted results and the measured results when they used modelling with source heights above 30 metres, he stated "I would say we've had reasonable correlation."[118]

195. When asked about the validity of the ISO 9613 standard where source to receptor distances were greater than 1,000 metres, Mr. Farquharson stated his office has commonly taken models beyond that limit and confirmed that the models have provided reasonable results.[119]

196. Regarding the appropriate ground attenuation factor, Mr. Farquharson stated that in most cases, the ground attenuation factor of G = 0.5 is a good starting point.[120]

7.6.4 Low frequency noise and infrasound

197. Mr. Farquharson testified that the AUC Rule 012 using test dBC minus dBA value "… gives you the first indication whether or not there's a higher component of low frequency noise in the overall sound scape."[121] He also stated that having a high dBC minus dBA value becomes of concern when the predicted facility contribution value is over 35 decibels.[122]

198. Mr. James stated that the dBC minus dBA test provides a good indication of whether most common community noise sources will produce low frequency noise.[123] However, he stated that the dBC minus dBA test is not sensitive to the extremely low frequency sounds from wind turbines and therefore it is not a useful tool for anticipating this type of problem.[124] To assess low frequency or infrasound from wind turbines, Mr. James recommended the use of dB unweighted minus dBA with the unweighted sounds including the energy down to the blade pass frequencies.[125]

199. Mr. James noted that the applicant's computer model did not evaluate the sound emitted by the wind turbines below the 31.5 Hz octave band and submitted that all acoustic energy below the 31.5 Hz octave band was therefore ignored in the 2013 NIA.[126] Mr. James suggested that a lower frequency than 31.5 Hz would be required to evaluate low frequency noise. Mr. James stated "If you are going to include the real characteristics of wind turbine noise, you need to include the sound pressure levels down to what I am referring to as the blade pass frequency. … So it's going to extend into that deep infrasoundic range."[127]

200. Mr. James stated that wind turbine noise is not addressed when dBA weighting and long averaging times are used due the sound energy content below 31.5 Hz. Mr. James stated the low frequency noise in the 2013 NIA would be subject to highly unbalanced spectrums. He stated that this may be a result of the combination of the other non-wind turbine noise sources and the

[118] Transcript, Volume 7, page 1647, line 4-9.
[119] Transcript, Volume 7, pages 1647-1648, lines 17-6.
[120] Transcript, Volume 7, page 1649, lines 9-23.
[121] Transcript, Volume 7, page 1650, lines 5-22.
[122] Transcript, Volume 7, page 1650, line 24.
[123] Transcript, Volume 8, page 1810, line 21-25.
[124] Exhibit 188.02, Rick James Updated Expert Report, page 4.
[125] Transcript, Volume 8, page 1810-1811, line 24-19.
[126] Exhibit 188.02, Rick James Updated Expert Report, page 4.
[127] Transcript, Volume 8, page 1815, line 5-12.

project. Mr. James explained that this would warrant serious consideration for a lower limit than the 40 dBA criteria.[128]

201. Mr. James noted that the applicant's model predictions in the 2013 NIA showed that almost all receptors have a dBC minus dBA value of 18 dB or greater.[129]

202. Mr. James explained that some complaints in regard to wind turbine noise are believed to be caused by the in-flow turbulence of the air stream entering the path of the blades. He stated that the turbulence would result in dynamically modulated infrasound and low frequency noise concentrated in the frequencies associated with the blade passage frequency and its harmonics. Mr. James stated that these frequencies are emitted in short duration bursts of acoustic energy, with peak sound pressure levels 30 to 40 dB higher than the sound pressure in the valleys between the peaks of the sound waves even though these may not reach the threshold of audibility.[130]

203. Mr. James referenced a recent study, known as the Shirley Wind Farm study.[131] That study described the findings of four acoustical consulting firms from a survey of low frequency noise conducted at residences located near the Shirley Wind Farm in Wisconsin. The Shirley Wind Farm study was prepared by four authors. The first part of the report represented the authors' consensus views. Each author also had their own appendix which reflected their individual views.

204. The Shirley Wind farm consists of eight 2.5-MW wind turbines with a hub height of 85 metres. Measurements were made at three unoccupied residences labelled as R1, R2 and R3. R1 was located 1,006 metres from the nearest wind turbine, R2 was located 390 metres from the nearest turbine and R3 was located 2,164 metres from the nearest wind turbine.

205. The survey revealed that wind turbine noise was present inside and outside R2. Measurements at R1 and R3 did not show the same results and the authors attributed this to the increased distance which reduced periodic turbine noise closer to the background and/or to change in turbine loads over the course of the study.

206. Mr. James referenced the Shirley Wind Farm study measurements and stated that they showed that the wind farm produced low frequency noise and infrasound. Mr. James expressed concerns that lower frequency sounds measured from wind turbines at the Shirley Wind Farm showed high peaks. Mr. James also noted that the outdoors average at one Hz was 60 dB (Lin), however, there were peaks that greatly exceeded the average. Mr. James stated that the average levels are measures of all of the sound energy over the entire measurement period, whereas the peaks are a measure of the sound energy that occur for one percent of the entire measurement period. He stated that when the an average is presented, the numbers seem to be moderate, but "… when you look at the pulsations that are occurring and are at their peaks and you don't use filters, then the levels reveal their true characteristic, which is that the peaks are up in the range of audibility."[132]

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128 Exhibit 188.02, Rick James Updated Expert Report, page 4.
129 Exhibit 188.02, Rick James Updated Expert Report, page 4.
130 Exhibit 140.02, Mr. James Expert Report, page 4.
131 Exhibit 129.09, A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin – December 24, 2012.
132 Transcript, Volume 8, pages 1760-1761, lines 20-1.

207. Mr. James contested the claims that wind turbine infrasound is insignificant because it does not reach the amplitudes needed to exceed the threshold of perception. Mr. James outlined that the threshold of perception is only known for single steady pure tones and explained that wind turbine sounds are more complex.[133] Mr. James stated that the presence of a complex set of tones would put the infrasound sound pressure level peaks within the threshold of perception for some people.[134] Due to complex set of tones, Mr. James contested the threshold of perception levels used in the Turnbull et al. and O'Neal et al. studies.[135]

208. With respect to low frequency noise, Mr. Farquharson stated that "Should the project proceed, the applicant should commit to the completion of a post commissioning sound monitoring survey at residences within the noise study area."[136] He further stated that the applicant should ensure that the instrumentation used for the post commissioning noise monitoring survey is capable of evaluating low frequency noise, including the one-third octave band level and the overall C-weighted level. He further proposed that continuous audio recordings of the monitored period should be completed.[137]

209. When questioned on whether a tone from the wind turbines can be addressed, Mr. Farquharson testified that "[a]t the modelling stage it's difficult to address if you don't have all the adequate input"[138] but it's no problem to address post-construction.[139]

7.7 Commission findings

210. The purpose of a noise impact assessment is to provide reasonable predictions of the project's noise that may be experienced at nearby residences.

7.7.1 Sound source identification

211. The primary issue raised by the interveners about the sound source identification in the 2013 NIA was the inclusion of 2010 field noise measurement data for 15 of the 438 third-party facilities in the project area. The KLG concerns with the 2010 field noise measurements included the measurement techniques, technician training, technician experience, instrumentation (calibration of the calibrator), third-party equipment operating conditions and meteorological conditions when the measurements were completed.

212. The calibrator used to conduct the field calibration of the sound level meter used in the May 2010 field noise measurements was calibrated by the manufacturer on January 16, 2009,[140] and therefore not within the one-year period specified in AUC Rule 012. The Commission finds that the absence of calibration records for the calibrator between one year prior to its use in the 2010 field noise measurements and its use in the 2013 field noise measurements by the applicant to be unacceptable. The Commission is not able to infer that the 2009 and 2013 calibration records show the calibrator was calibrated and the instruments were operating correctly when the 2010 field noise measurements were conducted.

133 Exhibit 140.02, Mr. James Expert Report, page 9.
134 Exhibit 140.02, Mr. James Expert Report, page 9.
135 Exhibit 140.02, Mr. James Expert Report, page 9.
136 Exhibit 185.02, Mr. Farquharson's Updated Expert Report, page 5.
137 Exhibit 185.02, Mr. Farquharson's Updated Expert Report, page 5.
138 Transcript, Volume 7, page 1651, lines 3-5.
139 Transcript, Volume 7, page 1651, lines 6-8.
140 Exhibit 110.22, Certificate of calibration.

213. In its review of the 2010 field noise measurements used in the 2013 NIA, the Commission notes that the 2010 field noise measurements for the Killarney North and South batteries were slightly higher than the 2013 field measurements for those facilities and thus were more conservative.[141] The Commission finds the use of these data values in the 2013 NIA to be acceptable since the results were more conservative than the measurements taken with the properly calibrated calibrator and sound level meter.

214. The Commission does not find the 2010 field noise measurement values for the Harvest Hayter South Battery, the nine progressive cavity pumps,[142] the Husky Battery and maintenance shack and the AltaLink Hayter 227S substation (the outstanding 2010 facilities) used in the 2013 NIA to be acceptable due to the calibrator not being calibrated within the required one-year period.

215. The Commission notes that an acoustical practitioner must not ignore the requirements of AUC Rule 012 to have sound measurement equipment, including the sound level meter and calibrator, calibrated within the time limits specified.

216. With the exception of the outstanding 2010 facilities effected by the calibration issue, the Commission is satisfied that the 2010 field noise measurements were otherwise conducted and recorded in a manner consistent with the requirements of AUC Rule 012.

217. Regarding the remaining 423 third-party facilities evaluated in the 2013 field noise measurements, the Commission finds that the approach taken by the applicant in conducting measurements for the determination of the sound power levels was reasonable.

218. Due to the calibration issue with the 2010 field noise measurement values used in the 2013 NIA, the Commission finds that should it approve the project, it would impose the following condition:

> Within three months subsequent to approval, the applicant must re-measure the outstanding 2010 facilities in the evaluation of their sound power levels. The applicant must then provide the Commission with the updated field noise measurement data including the calculated sound power levels produced by these facilities. The Commission requires a table comparing the 2010 calculated sound power levels with the re-calculated sound power levels. The Commission also requires a summary table comparing the 2013 NIA predicted cumulative sound levels for the project at all receptors with the updated predictions and a written summary of the findings. If there is a material difference between the re-measured data and results and the 2013 NIA, the Commission will determine whether further process is required to consider that information.

7.7.2 The 2013 NIA results and noise control measures

219. The applicant stated the nearest wind turbine to receptor R008 is 2,500 metres away. The applicant predicted that the sound level at receptor R008 would increase by 0.1 dBA to a predicted cumulative sound level of 41.2 dBA L_{eq} nighttime. The applicant stated the nearest wind turbine to receptor R009 is 2,752 metres away. The applicant predicted that the sound level

[141] Exhibit 157.12, NIA Appendix, PDF page 104.
[142] Exhibit 157.12, NIA appendix E: Golder Associates Report: Appendix E, Sound Power levels, page 9 of 10, lines 7-15, PDF 141.

at receptor R009 would increase by 0.3 dBA to a predicted cumulative sound level of 40.6 dBA. The Commission notes that the applicant's noise modelling has predicted that the existing third-party facilities are the main contributor to the exceedance of the nighttime PSL at both receptor locations.

220. Based on the evidence from Mr. James and Mr. Farquharson and the applicant, the Commission accepts that the proposed project noise contribution to the existing sound level at receptor R008 and receptor R009 will be insignificant. Given these circumstances, the Commission will allow a permissible sound level at these two receptor in excess of the 40 dBA L_{eq} nighttime pursuant to Section 1.4(1) of AUC Rule 012.

221. The Commission does not accept the KLG's assertion that the use of noise attenuation barriers and NRO modes should be restricted to post-construction mitigation. The Commission notes that seven of the eight third-party facility operators have expressed no concerns with respect to the noise attenuation barriers proposed by the applicant for their respective facilities. The applicant stated that it is working with the one remaining third-party facility operator to design a moveable barrier. The Commission accepts the applicant's evidence that construction of these barriers should allow the applicant to meet the PSL at nearby residences. The Commission also finds that the use of NRO modes, as proposed by the applicant, is a reasonable method for mitigating turbine noise.

222. With respect to the proposed mitigation measures, the Commission finds the proposed noise attenuation barriers and the proposed NRO modes for turbines during nighttime operations as reasonable mitigation measures.

223. Due to the importance of the noise mitigation measures to ensure the project's compliance with the PSL, the Commission finds that should it approve the project, it would require a condition that would state the following:

> The applicant must ensure that all noise mitigation measures proposed in the application are implemented, if necessary, to ensure compliance with the permissible sound level at all receptor locations in the study area. The noise control measures proposed in the application included: implementing Noise Reduced Operation (NRO) modes, shutting down of wind turbine(s) at nighttime, installation of noise attenuation barriers and additional means of reducing noise levels of the third-party facilities.

7.7.3 Noise modelling and standards

224. With respect to the wind turbine sound power level used in a noise impact assessment, Section 3.3(1) of AUC Rule 012 states:

> For noise impact assessments, the sound power level from a wind turbine must correspond to the maximum noise emitted when the wind turbine operates under the planned maximum operating conditions for both the daytime and nighttime period. These operating conditions and restrictions to one or more wind turbines must be documented in the noise impact assessment.

225. The Commission observes that the sound power levels provide by GE for use in the 2013 NIA were calculated using IEC 61400-11. This standard was specifically developed to calculate sound power levels for wind turbines and is internationally accepted. The Commission recognizes that there was a disagreement between Mr. Ashtiani and Mr. James about whether a further adjustment to the sound power levels using IEC 61400-11 was required. The Commission notes that GE guaranteed the wind turbine sound power levels calculated using IEC 61400-11. The Commission is satisfied that the sound power levels used by the applicant represent the turbine's maximum noise emitted when the wind turbine operates under the planned maximum operating conditions for both the daytime and nighttime period. The Commission therefore finds that the sound power levels used by the applicant were appropriate sound power levels to use as inputs for its noise model.

226. The applicant used the CadnaA model to prepare the 2013 NIA. The CadnaA model uses the ISO 9613-2 methodology for outdoor sound attenuation. ISO 9613-2 is one of the standards specifically identified in AUC Rule 012 as being acceptable for use when preparing a noise impact assessment. The Commission finds that this standard has been extensively used and recognized internationally and is the foundation of several commercially available noise propagation models in use today. The evidence before the Commission from Mr. Farquharson and Mr. Ashtiani supports this conclusion. Mr. Farquharson testified that he has used the ISO 9613 method successfully in the past and found that the results were reasonable when calculating predictions from sources above 30 metres and beyond the 1,000 metre range. Mr. Ashtiani also testified that modelling protocols that use ISO 9613-2 generally comply with measurements taken in the field.[143]

227. With respect to ground attenuation factors, ISO 9613-2 provides the following definitions for the ground attenuation factor:

> a) **Hard ground**, which includes paving, water, ice, concrete and all other ground surfaces having a low porosity. Tamped ground, for example, as often occurs around industrial sites, can be considered hard. For hard ground G = 0.
>
> b) **Porous ground**, which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land. For porous ground G = 1.
>
> c) **Mixed ground**: if the surface consists of both hard and porous ground, then G takes on values ranging from 0 to 1, the value being the fraction of the region that is porous.[144]

228. In the Commission's view, it would have been unreasonable for the applicant to use a ground attenuation factor of G = 0 given the definition above and the ground conditions in the project area. The Commission considers that the use of an attenuation factor of G = 0.5 was a reasonable assumption for the applicant to make in the 2013 NIA due to the ground conditions in the project area. Further, the Commission notes that even Mr. Farquharson testified that the ground attenuation factor of G = 0.5 is a good starting point.

229. The Commission recognizes that noise prediction models have a level of uncertainty. The sound power levels of the wind turbines used by the applicant have an uncertainty of plus or minus two dB. The use of the ISO 9613-2 standard in the model introduces an accuracy of plus

[143] Transcript, Volume 4, pages 1067-1068, lines 22-1.
[144] ISO 9613-2, 1996-12-15, page 6.

or minus three dB. In the Commission's view, the appropriate statistical method to determine the combined uncertainty is to calculate the square root of the sum of the squares, as explained by the applicant.

230. While all noise models have a level of uncertainty, AUC Rule 012 does not require an applicant to take this into account in its predicted cumulative sound levels and for determining whether the project meets the PSL. The applicant's compliance with the PSL is of paramount importance. Even if the modelling proves to be inaccurate, if the project is constructed it would still be required to comply with the PSL, which could be determined by a post-construction comprehensive sound level survey.

231. Having regard to the foregoing, the Commission finds that the applicant incorporated reasonable modelling assumptions and protocols when preparing the 2013 NIA. The Commission does not find the need to make any upward or downward adjustments to the predicted sound levels in the 2013 NIA due to the modelling and standards used. The Commission concludes that, with the exception of the calibration issue described above, the results of the 2013 NIA were reasonable and consistent with the requirements of AUC Rule 012.

7.7.4 Low frequency noise and infrasound

232. The Commission recognizes that wind turbines produce low frequency noise and infrasound.

233. Dr. Leventhall and Mr. Farquharson agreed that the AUC Rule 012 test, using the dBC minus dBA value, is a useful step for determining whether a project produces a higher component of low frequency noise in the overall soundscape. Mr. James also agreed that this test is useful when used for common community noise sources, however, he stated that it wasn't sensitive to the extremely low frequencies of wind turbines. Mr. James instead recommended using a dB unweighted minus dBA test with the unweighted sounds including the energy down to the blade pass frequencies.

234. The Commission finds that the dB unweighted minus dBA test suggested by Mr. James is not a proven practice for evaluating infrasound and low frequency noise from wind turbines. The dBC minus dBA calculation is recognized in other jurisdictions around the world for the evaluation of low frequency noise. This test was recommended by Mr. Farquharson and Dr. Leventhall, and was also recognized in several of the studies filed as an effective test. In the Commission's view, the dBC minus dBA test is a reasonable and proven method for identifying the potential for a low frequency noise condition.

235. AUC Rule 012 outlines the dBC minus dBA calculation as the first step to identify the potential for a low frequency noise condition. In accordance with that rule, a low frequency noise exists if the dBC minus dBA value is equal to or greater than 20 dB and there is a clear tonal component between the frequencies of 20 Hz to 250 Hz. The dBC minus dBA test is not designed to evaluate the infrasound frequencies below 20 Hz and the data below 20 Hz is not used in noise models. Although this data can be now measured by the latest commercially available instrumentation, it is not a common practice to conduct these measurements, except for the specific purpose of investigating infrasound.

236. The Commission notes that in the project area, the dBC minus dBA threshold of 20 dB is predicted to be exceeded at some existing receptor locations, without the addition of the project's

contribution.[145] The Commission also notes that the applicant stated that there is no tonal component for the turbines between 20 Hz and 250 Hz.[146] Given this, the applicant concluded that there was no indication that operation of the project would result in a contribution to low frequency noise at the receptors. The Commission finds that the applicant followed the requirements of AUC Rule 012 in conducting its low frequency noise analysis and is satisfied, based on the evidence, that there is no indication that operation of the project would result in a contribution to low frequency noise at the receptors. The Commission notes that the values in the 2013 NIA are predictions and that the low frequency noise and infrasound of the project can only be determined through measurements of an operating facility.

237. The Commission accepts the applicant's and Dr. Leventhall's evidence that there are many natural and man-made sources of infrasound.[147] This evidence was not contested by the KLG or its experts. The Commission notes that like other sounds, infrasound attenuates with distance. The Commission acknowledges that the rate at which infrasound attenuates can vary depending on site-specific and environmental factors. The Commission finds that it was helpful to review measurements from operating wind turbines to help understand expected low frequency sound and infrasound levels from wind turbines.

238. Both the applicant and Mr. James agreed that the Shirley Wind Farm measurements demonstrated that the wind farm produced low frequency noise and infrasound. Dr. Leventhall acknowledged that the Shirley Wind Farm study measured values down to lower frequencies than had previously been common practice. The Commission notes that the Shirley Wind Farm study measured the audible levels of low frequency noise at receptor R2 at a distance of 330 metres from the closest turbine to be 48 dBA, which would not be in compliance with AUC Rule 012 during nighttime. Therefore, the Commission finds that the Shirley Wind Farm study does not provide comparable values to the expected low frequency sound and infrasound levels that could be produced by the project. Further, if a wind farm was operating in Alberta with a low frequency noise component identified, AUC Rule 012 requires the project owner to add five dBA to the comprehensive sound level measurement in the determination of compliance with the PSL. If the project owner was unable to meet that PSL it would either be required by the Commission to take additional noise control measures to ensure compliance or shut the wind turbine down.

239. Mr. James also outlined concerns that the Shirley Wind Farm study showed that lower frequency peaks measured could be in the range of audibility. The Commission notes that Mr. James' concerns were in respect to the linear measurements of the wind farm. In AUC Rule 012, the linear measurements are not used for the demonstration of compliance with the PSL. The measure for compliance in AUC Rule 012 is based on the dBA weighting scale, predicted or measured over the daytime and nighttime period. The Commission finds the information that these lower frequency peaks could be measured to be in the range of audibility is irrelevant in its determination of predicted sound levels and actual sound levels for compliance of the project. In AUC Rule 012, instantaneous peaks in sound energy are averaged over the daytime and nighttime period for the purposes of compliance. This is because the peaks are only a part of the overall normal operating conditions of the facility.

[145] Transcript, Volume 4, page 1148, line 2-11.
[146] Exhibit 157.05, Environmental Noise Impact Assessment, page 16.
[147] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 7, paragraph 28.

240. The Commission found the studies by Turnbull et al. and O'Neal et al., which measured low frequency noise and infrasound levels from operating wind turbines, to be the most persuasive evidence on the record about the levels of low frequency noise and infrasound likely to be produced by the project. The Commission notes that while Mr. James contested the threshold of audibility used by Turnbull et al. and O'Neal et al., he did not dispute the low frequency and infrasound measurements in each of those studies.

241. Turnbull et al. concluded that at distances as close as 85 metres and 100 metres from the respective wind turbines that it measured, "the level of infrasound is well below the audibility threshold of 85 dB(G)."[148]

242. O'Neal et al. concluded that in both cases it studied, infrasound from the wind turbines was inaudible to even the most sensitive people at a distance of 305 metres from the wind turbines. O'Neal et al. also concluded that the wind turbines it studied might have slightly audible low frequency noise at frequencies at 50 Hz and above.[149]

243. The Commission finds that the wind turbines in the Turnbull et al. and O'Neal et al. studies had similar sound power levels to the turbine models proposed by the applicant in the project. While these turbines are different from those proposed for the project, the Commission finds that this is the best evidence before it with respect to the specific levels of low frequency noise and infrasound produced by wind turbines at a specific distances.

244. The Commission finds that the conclusions of the Turnbull et al. and O'Neal et al. studies are consistent with Dr. Leventhall's evidence that the low frequency noise from wind turbines at frequencies above about 40 Hz may exceed the hearing threshold and become audible outside a residence for those closest to the wind turbine.[150] The studies are also consistent with Dr. Leventhall's evidence that infrasound from wind turbines is inaudible at receptor distances.[151] These studies are also consistent with the studies referenced by Mr. Ashtiani which concluded that measurements at 200 metres from typical wind turbines have shown that the infrasound levels are well below the level of perceptibility.[152]

245. The nearest receptor for the project would be approximately 700 metres away from the nearest wind turbine. Having regard to the foregoing, the Commission finds that any infrasound from the project at that distance will be inaudible. If the project creates low frequency noise with a tonal component at the receptors, AUC Rule 012 requires mitigative measures to ensure compliance with the PSL, including in an extreme case, the shutting down of one or more turbines.

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148 Exhibit 110.13, Measurement and Level of Infrasound from Wind Farms and Other Sources, Chris Turnbull, Jason Turner and Daniel Walsh, Acoustics Australia 40(1), page 47.

149 Exhibit 110.14, Low frequency noise and infrasound from wind turbines, Robert D. O'Neal, Robert D. Hellweg Jr. and Richard M. Lampeter, Engineering Noise Control Journal, March-April, 2011, Volume 59, Number 2, page 135 to 157.

150 Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 26, paragraph 97.

151 Transcript, Volume 2, page 253, lines 23-25.

152 Exhibit 157.05, Environmental Noise Impact Assessment, page 19 references *Infrasound Emission from Wind Turbines*, Jorgen Jakobsen, Danish Environmental Protection Agency, 17 Aug 2005, *Infrasound from Wind Turbines-Fact, Fiction or Deception*, Geoff Leventhall, Journal of Canadian Acoustical Association, 2006.

7.7.5 Post-construction monitoring commitment

246. As already mentioned, the applicant's compliance with the PSL is of paramount importance to the Commission. The Commission acknowledges the applicant's commitment to perform post-construction noise monitoring surveys at some of the receptor locations with close compliance margins. The applicant committed to conducting post-construction noise monitoring at four receptors to verify compliance with AUC Rule 012. These receptors were identified as receptors R004, R062, R064 and R065.[153] The applicant also committed to conduct pre-construction noise monitoring at receptor R086 under conditions specified in AUC Rule 012.[154]

247. The Commission finds that if it approves the project, it would require a condition that any pre-construction and post-construction comprehensive sound surveys must be conducted under representative conditions and follow the requirements of AUC Rule 012. In addition, low frequency noise would be required to be evaluated, including a dBC minus dBA calculation, the evaluation for a tonal component and a comparison of the measurement results with the PSL according to the requirements of AUC Rule 012.

248. The Commission must look at a number of criteria to determine the locations to conduct pre-construction and post-construction noise measurement studies in the project study area. In its evaluation, the Commission considers the commitments made by the applicant, the layout of the project, the distribution of the turbines and third-party facilities, the project sound level contribution at the receptor locations, the overall cumulative predicted sound levels at the receptor locations and the issues and concerns brought forward by residents in the study area.

249. Should the Commission approve the project, it would require the applicant to conduct baseline (pre-construction or post-construction with no turbines operating) and post-construction comprehensive sound surveys, including an evaluation of low frequency noise, at the following receptors under representative operating conditions, in accordance with AUC Rule 012: R052, R063, R086, R141 and the receptor located in NW 31-40-1-W4M.

250. The Commission would also require the applicant to conduct post-construction comprehensive sound surveys, including an evaluation of low frequency noise, at the following receptors under representative operating conditions, in accordance with AUC Rule 012: R004, R055, R064, R065 and R070.

251. Although the applicant committed to measure at receptor R062 (an empty dwelling), the Commission does not find it necessary to direct the applicant to conduct post-construction noise measurement at this receptor because of its proximity to R064 and R065.

252. Based on the foregoing, if the Commission approves the project, it would require the following condition to verify and confirm that the project complies with the requirements of AUC Rule 012:

> The applicant shall:
>
> a) Conduct baseline (pre-construction or post-construction with no turbines operating) and post-construction comprehensive noise studies, including an evaluation of low

[153] Exhibit 157.05, Environmental Noise Impact Assessment, Section 7, Conclusion, Exhibit 157.13, IR AUC-1646658 AB-31, Transcript, Volume 1, pages 34–35, lines 24-1.

[154] Transcript, Volume 4, pages 1092-1093, lines 22-7.

frequency noise, at receptors R052, R063, R086, R141 and the receptor located in NW 31-40-1-W4M under representative conditions, in accordance with AUC Rule 012.

b) Conduct post-construction comprehensive noise studies and an evaluation of low frequency noise at receptors R004, R055, R064, R065 and R070 under representative operating conditions, in accordance with AUC Rule 012.

c) File all studies and reports relating to the pre-construction and post-construction noise survey with the Commission within one year of connecting the power plant to the Alberta Interconnected Electric System.

253. The applicant has provided a number of further attenuation measures that could be implemented in order to obtain compliance including operating the turbines in NRO modes on more turbines, additional noise attenuation barriers for third-party facility noise sources, source based noise mitigation for third-party facility noise sources (such as acoustic enclosures, equipment replacement and silenced building openings), and condition based curtailment of turbine operations.

7.7.6 Conclusion

254. Having regard to the foregoing, the Commission concludes that the noise from the project will likely meet the nighttime PSL, subject to the applicant providing the updated information described in paragraph 218. Further, the Commission finds that any infrasound produced by the project will be inaudible at receptors and that low frequency sound produced by the project must meet the requirements set out in AUC Rule 012.

8 Health

8.1 Introduction

255. The KLG expressed significant concerns about the health effects associated with living in proximity of wind turbines. The KLG hired Dr. Chris Hanning, Dr. Carl Phillips, Dr. Adrian Upton and Dr. Sarah Laurie to provide evidence on wind turbines and health effects. Mr. Rick James also provided evidence on this topic. It was the evidence of these experts that approval of the project would result in health effects, including sleep disturbance for nearby residents.

256. The KLG also filed the medical records of three of its members: J.B., C.H. and H.B. As noted in Section 4.2, the Commission decided to treat these medical records as confidential as well as any testimony and argument relating to those records. The Commission recognizes that each of these individuals has a serious underlying medical condition. The Commission appreciates their decision to share this confidential and private information with it and is of the view that this information was of assistance to it in making its decision on the application. While the Commission has taken this private and confidential information into account when making its decision, it finds that it is unnecessary to specifically refer to any of the confidential medical records, or the confidential testimony or argument about those records, in this decision.

257. The applicant hired three experts to provide reply evidence on the issue of the potential health effects of wind turbines: Dr. Richard McCunney, Dr. Christopher Ollson, and Dr. Leventhall. It was the evidence of these witnesses that the proposed wind farm should not result in health effects for nearby residents if the sound produced by the project is consistent with the noise levels predicted in the noise impact assessment.

258. In this section of the decision, the Commission first reviews international noise guidelines and exposure limits. It then provides an overview of some of the medical studies and reports that were most often referred to by the expert witnesses for the applicant and the KLG. The Commission then provides an overview of the evidence provided by each of these experts. The Commission's findings follow that overview.

8.2 International noise guidelines or exposure limits

8.2.1 World Health Organization

259. In 1999, the WHO published a document entitled *Guidelines for Community Noise* (1999 guidelines).[155] In 2009, the WHO published a new document entitled *Night Noise Guidelines for Europe* (2009 guidelines).[156] The 2009 guidelines were prepared by a panel of international experts and were peer reviewed for consensus among the experts and stakeholders from industry, government and nongovernmental agencies.

260. The WHO 1999 guidelines provided guideline values for community noise in specific environments. The guideline adopted by the WHO in 1999 for maximum noise levels outside bedrooms was 45 dB LA_{eq} measured at one metre from the façade of a living space. This sound level was proposed to allow people to sleep with their bedroom window open.[157]

[155] Exhibit 131.10, World Health Organization, Guidelines for Community Noise, 1999.
[156] Exhibit 131.11, World Health Organization, Night Noise Guidelines for Europe, 2009.
[157] Exhibit 131.10, World Health Organization, Guidelines for Community Noise, 1999, at pages xiii and xv.

261. In its 2009 guidelines, the WHO stated that these new guidelines may be considered as an extension to and an update of the 1999 guidelines.[158] The WHO stated that it developed the 2009 guidelines to "… provide expertise and scientific advice to the Member States in developing future legislations in the area of night noise exposure control and surveillance…"[159]

262. The 2009 guidelines are based on dB $L_{night,\ outside}$, which is the equivalent outdoor sound pressure level associated with a particular noise source during nighttime (at least eight hours) calculated over a period of a year.[160]

263. The conclusion of the 2009 guidelines was as follows:

> Below the level of 30 dB $L_{night,outside}$, no effects on sleep are observed except for a slight increase in the frequency of body movements during sleep due to night noise. There is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night,outside}$ are harmful to health. However, adverse health effects are observed at the level above 40 dB $L_{night,outside}$, such as self-reported sleep disturbance, environmental insomnia, and increased use of somnifacient drugs and sedatives. Therefore, 40 dB $L_{night,outside}$ is equivalent to the LOAEL [the lowest observed adverse effect level] for night noise. Above 55 dB the cardiovascular effects become the major public health concern, which are likely to be less dependent on the nature of the noise. Closer examination of the precise impact will be necessary in the range between 30 dB and 55 dB as much will depend on the detailed circumstances of each case.[161] (emphasis added)

8.2.2 Other jurisdictions

264. Dr. Ollson included a figure in his report that showed wind turbine noise limits in jurisdictions outside of Alberta.[162] In response to an undertaking to Commission counsel, Dr. Ollson provided the source document for this information[163] as well as a table providing context for the information found in the figure.[164] The following table summarizes residential nighttime noise limits/recommendations for wind turbines in a number of jurisdictions in Europe, Australia and Canada based on that information.

[158] Exhibit 131.11, World Health Organization, *Night Noise Guidelines for Europe*, 2009, at page VI.
[159] Ibid, at page VII.
[160] Ibid, at page 135.
[161] Ibid, at page 109.
[162] Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 30.
[163] Exhibit 285.01, Minnesota Department of Commerce: Energy Facility Permitting, *International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences*, October 19, 2011.
[164] Exhibit 285.02, Details of Upper and Lower Limits for Figure on Page 30 of Exhibit 202.05.

Table 2. Residential nighttime noise limits/recommendations for wind turbines

Jurisdiction	Residential Nighttime outdoor noise limit/recommendation	Setback distance from residences
Germany	35-45 dBA	
Spain	50 dBA	
Portugal	45 dBA	
Denmark	37-44 dBA depending upon wind speed and land use	
Netherlands	41 dBA	4 x hub height
Sweden	35-40 dBA	400-1000 metres
England	5 dBA above background to a maximum of 43 dBA	
Wales	5 dBA above background	500 metres
Scotland		2000 metres from cities, towns and villages
Ireland	5 dBA above background to a maximum of 43 dBA	
New Zealand	35-40 dBA or 5 dBA above background	
Australia		
New South Wales	35 dBA L_{A10}	
South Australia	35-40 dB L_{A90}	
Victoria	40 dB L_{A95}	
Western Australia	35 dB L_{A10}	
Canada		
Alberta	40-56 dBA depending upon wind speed, project location, existing noise	
Ontario	40-51 dBA depending upon wind speed	550 metres
New Brunswick	40-53 dBA depending on wind speed	
Prince Edward Island		3 x total height from
British Columbia	40 dBA	
Manitoba	40-53 dBA depending on wind speed	

8.2.3 Government reviews

8.2.3.1 Report of the chief medical officer of health for Ontario[165]

265. In May 2010, the chief medical officer of health for Ontario published a report on the potential health impacts of wind turbines. The report was based upon a review of existing scientific evidence on health effects associated with wind turbines. The chief medical officer of health for Ontario's conclusions regarding the potential health impacts of wind turbines included the following:

- While some people living near wind turbines report symptoms such as dizziness, headaches, and sleep disturbance, the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects.
- The sound level from wind turbines at common residential setbacks is not sufficient to cause hearing impairment or other direct adverse health effects. However, some people might find it annoying. It has been suggested that annoyance may be a reaction to the characteristic "swishing" or fluctuating nature of wind turbine sound rather than to the intensity of sound.

[165] Exhibit 110.19, Chief medical Officer of health for Ontario, The Potential Health Impacts of Wind Turbines, May, 2010.

- Low frequency sound and infrasound from current generation upwind model turbines are well below the pressure sound levels at which known health effects occur. Further, there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects.

8.2.3.2 Massachusetts departments of public health and environmental protection independent expert panel report (Massachusetts report)[166]

266. In January 2012, an independent panel of seven experts published a report on wind turbine health impacts at the request of the Massachusetts Departments of Public Health and Environment Protection. The experts had backgrounds in epidemiology, toxicology, neurology, sleep medicine, neuroscience and mechanical engineering. The panel was asked to review the science that explores health concerns related to noise, infrasound, vibrations and shadow flicker generated by wind turbines. Many of the medical studies and reviews considered by this independent panel were also filed in this proceeding.

267. The independent panel observed that "[m]ost epidemiologic literature on human health response to wind turbines relates to self-reported "annoyance" and this response appears to be a function of some combination of the sound itself, the sight of the turbine, and attitude towards the wind turbine project".[167] The independent panel found that it is possible that noise from some wind turbines can cause sleep disruption, but noted that there is insufficient evidence to provide sound pressure thresholds at which wind turbine noise cause sleep disturbance.

268. The independent panel found that there was insufficient evidence that noise from wind turbines is directly causing health problems and disease, but noted that this finding was independent from effect on annoyance or sleep. It also concluded that it has not been scientifically demonstrated that infrasound from wind turbines directly impacts the vestibular system and noted that available evidence demonstrates that infrasound levels near wind turbines cannot impact vestibular systems.

269. The independent panel stated that there is no evidence for a set of health effects from wind turbine exposure that could be characterized as a "wind turbine syndrome". It found that the weight of evidence suggested no association between noise from wind turbines and measures of psychological distress or mental health problems. It further concluded that none of the epidemiological evidence reviewed suggested an association between wind turbine noise and pain, stiffness, diabetes, high blood pressure, tinnitus hearing impairment, cardiovascular disease and headache/migraine.

8.2.3.3 Minnesota Department of Health: public health impacts of wind turbines[168]

270. The Minnesota Department of Health published a "white paper" evaluating possible health effects associated with low frequency vibrations and sound arising from wind turbines in May 2009. The report was prepared by two toxicologists employed by the department of health.

271. The authors found that wind turbines generate a broad spectrum of low-intensity noise. They found that higher frequencies are attenuated at typical setback distances but lower

[166] Exhibit 110.20, Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, Wind Turbine Health Impact Study: Report of Independent Expert Panel, January 2012.
[167] Ibid, page ES-5.
[168] Exhibit 110.17, Minnesota Department of Health Environmental Health Division, Public Health Impact6s of Wind Turbines, May 22, 2009.

frequencies are attenuated to the same degree. They found that low frequency noise is primarily a problem that may affect people in their homes, especially at night.

272. The authors found that the most common health complaints reported in the studies they reviewed were sleeplessness and headaches which were highly (but not perfectly) correlated with annoyance complaints. They stated that complaints were most likely when turbines were visible. The authors found that most available evidence suggested that reported health effects are related to audible low frequency noise and noted that complaints appear to rise with increasing noise levels above 35 dB(a). They stated that it has been "hypothesized that direct activation of the vestibular and autonomic nervous system may be responsible for less common complaints but evidence is scant."[169]

273. The authors observed that low frequency noise produced by a wind turbine is generally not easily perceived beyond a ½ mile but noted that this distance may be greater for turbines subject to aerodynamic modulation because of terrain or wind shear.

8.3 Studies referred to in the proceeding

8.3.1 Shirley Wind Farm study – December 24, 2012[170]

274. The measurement aspects of this study were described earlier in this report. However, the Shirley Wind Farm study also discussed the potential for infrasound related health impacts.

275. One of the report's authors experienced headaches and nausea over the course of the survey. The three other authors had no apparent health effects.

276. Another of the authors, Dr. Paul Schomer, stated that a 1986 study by the U.S. Navy noted that physical vibration of pilots in flight simulators induced motion sickness when the vibration frequency was in the range of 0.05 Hz to 0.9 Hz with the worst effect at around 0.2 Hz. He observed that this was not far from the blade passing frequency of future large wind turbines. He hypothesized that adverse response to wind turbines is an acceleration or vibration problem in the very low frequency region.

277. Another of the study's authors observed the following with respect to this hypothesis:

> Schomer and Rand contend that the illness that is being reported may be a form of motion sickness associated with the body experiencing motion in approximately the same frequency range as wind turbine blade passing infrasound. However, this conjecture is based on a Navy study in which subjects were physically vibrated in flight simulators at amplitudes that may or may not be comparable to the situation at hand, whereas any such force from a distant wind turbine would need to be conducted through the air. One must make the leap that motion of the body in still air is the same as being still in air containing some level of infrasound. While potentially plausible this hypothesis needs to be verified.[171]

[169] Ibid, at page 25.

[170] Exhibit 129.09, A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin – December 24, 2012.

[171] Exhibit 129.09, A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin – December 24, 2012. Appendix B, Hessler Associates, Inc. page 7, (PDF page 29).

8.3.2 Alec N. Salt and Timothy E. Hullar (Salt and Hullar) 2010[172]

278. In this article, Salt and Hullar looked at whether the ear responds physically to inaudible low frequency or infrasound at the levels generated by wind turbines. The authors noted that low frequency noise sensitivity has been observed in guinea pigs whose cochleas (inner ear) are similar (but shorter) to human cochleas. They stated that it was "reasonable to assume that if low frequency responses are present in the guinea pig at a specific level, then they will be present in the human at a similar or lower stimulus level".[173]

279. Salt and Hullar concluded that the "sensory cells or structures of the inner ear, such as the outer hair cells, are more sensitive to infrasound than the inner hair cells and can be stimulated by low frequency sounds at levels below those that are heard."[174] The authors recognized that even though some inner ear components respond to infrasound at the frequencies and levels generated by wind turbines, it does not mean that the infrasound will be perceived or will disturb function. However, they noted the possibility that infrasound produced by a wind turbine could influence the function or cause unfamiliar sensations. Given this potential, the authors stated that there is an urgent need for more research directly addressing the effects of long-term, low-level infrasound exposure on humans.

8.3.3 M. Nissenbaum, J. Aramani, C. Hanning 2012[175]

280. This study (the Nissenbaum study) compared the sleep and general health of 38 persons living between 375 metres to 1,400 metres of two different wind farms with the sleep and general health of 41 people living between 3,300 metres to 6,600 metres of the same two wind farms. The study used validated questionnaires to collect this information.

281. The study stated that it used noise measurements from publically available information to predict the noise levels to estimate noise at various distances for one of the wind farms. For the other wind farm, noise measurements were carried out at various distances over a single day.

282. The authors reported that those living between 375 metres to 1,400 metres of either wind farm had worse sleep, were sleepier during the day and had poorer mental health scores than those people living between 3,300 metres to 6,600 metres from the two wind farms. The authors recognized that attitude and visual impact may have contributed to the reported effects but primarily attributed the different results to wind turbine noise.

8.3.4 The studies of Eja Pedersen et al.[176]

283. Eja Pedersen is the author or co-author of a number of epidemiologic reports relating to wind turbine noise and health effects. These reports were generally based on questionnaires and some studies involved more than 1,900 people.[177] Seven of those reports were filed as exhibits

[172] Exhibit 141.17, Alec N. Salt and Timothy E. Hullar, Responses of the ear to low frequency sound, infrasounds and wind turbines, Hearing Research 268, 2010.
[173] Ibid, page 16
[174] Ibid, page 19.
[175] Exhibit 130.08, Michael A. Nissenbaum, Jeffrey Aramani, Christopher Hanning, Effects of industrial wind turbine noise and health , Noise & Health, September-October 2012.
[176] See Exhibits 131.08 and 130.11-130.17.
[177] Pedersen, van den Berg, Bakker, Bouma, Response to noise from modern wind farms in the Netherlands, Journal of the Acoustical Society of America, 126 (2) August 2009, page 62 as referenced in Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 6.

and several more were referenced in the expert evidence filed in this proceeding. These reports were referenced by the applicant's experts and the KLG's experts.

284. The authors of these reports generally observed that annoyance related to wind turbine noise increased with calculated sound pressure levels. They also observed that annoyance with wind turbine noise was associated with a negative attitude towards wind turbines in general and towards their visual impacts. Other general observations of the authors were that wind turbine noise is easily perceived and relatively annoying when compared with other community sources.[178] The authors of these reports also noted that persons living near wind turbines who received economic benefits from those turbines reported less annoyance from those turbines than residents that did not receive economic benefits.

8.3.5 Paller, Bigelow, et al. Wind Turbine Noise, Sleep Quality and Symptoms of Inner Ear Problems (Bigelow study)[179]

285. The results of this recent study, in the form of a poster, were filed by the KLG as an exhibit in the proceeding. It was a survey study of eight communities in Ontario. The study investigated the impact of wind turbine noise on quality of life and sleep disturbance in eight Ontario communities using questionnaires. Distance from turbines in each community was used as a surrogate for noise levels. Over 4,876 surveys were sent to area residents of which 396 were used in the study's analysis.

286. On October 27, 2013, Dr. Phillip Bigelow, one of the study's authors wrote to the lawyers for the applicant and the KLG. Dr. Bigelow described the study as follows:

> Clair Paller, the primary author, is completing a Master's degree and this is part of her thesis project. Her statistical modeling was well conducted and does, with the data that we have, show that a subjective measure of sleep quality (PSQI) and self-reported vertigo do significantly vary with distance from the closest wind turbine. However, we were very disappointed with our response rate for the study which was impacted by circumstances beyond our control. The overall response rate of under 10% is very problematic and we recognize the opportunity for bias that would invalidate the findings reported on the poster.
>
> The study results are currently being written up for publication in a peer-reviewed journal and at that point the scientific community will weigh-in on the validity of the findings. Studying outcomes as complex as sleep, vertigo, tinnitus and their relationships with environmental exposures is challenging. Getting the full picture of the impacts of wind turbine noise on these outcomes will require many studies and this is only one.[180]

8.4 The KLG's evidence on health effects

8.4.1 Dr. Carl Phillips

287. Dr. Phillips has masters and doctorate degrees in public policy with an emphasis on economics in decision-making. Dr. Phillips also did two post-doctoral fellowships, one in health policy research and one in the philosophy of science. Dr. Phillips was a professor of public health at the universities of Minnesota, Texas and Alberta, and the Kennedy School of

[178] Ibid.
[179] Exhibit 219.04, Paller, Bigelow, Majowicz, Law, and Christidis, Wind Turbine Noise, Sleep Quality and Symptoms of Inner Ear Problems.
[180] Exhibit 239.01, email from Phillip Bigelow to Teri-Lee Oleniuk and Richard Secord.

Government at Harvard University. Dr. Phillips' research work has focused on epidemiologic methods, environmental health, science and ethics based policy making and tobacco harm reduction. Dr. Phillips has published numerous articles in peer-reviewed publications.

288. Dr. Phillips has previously testified on behalf of opponents of wind projects in other jurisdictions. He is also a scientific advisor to the Society of Wind Vigilance. However, Dr. Phillips indicated that he has done very little on behalf of that society in his capacity as a scientific advisor.

289. Dr. Phillips filed an expert report and gave evidence in this proceeding. In his report Dr. Phillips described the evidence he relied upon when developing his opinion, made predictions with respect to the health effects with the project and provided a critique of the health information provided to area residents by the applicant.

290. In his report, Dr. Phillips concluded that wind turbines sited near residences cause serious health problems for some people living in those residences. He stated that the most commonly reported health problems "include a constellation of diseases that may be caused by constant mild stress reactions, including sleep disorders, difficulty concentrating, mood disorders fatigue and headaches".[181] Dr. Phillips stated that he primarily relied upon adverse event reports made by residents living near wind turbines when reaching this conclusion. He stated that these adverse event reports come from many sources ranging from systematic collections to self-published Internet accounts.

291. When questioned about which adverse event reports he reviewed when preparing his report, Dr. Phillips clarified that he had not reviewed any because he had reviewed hundreds of such reports in the past and that his scientific opinion was based on those previous reviews.[182] Dr. Phillips also confirmed that he had not broken down the data provided by the adverse reports in a systematic way.[183]

292. It was Dr. Phillips' opinion that most of the diseases listed in the adverse event reports are closely related and known to be responses to chronic stress related to subconscious sensory stimulation or noise. In response to a question from Commission counsel on this topic, Dr. Phillips stated that "I have not seen anyone propose a plausible physical pathway that doesn't involve noise most of the time".[184] Dr. Phillips stated that many researchers, himself included, believed that stress is the most likely explanation for the observed diseases, but he acknowledged that there are other possibilities. In his direct evidence, Dr. Phillips added that there is also a pattern of disease, i.e. balance problems and tinnitus, that might be related to low frequency noise and not a general stress reaction.[185]

293. Dr. Phillips argued that complicated statistical studies were unnecessary to demonstrate that wind turbines cause the identified problems given the case crossover nature of the data provided by the adverse event reports. Dr. Phillips concluded that even if adverse event reports were the only evidence available, it would still be reasonable to conclude that wind turbines cause health problems for nearby residents.

[181] Exhibit 134.02, Expert report of Carl V. Phillips PhD, February 21, 2013, page 2.
[182] Transcript, Volume 3, pages 803-804, lines 25-6.
[183] Transcript, Volume 3, page 809-810.
[184] Transcript, Volume 3, page 802, lines 9-10.
[185] Transcript, Volume 3, page 676, lines 5-9.

294. Dr. Phillips asserted that, in addition to the adverse event reports, there are some systematic studies that also support his conclusion that individuals exposed to wind turbines experience harm, including health problems. Dr. Phillips referred to the Nissenbaum et al. (2012) study in support of his position that residents living near wind turbines were likely to suffer from lower-quality sleep. In his direct evidence, Dr. Phillips also addressed the Bigelow study. He stated that this study showed much higher rates of sleep disorders, vertigo and tinnitus among those living near wind turbines.

295. Dr. Phillips stated in his report that the evidence shows that health effects are common within 1.4 kilometres to two kilometres from wind turbines and may occur at three kilometres and further. However, he observed that risk appears to diminish with distance. Dr. Phillips noted that the available evidence does not allow for the identification of those who may be at a higher risk of health problems from wind turbines, but suggested that people who are particularly sensitive to noise and or prone to stress, sleep disorders or mood disorders may be at greater risk.

296. Dr. Phillips asserted that, using the available evidence, some very rough estimates can be made with respect to potential health effects associated with the proposed wind farm. Dr. Phillips predicted that one or two people living within two kilometres of the project will suffer severe health problems and more than 30 people will suffer substantial but not as severe health problems. Further, it was Dr. Phillips' opinion that four members of the KLG group who have pre-existing medical conditions would be at a higher risk of experiencing health impacts from the project because of those pre-existing conditions.

297. Dr. Phillips suggested that the only way to mitigate the observed health effects from wind turbines is to ensure that they are located several kilometres from homes.

8.4.2 Dr. Christopher Hanning

298. Dr. Hanning is a medical doctor from the United Kingdom with a specialty in anesthesia and a special interest in sleep medicine. Dr. Hanning has a bachelor of science degree in physiology, bachelor's degrees in medicine and surgery and a doctorate in medicine. Dr. Hanning was appointed senior lecturer in anesthesia and Honorary Consultant anesthetist to Leicester General Hospital and Honorary Consultant in Sleep Disorders Medicine to the University Hospitals of Leicester. Dr. Hanning has published on wind turbine noise and sleep in peer-reviewed journals and is actively involved in research on this topic.

299. Dr. Hanning confirmed at the hearing that his interest in the health effects of wind turbines began when a wind project was proposed near his home in England. Dr. Hanning has previously testified on behalf of opponents of wind turbine projects in other jurisdictions and is on the board of directors for the Society for Wind Vigilance.

300. Dr. Hanning filed an expert report and gave oral evidence in this proceeding. Dr. Hanning's report focused on the potential health effects associated with sleep disturbance caused by wind turbines.

301. In his report, Dr. Hanning reviewed the physiology of sleep and described generally how noise can interfere with sleep. Dr. Hanning noted that noise can cause awakenings, which are remembered, and arousals, which are not. Dr. Hanning stated that both disrupt sleep and make it un-refreshing. Dr. Hanning stated that the character of the noise is important when determining whether an arousal has occurred. He noted that sounds with an impulsive quality are more likely

to cause an arousal when compared to steadier sounds. He also stated that arousals can occur at noise levels well below 35 dBA, relying upon a 2010 study by Dang-Vu et al.[186]

302. Dr. Hanning explained that sleep disturbance is not trivial and, in the long-term, is linked to depression, weight gain, diabetes, high blood pressure and heart disease. Dr. Hanning noted the WHO 2009 guidelines in this respect. Dr. Hanning submitted that sensitivity to noise has a physical basis and may also be influenced by psychological factors. Dr. Hanning stated in his report that "approximately 15 per cent of the population are noise sensitive and have both a lowered annoyance level and enhanced cortisol response, a physiological marker of stress".[187] Dr. Hanning stated that nighttime turbine noise can result in a reinforcing cycle of decreased quality and quantity of sleep and stress.

303. It was Dr. Hanning's opinion that approval of the project would pose an unacceptable risk to the sleep quality and health of persons living within 1.5 kilometres of the project. He stated that his opinion is based on (a) epidemiological studies and anecdotal reports of harm following exposure to wind turbine noise, (b) opinions from other experts as to appropriate setback distances, (c) studies of health-related effects such as annoyance, and (d) studies of health effects and sleep disturbance.

304. In support of his assertion that wind turbine noise can cause sleep disturbance for people living less than 1.5 kilometres of turbines, Dr. Hanning made reference to the Nissenbaum et al. study described above. Dr. Hanning included a table that summarized the recommended setbacks of 19 scientists, legislators and acousticians to support his recommended setback of 1.5 kilometres.[188] He noted that the mean setback distance recommended was 2.08 kilometres.

305. Dr. Hanning reviewed several studies from New Zealand, the United Kingdom, the Netherlands, Australia, Canada (the Bigelow study described above) and Poland, some of which were peer reviewed and some of which were not. He argued that the studies reviewed supported his conclusion that wind turbine noise adversely affects health at distances of at least 1.5 kilometres and at sound levels of less than 40 dBA, with the primary concern being sleep quality and sleep disturbance.

306. Dr. Hanning also discussed the health effects of low frequency noise and infrasound in his report. He noted that the harmful effects of low frequency noise have been recognized for over 50 years. He noted the Salt and Hullar paper described above and proposed that this report suggests inaudible sound may reach the cortex and impact cerebral function.

307. Dr. Hanning submitted that children are at least as vulnerable as adults to the adverse effects of nighttime noise. He noted that there are no controlled studies on the effects of wind turbine noise on children but stated that there are a number of anecdotal reports, including those in Nina Pierpont's 2009 book, *Wind Turbine Syndrome*. Dr. Hanning also addressed the Shirley Wind Project study.

308. Dr. Hanning suggested to the Commission that it should regard the WHO's recommendations with respect to noise levels with caution because they are based on research relating to traffic, rail and aircraft noise and not on wind turbine noise. He argued that wind

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[186] Exhibit 129.11, Dang-Vu, T.T., McKinney, S.M., Buxton, O.M., Solet, J.M., & Ellenbogen, J.M. 2010. Spontaneous brain rhythms predict sleep stability in the face of noise. *Curr.Biol.*, 20, (15) R626-R627.

[187] Exhibit 129.02, Wind Turbine Noise, Sleep And Health, Dr. Christopher Hanning, page 11.

[188] Exhibit 129.02, Wind Turbine Noise, Sleep And Health, Dr. Christopher Hanning, page 61.

turbine noise is more annoying than other noise sources and referred to several of the Pedersen studies as support for that proposition.

8.4.3 Dr. Sarah Laurie

309. Dr. Laurie is a medical doctor from Australia. Dr. Laurie practiced as a rural general practitioner from 1999 to 2002. Dr. Laurie no longer practices medicine. Dr. Laurie has spent the last three years working for the Waubra Foundation, an Australian organization whose goal is to facilitate properly conducted, independent multidisciplinary research into the health problems identified by residents living near wind turbines. Dr. Laurie is currently the chief executive officer of that organization. Dr. Laurie has previously testified on behalf of opponents of wind farm projects in other jurisdictions. Dr. Laurie stated in her report that her interest in the health effects of wind turbines was prompted by a proposed wind development near her home.

310. In her report, Dr. Laurie summarized information provided to her by a number of individuals regarding the health effects they have experienced living near wind turbines. She stated that the symptoms reported included: sleep deprivation, stress and vestibular disorders. She stated that all of the people she spoke to reported that they had not experienced these symptoms prior to the construction of nearby wind turbines. She also observed that residents with pre-existing medical conditions experienced worsening of those conditions when the turbines were operating.

311. Dr. Laurie suggested in her report that the symptoms experienced by those living near turbines are likely caused by low frequency noise or infrasound produced by turbines. Dr. Laurie reviewed recent studies from Australia and Wisconsin that measured low frequency noise and infrasound produced by wind turbines at nearby residences. She stated that this recent Australian and Wisconsin empirical acoustic survey data demonstrated that wind turbines emit sound in frequencies below those measured using dBA, which have the potential to affect the health of some people.

312. Dr. Laurie challenged the notion that the symptoms experienced by those living near wind turbines are caused by the "nocebo" effect which suggests that nearby residents develop symptoms based on pre-existing knowledge and expectation of such symptoms.

313. Dr. Laurie summarized a number of unpublished studies that reported adverse health effects, including sleep disturbance by those living near wind turbines.[189] Dr. Laurie also referred to the paper by Salt and Hullar.

314. Dr. Laurie stated that she has not found any evidence to suggest that a two- kilometre setback for turbines from residences will protect residents from low frequency noise and infrasound. Dr. Laurie submitted that setbacks of five to 10 kilometres are necessary to protect human health.

8.4.4 Dr. Adrian Upton

315. Dr. Upton is a medical doctor with a specialty in neurology. He is a professor of medicine (neurology) at McMaster University and practices clinical neurology and neurophysiology in Hamilton, Ontario.

[189] Exhibit 184.02, Dr. Sarah Laurie, Expert report, paragraphs 56-73.

316. Dr. Upton was retained by the KLG to provide an expert opinion with respect to the effect that noise, shadow flicker and light pollution from the proposed project will have on J.B., and potential health effects of the proposed wind farms on J.B., a nine-year old boy with epilepsy who lives approximately 1,136 metres from one of the proposed turbines.

317. Dr. Upton reviewed J.B.'s medical records and filed a brief report dated February 21, 2013.[190] Dr. Upton stated that there is no indication that J.B. is photosensitive. Dr. Upton observed that "In 41 years of infant, pediatric care, and adult EEG records we have seen less than 10 seizure disorders caused by flickering of lights below 5 hertz."[191] Dr. Upton noted that the wind turbines turn at about three Hz. Dr. Upton concluded that flickering of light due to wind turbines should not produce any risk to J.B. However, Dr. Upton did note that J.B.'s medical records indicated that his absence attacks were worse with fatigue. Dr. Upton stated that J.B.'s risk of seizures would be increased by turbine noise and the effects of sleep impairment.

318. Dr. Upton also gave evidence during the hearing. Dr. Upton stated that the medical and epidemiological literature he reviewed supported a relationship between turbine noise and sleep deprivation.

319. It was Dr. Upton's opinion that all children in the project area were at risk of being negatively affected by noise from the proposed turbines.

320. Dr. Upton stated that, based upon studies by Nissenbaum, Bigelow and Pedersen, he believed that there is a dose response relationship between exposure to wind turbine noise and health effects. Dr. Upton also testified that he understood infrasound can travel distances over two kilometres and can trigger symptoms of sea sickness in susceptible individuals.

8.4.5 Mr. Rick James

321. The KLG also retained Mr. Rick James, the owner and Principal Consultant of E-Coustic Solutions. As noted above, Mr. James is an acoustical engineer and acoustician with expertise in the field of sound including noise, low frequency noise, sounds emitted from industrial wind turbines and human response to noise. Mr. James was also a founder and board member of the Society for Wind Vigilance. Mr. James has previously testified for wind project opponents in other jurisdictions.

322. Mr. James made a number of conclusions on the influence of infrasound and low frequency noise on the vestibular system. Mr. James stated that the work performed by Salt and Hullar demonstrated that the vestibular system responds to infra and low frequency sound. Mr. James also asserted that work by Dr. Nina Pierpont had established a causal link between low frequency noise and infrasound from wind turbines and medical pathologies.

323. Mr. James also reviewed a number of other reports that he believed supported the proposition that low frequency noise and infrasound from wind turbines can produce adverse health effects mediated through the body's organs of balance and proprioception.

[190] Exhibit 136.02, Dr. Adrian Upton, medical report of J.B., February 21, 2013.
[191] Exhibit 136.02, Dr. Adrian Upton, medical report of J.B., February 21, 2013, page 2.

8.4.6 Dr. McCunney

324. Dr. McCunney is a research scientist and medical doctor who is board certified in occupational and environmental medicine. Dr. McCunney has master's degrees in environmental health and public health and a medical degree. Dr. McCunney has contributed chapters on the implications of noise on health in two text books and lectured on the topic at the university level. Dr. McCunney is the author or co-author of numerous peer-reviewed articles in the field of occupational health including articles on the occupational exposure to noise.

325. Dr. McCunney has previously testified on behalf of wind farm developers in other jurisdictions. Dr. McCunney reviewed the medical records of three members of the KLG group and provided his opinion on whether the construction and operation of the proposed wind farm would exacerbate the medical conditions of those members. Dr. McCunney also reviewed and critiqued the expert reports of Drs. Upton, Laurie, Hanning and Phillips.

326. Dr. McCunney agreed with Dr. Upton that the scientific literature does not support the view that shadow flicker from the project will pose a risk of provoking a seizure in J.B. Like Dr. Upton, Dr. McCunney noted that the frequency of turbine blade rotation is too low to provoke a photo epileptic seizure.

327. Dr. McCunney noted that the nighttime noise levels associated with the project are not expected to be above 40 dBA. He observed that the WHO did not consider 40 dBA to be a noise level associated with sleep disturbance in its 2009 Guidelines. Dr. McCunney concluded that noise from the project would not adversely affect J.B.'s epilepsy.

328. Dr. McCunney reviewed the medical records and hearing submissions of C.H., a 45-year-old resident whose home is located approximately 1,315 metres from the nearest proposed turbine. C.H. was diagnosed with major depression and has received various treatments over the past 20 years. C.H. also reported that she suffered from insomnia. Dr. McCunney concluded that the anticipated turbine noise at C.H.'s home would not be sufficiently high to aggravate her underlying depression.

329. Dr. McCunney also reviewed the medical records of H.B., a 50-year-old resident whose home is located approximately 2,100 metres from the closest proposed turbine. H.B. was diagnosed with systemic lupus erythematosis in 1999 and with lupus nephritis in 2005. Dr. McCunney noted that there was no mention in the medical records of any noise related exacerbations of her lupus.

330. Dr. McCunney observed that H.B. lives more than 2.1 kilometres from the nearest wind turbine and concluded that "[a]t this distance, noise from the wind turbines will not adversely affect her lupus, an auto immune disorder not affected by noise."[192] He also concluded that any short-term shadow flicker experienced by H.B. when driving to pick up mail would not affect her lupus.

331. Regarding one KLG member's concerns about the impact of the project on pre-existing tinnitus, Dr. McCunney noted that it is a condition with many causes. He noted that it would be best if the resident had the tinnitus evaluated medically. He was of the view that the noise from the project was unlikely to have an adverse effect on this KLG member.

[192] Exhibit 203.02, Report of Dr. Robert McCunney, September 12, 2013, at page 7.

332. Dr. McCunney reviewed Dr. Laurie's report and it was his opinion that the report suffered from the following shortcomings:

- selective and incomplete interpretation of the scientific literature
- failure to address confounding in interpreting research studies
- citation of unpublished studies of dubious quality for forming public policy such as determining a proper noise level to protect human health
- failure to discuss noise levels predicted from the operations of the proposed turbines
- uncritical assessment of the literature
- inappropriate approach to diagnosis and causality

333. Dr. McCunney expressed particular concern that Dr. Laurie did not adequately address dose-response in her report. He stated that "one of the most important principles in evaluating the potential for exposure to any hazard to adversely affect human health is the dose-response relationship noted in research studies of humans exposed to hazard."[193] Dr. McCunney explained that the dose-response relationship essentially means that as the exposure to a hazard increases (in intensity or duration), so will the risk of disease from that exposure.

334. Dr. McCunney asserted that Dr. Laurie failed to take into account the dose-response relationship in her discussion of a 2001 National Institute of Environmental Health Sciences (NIEHS) review of scientific literature on infrasound. Specifically, Dr. McCunney noted that the infrasound described in the NIEHS report was generally at levels above 110 dBA which is many orders of magnitude above the expected noise levels produced by the proposed project at area residences (maximum 40 dBA). He stated that this report does not support Dr. Laurie's conclusion that exposure to wind turbine infrasound will cause health effects.

335. Dr. McCunney generally agreed with Dr. Hanning's observations regarding the physiology of sleep and the importance of sleep from a health perspective. However, it was Dr. McCunney's view that Dr. Hanning ignored two major documents that address environmental noise and sleep: the WHO 2009 guidelines and a 2007 epidemiology study by Pedersen et al.

336. Dr. McCunney observed that the WHO 2009 guidelines represented the consensus and conclusions of over 35 international scientists. He stated that this report concluded that noise levels less than 40 dBA would not adversely affect sleep.

337. Dr. McCunney stated that the 2007 Pedersen study was one of the largest studies conducted to date with over 750 people responding. He explained that of the 32 people who reported noise related annoyance, only 11 noted sleep disturbance. He also pointed out that the authors did not attribute the sleep disturbance to wind turbine noise.

338. Dr. McCunney observed that Dr. Hanning failed to cite publications that refute his assertion that wind turbine noise is different and more annoying than other sources of environmental noise. He noted that Dr. Hanning relied on Pedersen (2004) for this assertion but failed to note that the same authors did not report the same results in a larger, subsequent study (Pedersen 2009). Dr. McCunney also noted that Dr. Hanning concluded that sleep disruption can

[193] Exhibit 203.02, Report of Dr. Robert McCunney, September 12, 2013, at page 8.

occur at noise levels less than 35 dBA based upon a study in which the lowest noise levels referenced were 40 dBA.[194]

8.4.7 Dr. Ollson

339. Dr. Ollson has a doctorate degree in environmental science and a master's degree in environmental chemistry. Dr. Ollson's experience is in the evaluation of potential health effects associated with environmental issues. Dr. Ollson is the author or co-author of a number of peer-reviewed articles in the fields of environmental health and risk assessment. Dr. Ollson is an adjunct assistant professor at the Royal Military College in the department of chemistry and chemical engineering. Dr. Ollson has also taught graduate level courses in environmental risk assessment at the University of Toronto. Dr. Ollson has previously testified on behalf of wind project developers in other jurisdictions.

340. Dr. Ollson wrote a report on behalf of the applicant that was filed as reply evidence. In his report, Dr. Ollson provided his opinion with respect to the potential effects of the proposed project on human health. It was Dr. Ollson's opinion that the Commission's nighttime PSL of 40 dBA and the municipal setbacks in Provost and Wainwright are sufficient to protect against adverse health effects.

341. Dr. Ollson stated that a small proportion of people who live near wind turbines have reported adverse health effects such as ringing in ears, headaches, lack of concentration, vertigo and sleep disturbance. He noted that some people attribute these symptoms to turbine noise, including low frequency noise and infrasound, whereas others attribute the symptoms to environmental stressors that create an annoyed/stressed state for a small percentage of the population. Dr. Ollson supported the latter rationale as the cause of the observed symptoms.

342. In 2011, Dr. Ollson and a colleague published an article entitled *Health Effects and Wind Turbines: A Review of the Literature in Environmental Health*. They concluded that there was some evidence that wind turbines can be a source of annoyance (especially at sound levels above 40 dBA) but no evidence demonstrating a "direct causal link between living in proximity to a wind turbine and other more serious physiological health effects".[195] Dr. Ollson stated that some of the key findings in this article include:

- People tend to notice sound from wind turbines almost linearly with increasing sound pressure level, from roughly five to 15 per cent noticing noise at 29 dBA to 45 to 90 per cent noticing noise at 41 dBA.
- Of people who notice sound from wind turbines, the proportion who are fairly annoyed or very annoyed remains fairly constant through the 29 to 37 dBA range (no more than roughly five per cent), but increases at noise levels above 37 dBA, with peaks at 38 dBA and 41 dBA where up to 30 per cent of people may be very annoyed.
- Noise annoyance is not only related to wind turbine noise itself, but also to subjective factors like attitude to visual impact, attitude to wind turbines in general and sensitivity to noise.

[194] Dang-Vu et al. 2010. Spontaneous brain rhythms predict sleep stability in the face of noise. Current Biology. 20:R626-7 as referenced in Exhibit 129.02, Wind Turbine Noise, Sleep And Health, Dr. Christopher Hanning, page 64.

[195] Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 6.

- Visual impact has come out as a stronger predictor of noise annoyance than wind turbine noise itself.
- People who economically benefit from wind turbines have significantly decreased levels of annoyance compared to individuals that received no economic benefit, despite exposure to similar sound levels.[196]

343. Dr. Ollson reviewed a number of peer-reviewed articles on wind turbine noise and health effects that were published after his 2011 article. Dr. Ollson's conclusions with respect to these articles were similar to those outlined in the bullets above.

344. The articles on low frequency noise and infrasound reviewed by Dr. Ollson had varying conclusions. One article reported health effects experienced by the authors and attributed to low-frequency sound, but at sound pressures lower than those which have ever been shown to cause a physical response in humans.[197] Another article, a literature review, concluded that claims that low frequency noise and infrasound cause serious health effects lack empirical support.[198]

345. Dr. Ollson also reviewed reports prepared by a number of government agencies.[199] He submitted that the overall conclusion of these agencies was that noise from wind turbines can be a cause of annoyance, but is not causally related to adverse health effects.

346. Dr. Ollson concluded that noise from wind turbines is not causally related to adverse effects but can be cause of annoyance to some people. He stated that annoyance caused by wind turbine noise, especially at sound pressure levels in excess of 40 dBA, may be associated with health effects. Dr. Ollson contended that the studies and articles he reviewed support the proposition that subjective variables, like visual impact, attitude and personality traits are more strongly related to annoyance than noise itself. He submitted that the adverse effects experienced by some people living near wind turbines are likely a response to stress and annoyance which arise from multiple environmental and personal factors and do not arise from some unique characteristic of wind turbines.[200]

347. Dr. Ollson also commented on the reports prepared by Drs. Hanning, Phillips, Laurie and Upton and Mr. James. Dr. Ollson generally disagreed with the conclusions of these experts regarding health effects associated with wind turbines.

[196] Ibid, page 7.
[197] Ibid, page 18.
[198] Exhibit 202.2, Infrasound and low frequency noise from wind turbines: exposure and health effects Karl Bolin, Gosta Bluhm, Gabriella Eriksson and Mats E Nilsson.
[199] Chatham-Kent Public Health Unit; the Chief Medical Officer of Health Ontario, 2010; Australian Government, National Health and Medical Research Council, 2010; Australian Senate, 2011; Massachusetts Department of Environmental Protection (MassDEP) and Massachusetts Department of Public Health (MDPH), 2012, Oregon Health Authority, 2012; South Australia Environmental Protection Authority, 2013).
[200] Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 31.

348. Dr. Ollson also reviewed scientific literature on shadow flicker. He noted that the scientific consensus is that shadow flicker does not pose a risk of inducing seizures in photosensitive epileptics. He noted that Germany is one of the only countries to implement shadow flicker guidelines. Those guidelines are as follows:

- maximum 30 hours per year of astronomical maximum shadow (worst case)
- maximum 30 minutes worst day of astronomical maximum shadow (worst case)
- maximum eight hours per year actual[201]

8.4.8 Dr. Leventhall

349. Dr. Leventhall is an acoustician from the United Kingdom. He has a bachelor's degree in physics and masters and doctorate degrees in acoustics. Dr. Leventhall was a professor and head of the Institute of Environmental Engineering at London South Bank University. Dr. Leventhall was the founding editor of the Journal of Low Frequency Noise and Vibration and edited that publication for 18 years. Dr. Leventhall has written a number of articles and a book on wind turbine noise. Dr. Leventhall has previously given expert evidence on behalf of wind developers in other jurisdictions.

350. Dr. Leventhall prepared an expert report on behalf of the applicant which was filed as reply evidence. In his report Dr. Leventhall provided some background about sound power and pressure, sound frequencies and their levels. His report described low frequency noise and infrasound and described their relationships to wind turbines. Dr. Leventhall also provided a critique of the evidence filed by Mr. James and Dr. Laurie.

351. Dr. Leventhall stated that there are widespread misunderstandings about infrasound and low frequency noise. He stated that some of these misunderstandings arise from focusing on frequency while ignoring sound power levels. Another source for misunderstandings described by Dr. Leventhall related to the difference between tonal and broadband low frequency noise. He explained that tonal noises are more annoying than the broadband low frequency noise usually associated with wind turbines.

352. Dr. Leventhall contended that wind turbines do not normally produce audible tones at infrasonic or low frequencies. He noted that low frequency noise produced by wind turbines is generally at about five dB/octave and does not exceed the hearing threshold at normal separation distances until frequencies greater than 40 Hz to 50 Hz are reached. Dr. Leventhall noted that infrasound, like sound at other frequencies, attenuates with distance at a rate of six dB for each doubling of distance. He acknowledged that under certain weather conditions the attenuation at a distance from the source may reduce to three dB for each doubling of distance.

353. Dr. Leventhall argued that there is no evidence that inaudible infrasound from wind turbines disturbs the vestibular system. It was his opinion that this misconception was initiated by Dr. Pierpont in her book, *Wind Turbine Syndrome: A Natural Experiment*. He stated that Dr. Pierpont misinterpreted a paper that compared vestibular and cochlear detection of vibration applied to the mastoid bone. Dr. Leventhall noted that the author of that paper later repudiated Dr. Pierpont's application of his work to infrasound from wind turbines.[202] Dr. Leventhall also stated that the work of Dr. Pierpont was not a study of the effects of infra and low frequency

[201] Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 21.
[202] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 7, paragraph 30.

sound on the organs of balance, as claimed by Mr. James. Instead, he stated that Dr. Pierpont's book simply reported the symptoms experienced by some people living near a wind turbine.

354. Dr. Leventhall questioned Mr. James' conclusions regarding infrasound and low frequency noise on the vestibular system. Dr. Leventhall did not agree with Mr. James that the work performed by Salt and Hullar demonstrates that the vestibular system responds to infrasound and low frequency noise. Dr. Leventhall stated that while Salt and Hullar's work demonstrated that the outer hair cells in experimental guinea pigs responded to infra and low frequency noise at levels below the hearing threshold this was not a vestibular response.

355. Dr. Leventhall pointed out the following quotation from a 1995 WHO document:

> There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects. Infrasounds above detection threshold may cause perceptual effects but these are of the same character as for "normal" sounds. (Page 41 Community Noise, 1995)[203]

356. Dr. Leventhall noted that Dr. Laurie is highly dismissive of the nocebo effect. However, he was of the view that this argument was a strong one that should not easily be dismissed. Dr. Leventhall submitted that there are several papers that illustrate how perceptions regarding the ill health effects of wind turbines may affect outcomes.[204]

357. Dr. Leventhall also expressed the same concern that Dr. McCunney had about Dr. Laurie's reliance on the 2001 NIEHS report on infrasound. He argued that none of Dr. Laurie's references to this report were relevant to wind turbine noise given the difference in dosage.

358. Dr. Leventhall also questioned Dr. Laurie's reference to a paper that he had co-authored for the United Kingdom Department for Environment Food & Rural Affairs. Dr. Laurie cited this report as evidence that exposure to infrasound and low frequency noise leads to deterioration in health. Dr. Leventhall explained that the study related to the exposure of sleeping children to low frequency noise (65 dB at 60 Hz) from heavy trucks. He stated that this data should not be compared to wind turbine noise because it related to a different noise spectrum shape and higher sound levels.

359. Dr. Leventhall addressed the Shirley Wind Farm study in his report. He stated that this study measured infrasound at a distance of 330 metres from the nearest turbine. He stated that the report showed little new information because it was already accepted that wind farms produce infrasound down to very low frequencies.

360. Dr. Leventhall challenged the hypotheses of Dr. Schomer, one of the authors of the Shirley Wind Farm study, that feelings of illness reported by some people living near wind farms were associate with the 0.2 Hz frequency that may occur in turbine noise. Dr. Leventhall acknowledged that 0.2 Hz is a frequency most likely to cause motion sickness when experienced through whole body vibration. Dr. Leventhall argued that whole body vibration at 0.2 Hz has a different pathway than infrasound at 0.2 Hz.

[203] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 1, paragraph 53.
[204] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, page 14.

361. Dr. Leventhall explained that natural infrasound in the region of 0.2 Hz can be produced by marine storms (microbaroms) and noted that humans are not affected by this infrasound which is at higher sound pressure levels than wind turbine infrasound at 0.2 Hz. Dr. Leventhall also noted that the fluid of the inner ear is exposed to high-level, infrasonic pulses from normal internal process such as heartbeat, breathing, etc. He argued that it was therefore implausible that the ear is affected by similar low frequency infrasound from wind turbines.

362. Dr. Leventhall also discussed the issue of wind turbines and annoyance in his report. He noted three studies that suggested that there is little difference between annoyance associated with industrial noise, wind turbine noise and transportation noise at similar levels. He noted that any effects from wind turbines are likely to stem from audible noise but pointed out that an audible noise is not necessarily an annoying noise.

363. Dr. Leventhall reviewed the importance of attitudes towards a noise source, including fear of a noise source, when considering responses to that noise source. He noted several studies that showed a correlation between levels of fear or worry about a noise source and levels of annoyance with the noise source.

8.5 Commission findings

364. In this section, the Commission considers whether operation of the project may cause adverse health effects for nearby residents, including those with pre-existing medical conditions. Eight expert witnesses filed reports and testified on this topic in the proceeding.

365. The record before the Commission on this topic was considerable. In addition to the expert reports, numerous medical, epidemiologic and acoustic studies and reports were referenced or filed in the proceeding. These reports varied widely; some were prepared by experts in the various fields, some were prepared by government agencies and some were authored by laypeople. Some of the studies filed were peer reviewed while others were simply published on the Internet. When sifting through the material filed, the Commission focused most on those studies that had been described, endorsed or critiqued by the experts attending the hearing. Another factor the Commission took into account when reviewing this part of the record was whether the report or study had been peer-reviewed.

366. The KLG's health concerns about the project related to various symptoms that have been reported by some people living near wind turbines, including sleep disturbance, headache, tinnitus, other ear and hearing sensations, disturbance to balance and equilibrium, nausea, anxiety and irritability. Those symptoms have been attributed to the audible and inaudible noise (low frequency noise and infrasound) produced by wind turbines and to the stress or annoyance arising from living in the proximity to wind turbines.

367. Before providing its conclusions on the substantive issues, the Commission must first address the issue of witness objectivity and the weight that should be accorded to the evidence of the various experts that participated in the proceeding.

8.5.1 Findings on expert objectivity and weight

368. The Commission finds that Drs. Hanning, McCunney and Ollson, and Mr. James all provided evidence that was consistent with their expertise and in a relatively objective manner. These experts demonstrated considerable knowledge of the wind turbine, health-related issues raised in the hearing and demonstrated some flexibility in the views and positions that they

presented to the Commission. The Commission found these witnesses to be credible and, subject to the exceptions discussed later in these findings, their evidence to be useful.

369. The Commission finds that Dr. Phillips provided evidence that was consistent with his expertise. The Commission is also satisfied that Dr. Phillips attempted to provide his evidence in an objective manner. It observes that Dr. Phillips was far less definitive in his oral testimony than he was in his written evidence with respect to many of his conclusions. This suggests to the Commission that Dr. Phillips retained some flexibility in his views regarding the health effects associated with wind turbines. However, for reasons provided later in this decision, the Commission finds that it can give little weight to Dr. Phillips' specific conclusions regarding the project's health effects on nearby residents.

370. The Commission finds that Dr. Leventhall is an expert in the field of acoustics with considerable training, knowledge and experience on the topic of low frequency noise and infrasound and its effects, a field in which he has practiced for more than 40 years. The Commission finds that Dr. Leventhall's evidence was based upon his scientific convictions that appeared to be reasonably held and supported.

371. The Commission recognizes that Dr. Leventhall expressed strong views about the work of other scientists or authors who did not share his views. While the Commission observes that Dr. Leventhall sometimes expressed these concerns in a manner that was more pointed than was necessary, in the Commission's view, this did not detract from his objectivity on the topics of his expertise. The Commission observes that under cross-examination Dr. Leventhall recognized and even praised the contributions of other scientists or acousticians whose views he did not share.[205] The Commission found Dr. Leventhall's evidence to be credible and it was of assistance to it.

372. The Commission accepts Dr. Upton as an expert in neurology and finds that his evidence regarding J.B.'s epilepsy was credible and consistent with the evidence of other expert witnesses on that topic and was of assistance to the Commission. Dr. Upton also provided an opinion about the general health effects of the proposed turbines on J.B. and other children in the project area in his opening statement. Dr. Upton stated that his conclusions in this regard were based on literature he had read on wind turbines.

373. In the Commission's view, Dr. Upton did not appear to have specialized knowledge or experience specifically with respect to wind turbines and their health effects (other than epilepsy). Dr. Upton appeared to be unfamiliar with the qualifications of some of the authors of the reports he relied upon in forming his opinion on the health impacts of wind turbines or whether the reports he referenced were published or peer reviewed. The Commission took this apparent unfamiliarity with the subject into account when it weighed Dr. Upton's evidence regarding the general health impacts of wind turbines on nearby residents.

374. The Commission accepts that Dr. Laurie is a currently unlicensed medical doctor with experience in rural medicine. It is clear to the Commission that Dr. Laurie has taken considerable interest in the issue of health effects associated with wind turbines since she stopped practising medicine. Dr. Laurie's report included descriptions of symptoms reported to her by people living near wind turbines. Her submissions and conclusions on this topic were similar to, and even

[205] For example, Dr. Leventhall agreed with many of the conclusions of Dr. Swinbanks, Transcript, Volume 2, page 331, lines 9-15, pages 332-333, lines 24-3, page 335, lines 2-3. Dr. Leventhall also stated that the published work of Salt was scientifically credible at Transcript, Volume 2, page 311, line 15.

referenced, the submissions and conclusions of Dr. Phillips. Accordingly, the Commission's conclusion on this element of her evidence was that there are a number of people that live near wind turbines that have reported a similar set of symptoms.

375. Dr. Laurie's written evidence also included her interpretation and discussion of numerous published and unpublished epidemiological and acoustical reports and studies. In the Commission's view, Dr. Laurie lacks the necessary skills, experience and training to comment on the interpretation of epidemiologic studies or the interpretation of acoustical studies and reports. The Commission gave little weight to this aspect of Dr. Laurie's evidence.

8.5.2 Health effects from audible wind turbine noise

376. The evidence before the Commission was that audible noise from wind turbines can be associated with sleep disturbance and annoyance, both of which can lead to other health effects including those symptoms described above.

377. All of the experts agreed that audible wind turbine noise can result in sleep disturbance but disagreed about the level at which such disturbance may occur. If the project is approved, the applicant must comply with AUC Rule 012, which dictates that the cumulative noise at nearby receptors cannot exceed the nighttime PSL of 40 dBA L_{eq}. The parties disagreed about whether compliance with the PSL would protect the health of nearby residents.

378. The applicant's witnesses submitted that, if the cumulative noise including wind turbine contributions at nearby receptors was less than 40 dBA L_{eq}, the sleep and health of nearby residents would not be affected. The applicant submitted that the project's 40 dBA L_{eq} nighttime PSL was consistent with the WHO 2009 guidelines and would be protective of human health for nearby residents.

379. The KLG submitted that sleep disturbance and health effects caused by audible wind turbine noise can occur at levels below 40 dBA. The KLG and its experts referenced the Nissenbaum and Bigelow studies described earlier in support of this position. Dr. Phillips submitted that even if noise from the project meets the 40 dBA L_{eq} nighttime PSL, three per cent of area residents will experience severe health effects and approximately 50 per cent will experience some health effects if the project is approved.[206]

380. The Commission does not find the Nissenbaum study to be compelling evidence that wind turbine noise below 40 dBA will cause sleep disturbance or health effects. The Commission considers that the study's use of noise data from publically available records and from a single day of measurements is not a sufficient basis for drawing conclusions about a dose-response relationship for wind turbine noise. However, even if the use of such data was sufficient, the Commission notes that there were very few sites identified in the study with levels in the 30 to 40 dBA range. Most of the predicted and measured noise levels for the individuals that lived between 375 metres and 1,400 metres, appear to have been in excess of 40 dBA, especially when the range of predicted or measured wind turbine noise is considered rather than the average. The Commission also observes that the higher rates of reported sleep disturbance appear to be associated with noise levels above the 40 dBA level.

381. The Commission is of the view that the unpublished Bigelow study referenced by the KLG in its evidence is of little assistance to it when considering the possible health effects

[206] Exhibit 134.02, Expert report of Carl V. Phillips PhD, February 21, 2013, page 13.

associated with wind turbine noise. One of the report's authors, Dr. Bigelow, acknowledged that there are concerns with the very low response rate for the study and the resultant opportunity for bias that could invalidate the study' results. Another concern for the Commission is that the conclusions of the report are based on distance rather than noise levels. Finally, the Commission observes that the report is an initial draft that has yet to be peer reviewed.

382. The Commission carefully reviewed the evidence provided by Dr. Phillips and finds that his prediction that three per cent of area residents will experience severe health effects and approximately 50 per cent will experience some health effects is not supported by the evidence for the following reasons.

383. First, Dr. Phillips provided little rationale for his predictions regarding the number of people who would experience health effects from the project. Dr. Phillips stated he based his prediction that 50 per cent of nearby residents will experience health effects on "things like the Nissenbaum study"[207] but did not elaborate further. Dr. Phillips also qualified his prediction that three percent of nearby residents would experience serious health effects and stated "[t]he numbers for the severe impacts are much fuzzier, and I hope I haven't over-stated the precision that I'm claiming here, and those are based on situations where we seem to have pretty thorough collections of adverse event reports".[208]

384. Second, Dr. Phillips confirmed that his conclusions were not based upon any particular adverse event reports and, in fact, he had not reviewed any adverse event reports in the preparation of his written evidence. He clarified that the adverse event reports or series that he discussed in his evidence were included just to demonstrate that such reports are out there.[209]

385. Third, Dr. Phillips confirmed that the data he looked at was not organized in a systematic way and that he did not break down the data to determine a dose-response relationship between wind turbine operation and the symptoms he described.[210] In other words, he did not correlate the prevalence or the intensity of the constellation of symptoms he identified with the sound levels at the persons' residences or the distance between the person experiencing the symptoms and the turbine(s) in question.

386. Fourth, Dr. Phillips conceded that he had not specifically defined the population upon which his conclusions were based upon. Dr. Phillips stated:

> The population of interest for the analysis that I've done over the years has been less precisely defined than is ideal, though not particularly less precisely defined than many epidemiologic studies, which is basically people living near wind turbines. What does "near" mean? I think I've pointed out quite explicitly that we don't know exactly. You know, 1 kilometre is definitely near. 2 kilometres I would argue is still definitely near. Is 3? Is 4? Probably not, maybe. So we're talking about that population.[211]

387. Having regard to the health-related evidence on the record, the Commission finds that the most comprehensive report regarding the effects of noise on sleep disturbance filed in the proceeding was the WHO 2009 guidelines. In those guidelines, the WHO found that

[207] Transcript, Volume 3, page 830, lines 15-17.
[208] Transcript, Volume 3, page 830, lines 23-25.
[209] Transcript, Volume 3, pages 804-805, lines 25-22.
[210] Transcript, Volume 3, pages 809-811, lines 5-1.
[211] Transcript, Volume 3, pages 811-812, lines 21-5.

40 dB $L_{night, outside}$ is equivalent to the lowest observed adverse effect level for night noise. It also found that there is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night, outside}$ are harmful to human health. The WHO concluded:

> For the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than 40 dB $L_{night, outside}$ during the part of the night when most people are in bed. The LOAEL [lowest observed adverse effect level] of night noise, 40 dB $L_{night, outside}$, can be considered a health-based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.[212] (Emphasis added)

388. The Commission finds that the 40 dBA L_{eq} nighttime PSL for the project is the practical equivalent to the WHO's 40 dB $L_{night, outside}$, limit in the 2009 guidelines. This was confirmed by Dr. Leventhall[213] and Mr. James.[214]

389. The KLG argued that the 40 dB $L_{night, outside}$ should not apply to wind turbine noise because the WHO 2009 guidelines did not specifically reference wind turbine noise, which is different in character from the transportation noise considered in the 2009 guidelines. It therefore argued that a level lower than 40 dBA was appropriate. In support of this position the KLG observed that one of the studies by Pedersen et al. concluded that noise from wind turbines was perceived as being more annoying than all other sources of transportation noise, with the exception of railroad shunting yards.[215]

390. The Commission does not agree with the KLG that the fact that wind turbine noise has been perceived as being relatively annoying compared to other sources of community noise, invalidates the WHO's conclusions regarding nighttime noise as they relate to wind turbines. The Commission notes that another paper published by Pedersen in 2009 looked at three separate studies on sleep disturbance and wind turbine noise, two in Sweden and one in the Netherlands.[216] Pedersen reported that the impact of wind turbine and traffic noise on sleep disturbance did not increase gradually with noise levels, rather it increased sharply at around 40 dBA in one of the Swedish studies and at approximately 45 dBA in the Dutch study.[217]

391. The Commission also observes that the same authors of the study referenced by the KLG above published a subsequent study in 2012 (the Bakker, Pedersen, et al. study).[218] In that study the authors found that wind turbines were less frequently reported as a sleep disturbing sound

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[212] Exhibit 131.11, World Health Organization, Night Noise Guidelines for Europe, 2009, page XVIII.

[213] Transcript, Volume 1, pages 195-196, lines 25-1.

[214] Transcript, Volume 8, page 1782, lines 16-17.

[215] Exhibit 129.02, Wind Turbine Noise, Sleep And Health, Dr. Christopher Hanning, page 21, paragraph 3.4.4, Exhibit 130.16, Eja Pedersen,Frits van den Berg, Roel Bakker, Jelta Bouma, Response to noise from modern wind farms in the Netherlands, Journal of the Acoustical Society of America, August, 2009, page 641.

[216] Exhibit 130.15, Eja Pedersen, Effects of wind turbine noise on humans, paper for the Third International Meeting on Wind Turbine Noise, Aalbord, Denmark 17-19 June 2009. Pedersen later published a revised version of this paper in Noise Control Engineering Journal (1) Jan-Feb 2011. The conclusions cited above were consistent in both versions of the paper.

[217] Ibid, Pedersen noted that sleep interruption was not common in the second Swedish study which was conducted in a more densely populated area.

[218] R.H. Bakker, E Pedersen, G.P. van den Berg, R.E Stewart, W. Lok, J Bouma, Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress., Science of the Total Environment 2012 (425) (2012) 42-51 as referenced in Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 9.

source than other environmental sound sources such as sounds produced by people, animals, traffic and other mechanical processes.[219]

392. The authors of this study reported that only three per cent of persons receiving economic benefit from the wind turbines found outdoor turbine noise to be annoying or highly annoying compared to 12 per cent of persons who received no benefit. They also observed that persons benefitting from the turbines were the most highly exposed to the turbine noise. Regarding sleep disturbance from wind turbine noise, the authors noted that the frequency of sleep disturbance was reported as being almost exactly the same for sound levels of 30 to 35, 35 to 40 and 40 to 45 dBA. The authors observed:

> …sleep disturbance increased with increasing sound pressure level due to wind turbines, but this increase is significant only at high levels... The significant increase in sleep disturbance at sound pressure levels of 45 dB(A) and higher is close to the recommendation of the WHO that an average outdoor noise level at night should be no more than 40 dB(A)[220]

393. In the Commission's view, the conclusions of these reports by Pedersen et al. support the application of the WHO 2009 guidelines to wind turbine noise. Both reports suggest that increases in sleep disturbance from wind turbines occur at noise levels between 40 and 45 dBA which is consistent with the WHO's identification of 40 dB $L_{night,\ outside}$ as the lowest observed adverse effect.

394. The Commission finds that, in addition to being consistent with the WHO's recommended guideline for nighttime noise, the 40 dBA L_{eq} nighttime PSL (outside) for the project is generally consistent with nighttime noise limits for wind turbines in other jurisdictions in Canada and abroad as shown in Table 2.

395. The evidence before the Commission was that the nighttime noise limits for turbine noise in other jurisdictions are generally between 35 dBA and 43 dBA. The Commission recognizes that the values shown in the chart are not directly comparable because each depends on a number of variables including wind speed(s), location (rural vs. urban), exposure time (i.e., LA_{90} vs. LA_{10}), etc.

396. One important difference between the Alberta noise limits and the noise limits in other jurisdictions is that the Alberta limits are based on cumulative noise whereas the limits in some other jurisdictions are based on project noise alone. The effect of using a cumulative value rather than a project-based value can be easily quantified. To meet the project PSL, the contribution from the project can be no more than 38.4 dBA because noise levels higher than that would result in a cumulative predicted sound level, which includes the assumed ambient sound level of 35 dBA, in excess of 40 dBA.

397. Notwithstanding the variations between these limits, the Commission finds that the nighttime noise limits in other jurisdictions at or near the 40 dBA level generally consistent with the WHO's 40 dB $L_{night,\ outside}$ nighttime noise limit. This uniformity suggests to the Commission that a number of other jurisdictions have considered what nighttime noise limits are appropriate

[219] R.H. Bakker, E Pedersen, G.P. van den Berg, R.E Stewart, W. Lok, J Bouma, Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress., Science of the Total Environment 2012 (425) (2012) 42-51 as referenced in Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 9.

[220] Ibid, page 48.

for wind turbines and have determined that a limit in the range of 40 dBA would be protective of human health.

398. The evidence provided by Mr. James regarding audible turbine noise also supports the reasonableness of the 40 dBA L_{eq} PSL for nighttime noise. Mr. James testified that he had worked with many U.S. communities at the local or township level to set nighttime noise standards. He stated that he has recommended a 35 dBA L_{eq} as a not-to-exceed level for audible noise to prevent sleep disturbance but noted that most communities he worked with set levels between 35 dBA and 40 dBA. Mr. James explained that his 35 dBA L_{eq} recommendation is based on a 40 dBA limit to protect health with a five dBA penalty to account for the "swishing" sound that turbines make at night. Mr. James stated that the 40 dBA starting point was based in part on the WHO 2009 guidelines and also on his own experience:

> … I worked for years with large auto manufacturers where we put in assembly plants, stamping plants, foraging plants, foundries, et cetera. We have found if we can stay below 40 at the nearest residence property line, we generally don't have complaints. Unless there is impulsive noise like near a foraging operation or a stamping plant, with a scrap operation, in which case we may have to set a lower limit or ask the industrial emitter to use noise controls to eliminate those sounds.
>
> …
>
> But 40 seems to be a point at which -- it doesn't eliminate complaints, but we don't have reports of adverse health effects.
>
> People may still say they hear it on their patio and it annoys them, but we don't get people showing up with sleep disturbance, et cetera . [221]

399. Having regard to the foregoing, the Commission finds that adherence to the 40 dBA L_{eq} nighttime PSL for the project will protect the members of the community surrounding the project, including children, the chronically ill and the elderly, from health effects related to audible noise produced by the project. The 40 dBA L_{eq} PSL is practically consistent with the WHO 2009 guidelines of lowest observable adverse effects for nighttime noise and is also generally consistent with the nighttime noise levels set in other Canadian and international jurisdictions. Finally, even without taking into account the fact that the project PSL is cumulative rather than project specific, it is consistent with the nighttime noise limits adopted by many of the American jurisdictions that Mr. James has advised.

8.5.3 Health effects from low frequency noise and infrasound) from wind turbines

400. In this section, the Commission must decide if low frequency and infrasound produced by the project, if approved, is likely to result in health effects for nearby residents. The Commission finds, for the reasons that follow, that the evidence filed in this proceeding does not support such a finding.

401. In Section 7, the Commission accepted the applicant's low frequency noise analysis, including its assertion that there was no indication that operation of the project would result in a contribution to low frequency noise or audible infrasound at receptors.

[221] Transcript, Volume 8, pages 1780-1781, lines 9-1.

402. The Commission finds that even if the infrasound or low frequency noise produced by the project is present at receptors, the evidence in this proceeding does not support the KLG's contention that the infrasound or low frequency noise will cause adverse health effects because it will not be at sound pressure levels associated with such health effects.

403. The KLG submitted that infrasound produced by wind turbines may be responsible for many of the symptoms reported by some individuals that live near wind turbines. In support of these assertions, the KLG urged the Commission to review the work by Salt and Hullar,[222] Schomer and Swinbanks.

404. The Commission finds that Salt and Hullar's work does not support the KLG's assertion. While they observed that the sensory cells or structures of a guinea pig's inner ear, including the outer hair cells, can be stimulated by low frequency sounds at levels below those that can be heard, they did not conclude that this stimulation is associated with health effects. To the contrary, Salt and Hullar stated "[t]he fact that some inner ear components (such as the OHC [outer hair cells]) may respond to infrasound at the frequencies and levels generated by wind turbines does not necessarily mean that they will be perceived or disturb function in any way".[223]

405. In the Shirley Wind Farm study, Dr. Schomer predicted that the blade pass frequency of future large wind turbines would be about 0.2 Hz. He noted that a 1986 study by the U.S. Navy reported that a vibration frequency of 0.2 Hz induced motion sickness for pilots in flight simulators. He hypothesized that if one could make "the leap from physical vibration of the body to physical vibration of the media the body is in, it suggests adverse response to wind turbines is an acceleration or vibration problem in the very low frequency region".[224] Dr. Schomer expanded on this hypotheses in a paper published in Acoustics Today in October, 2013 in which he postulated that the force generated on the otolith in the inner ear by acceleration at a certain rate is nearly identical to the force generated by acoustic pressure at a certain level and frequency.[225]

406. Dr. Schomer's hypothesis is untested, and premised upon the assumption that the effects of the wind turbine infrasound mediated through the ear will be the same as direct physical vibration of the body. Further, the hypothesis does not account for the fact that there is atmospheric infrasound at the same frequency but higher power levels than those produced by wind turbines that is not associated with the symptoms described. Dr. Leventhall explained that marine storms can generate acoustic waves called microbaroms, which peak at a frequency of 0.2 Hz. Dr. Leventhall testified that these microbaroms can travel for thousands of kilometres with little attenuation at power spectral levels around 120 dB, and have not been known to cause symptoms.[226]

407. In the Commission's view, Dr. Schomer's hypothesis is not compelling evidence of a link between infrasound that may be produced by wind turbines and the symptoms reported by some residents living near wind turbines.

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[222] Exhibit 141.17, Alec N. Salt and Timothy E. Hullar, Responses of the ear to low frequency sound, infrasounds and wind turbines, Hearing Research 268, 2010.

[223] Exhibit 141.17, Alec N. Salt and Timothy E. Hullar, Responses of the ear to low frequency sound, infrasounds and wind turbines, Hearing Research 268, 2010, page 19.

[224] Exhibit 141.10, A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin – December 24, 2012, page 7.

[225] Exhibit 219.05, Comments on Recently Published Article, "Concerns About Infrasound From Wind Turbines", Paul D. Schomer.

[226] Exhibit 202.11, Witness Statement of Dr. Geoff Leventhall, pages 18 and 32-34.

408. Two papers by Dr. Swinbanks were filed by the KLG in response to information requests from the applicant to Mr. James.[227] One was a paper presented by Dr. Swinbanks at a wind turbine noise conference in Rome and the other was a paper he presented at a conference in New York. The underlying premise of both papers was that low frequency noise and infrasound produced by wind turbines may be perceptible at lower levels than previously observed. The New York paper compared simulated wind turbine infrasound with a reference signal 2.14 Hz infrasound at 110 dB sound pressure level that was used in another study by Yuan et al.[228] Dr. Swinbanks' conclusions were based entirely on numerical simulations; there was no assessment of sound perception by human subjects. Dr. Swinbanks noted that the five young adults that had been exposed to the reference signal in the Yuan et al. study, which was only 10 dB to15 dB below his simulated levels, experienced adverse effects after one hour.

409. Mr. James referenced the two papers by Dr. Swinbanks in his information responses but did not comment on them or otherwise explain their relevance in those responses. Mr. James also briefly mentioned these papers in his oral evidence. The KLG briefly questioned Dr. Leventhall on these two papers and was asked whether he disagreed with anything in the New York paper. Dr. Leventhall's response was:

> Yes. What I disagree with, I disagree with people who take a single frequency at a very high level and try to say that it has some relevance to wind turbines. It has not.
>
> Wind turbine sound down to 2 hertz is a gently varying broadband sound. Broadband sound and pure tones have a different effect on people.[229]

410. The KLG did not explain what inferences or conclusions that it wanted the Commission to draw from these two papers in its evidence or argument, other than to urge the Commission to read them. The only person at the hearing who addressed these papers in a meaningful way was Dr. Leventhall, who noted that the infrasound simulated by Dr. Swinbanks in one his studies was dissimilar to the infrasound that is produced by wind turbines. Dr. Leventhall's evidence in this regard was uncontroverted. Accordingly, the Commission did not find the KLG's reference to these two papers to be of assistance to it when considering the KLG's concerns about the low frequency and infrasound that may be produced by the project.

411. The Commission concludes that the studies by Salt and Hullar, Schomer, and Swinbanks do not support the KLG's position that infrasound or low frequency noise produced by the project will cause adverse health effects for area residents. In the Commission's view, the evidence before it suggests a contrary conclusion.

412. As noted earlier, infrasound occurs naturally in the human body, the environment and as a result of human activity. In fact, the 2013 NIA predicted that low frequency noise already exists at many receptors in the project area. The work by Turnbull et al. referenced and explained by Dr. Leventhall in his witness statement, and discussed in the previous section demonstrates that exposure levels for infrasound from wind turbines are similar to exposure levels for

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[227] Exhibit 196.06, M.A. Swinbanks, The Audibility of Low Frequency Noise, April, 2011, Exhibit 196.07, M.A. Swinbanks, Numerical simulation of infrasound perception, with reference to prior laboratory results, August, 2012.

[228] Exhibit 196.07, reference Chen Yuan, Huang Quibai, Hanmin Shi, "An Investigation on the Physiological and Psychological Effects of Infrasound on Persons", Journal of Low Frequency Noise Vibration and Active Control, 2004.

[229] Transcript, Volume 2, page 337, lines 18-24.

infrasound from ocean waves, power stations and a large city.[230] This suggests to the Commission that infrasound from the proposed project is unlikely to result in adverse health effects for nearby residents.

413. The O'Neal et al. study referenced above was also helpful to the Commission when considering the health effects of low frequency noise and infrasound produced by wind turbines. As noted earlier, the authors of that study measured the infrasound and low frequency noise from two turbine types and found that they complied with several different national standards or criteria for low frequency noise, infrasound and vibration, including the American National Standards Association standard for low frequency noise in bedrooms, classrooms and hospitals (see paragraph 171).

414. While the Commission recognizes that the 2.3-MW turbine used in the O'Neal et al. study is slightly smaller than the 2.5-MW turbines proposed for the project, it nonetheless considers this to be the best evidence on the record regarding the infrasound and low frequency noise likely to be produced by project's turbines. In the Commission's view, the fact that the measured low frequency noise and infrasound from the 2.3-MW turbine complied with the international standards and criteria discussed earlier supports the conclusion that the low frequency and infrasound produced by the project will not result in adverse health effects.

415. The Commission also found a recent study by Bolin et al.,[231] which was referenced and explained in Dr. Ollson's evidence, to provide compelling evidence about the absence of health effects associated with low frequency noise and infrastructure. What the Commission found particularly helpful in this paper was that it effectively summarized and brought together the conclusions of numerous other reports and studies that had been filed by the experts in the proceeding, including the Pedersen et al., studies, the O'Neal study, the WHO 2009 guidelines, Salt and Hullar, etc.

416. Bolin et al. reviewed current literature for infrasound and low frequency exposure from wind turbines and health effects, including several studies that compared indoor and outdoor low frequency noise, including the O'Neal et al. study discussed earlier. They found that infrasound from wind turbines was inaudible at close range and even less so at distances where residences are found. They also found "[t]here is no evidence that infrasound at such levels contributes to perceived annoyance or other health effects."[232]

417. Regarding low frequency noise, the authors observed that the conclusions of several studies were that indoor low frequency noise from wind turbines typically complies with national guidelines for low frequency noise when outdoor levels do not exceed corresponding guidelines for façade exposure. The authors recognized that a sizeable low frequency noise component may occur in rare cases and recommended the use of a dBC-dBA analysis to identify a low frequency noise component.

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230 Exhibit 110.13, Measurement and Level of Infrasound from Wind Farms and Other Sources, Chris Turnbull, Jason Turner and Daniel Walsh, Acoustics Australia 40(1), page 45-49.

231 Exhibit 202.20, Karl Bolin, Gosta Bluhm, Gabriellla Erickson and Mats Nilsson, Infrasound and low frequency noise from wind turbines: exposure and health effects, 2011.

232 Exhibit 202.20, Karl Bolin, Gosta Bluhm, Gabriellla Erickson and Mats Nilsson, Infrasound and low frequency noise from wind turbines: exposure and health effects, 2011, page 5.

418. The authors' conclusions included the following:

> The dominant source of wind turbine low frequency noise, LFN [low frequency noise] (20–200 Hz), is incoming turbulence interaction with the blade. Infrasound (1–20 Hz) from wind turbines is not audible at close range and even less so at distances where residents are living. There is no evidence that infrasound at these levels contributes to perceived annoyance or other health effects. LFN from modern wind turbines are audible at typical levels in residential settings, but the levels do not exceed levels from other common noise sources, such as road traffic noise. Although new and large wind turbines may generate more LFN than old and small turbines, the expected increase in LFN is small.
>
> …
>
> It has been argued that infrasound and low frequency noise from wind turbines may cause serious health effects in the form of 'vibroacoustic disease', 'wind turbine syndrome' or harmful infrasound effects on the inner ear. However, empirical supports for these claims are lacking.[233]

419. In the Commission's view, the evidence on the record of this proceeding does not support the KLG's assertion that infrasound or low frequency noise from the project would result in adverse health effects for nearby residences. To the contrary, the evidence before the Commission was that infrasound at levels similar to that which will be produced by the project are similar to infrasound from natural and man-made sources. The Commission finds that the evidence before it supports the conclusion that infrasound from the project would be inaudible at nearby residences and is not associated with annoyance or any other health effects at the expected levels. While low frequency noise may be audible at some residences, the Commission finds that those levels will not exceed the levels of other common sources of low frequency noise such as traffic noise. Further, in accordance with the condition described above, the applicant will be required to do pre- and post-construction monitoring for low frequency noise. Should a low frequency noise condition exist, the applicant will be required to mitigate that noise to achieve the PSL or shut down one or more turbines.

8.5.4 Stress and annoyance

420. Numerous studies and reports were filed in the proceeding that described the annoyance reported by some people who live near wind turbines. The experts in the proceeding recognized that prolonged stress and annoyance can lead to a number of health effects including many of those attributed to wind turbine noise such as sleep disturbance, headaches, etc.

421. It was Dr. Phillips' opinion that stress or annoyance related to wind turbine noise was the most likely explanation for the symptoms reported by some persons who live near wind turbines.[234] Likewise, Dr. Hanning suggested that the nature of wind turbine noise, including its "…low frequency content and pulsatile nature are the probable causes of its enhanced ability to cause annoyance and other related health effects including sleep disturbance."[235]

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[233] Exhibit 202.20, Karl Bolin, Gosta Bluhm, Gabriellla Erickson and Mats Nilsson, Infrasound and low frequency noise from wind turbines: exposure and health effects, 2011, page 5.

[234] Transcript, Volume 3, pages 823-824, lines 7-5.

[235] Exhibit 129.02, Wind Turbine Noise, Sleep And Health, Dr. Christopher Hanning, page 38.

422. Dr. Ollson was also of the view that many of the symptoms reported by persons living near wind turbines were caused by stress or annoyance. Dr. Ollson acknowledged that noise from wind turbines can be annoying and associated with some health effects, especially at sound levels greater than 40 dBA. However, he proposed that the annoyance experienced by some people was more strongly related to visual cues and attitude than it was to the noise.[236]

423. The various studies filed in the proceeding support the position that wind turbine noise is considered by many to be more annoying than other sources at comparable sound levels. However, most studies also recognized that the perceived annoyance can also be related to attitudes about turbines, visual impacts, the setting of the turbines (urban versus rural, hilly versus flat), the presence or absence of economic benefit, etc. For example, Pedersen et al., made the following comments:

> Respondents were more likely to be annoyed by sound from wind turbines when they noted changes for the worse in their living environment and when they had a more negative view on wind turbines in general or their impact on the landscape scenery.[237]
>
> A strong correlation between noise annoyance and negative opinion of the impact of wind turbines on the landscape was found in early studies of perceptions of wind turbines (Wolsink and Sprengers, 1993); this was confirmed in the present study, as manifested by words such as "ugly," "repulsive," and "unnatural."[238]

424. This correlation between annoyance and visual impacts and attitudes was recognized in the Nissenbaum paper that Dr. Hanning co-authored[239] as well as in numerous other papers filed or referenced in in this proceeding.[240]

425. The Commission recognizes that the project is comprised of large wind turbines that will change the landscape and soundscape of the community. Based on the epidemiologic literature, the Commission foresees that it is likely that the presence of the wind turbines, and the noise they will make, will be perceived as annoying by some members of the community. The Commission understands that this annoyance may be triggered by sensitivity to noise, visual impacts, attitudes about wind turbines, fears or uncertainties about health effects or some combination of the above.

426. To the extent that annoyance with the project is noise related, the Commission is satisfied that the 40 dBA L_{eq} nighttime PSL for the project will prevent sleep disturbance.

427. Regarding annoyance arising from underlying concerns about health impacts, the Commission recognizes that the issue of the health effects from wind turbines is controversial and charged. The volume of information related to wind turbines and health effects filed in this proceeding alone demonstrates the polarized nature of this debate. The Commission observes that landowners seeking information on the topic could easily become concerned or even overwhelmed depending upon the materials reviewed. In the Commission's view, such concerns

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236 Exhibit 202.05, Christopher A. Ollson, PH.D, Expert Report, page 32.

237 Exhibit 131.08, Fritz van den berg, Eja Pedersen, Jelte Bouma, Roel Bakker, Visual and acoustic impact of wind turbine farms on residents, June3, 2008, page ii.

238 Exhibit 130.16, Eja Pedersen, Frits van den Berg, Roel Bakker, Jelta Bouma, Response to noise from modern wind farms in the Netherlands, Journal of the Acoustical Society of America, August, 2009, page 641.

239 Exhibit 130.08, Nissenbaum 2010, page 5.

240 See for example, Exhibits 130.11, 130.12, 130.13, 130.14, 130.16, 130.17, 131.08, Exhibit 202.05, sections 4.5.4, 4.6.2, 4.6.5 and Exhibit 110.20, pages ES-12, ES-15, ES-16.

may be partially addressed by providing stakeholders with balanced and up-to-date information from reputable sources on this topic. It is for this reason that the applicant was required by AUC Rule 007 to provide information to stakeholders on the potential health effects of the project.

428. The Commission understands that the applicant provided stakeholders with a number of papers and reports on the subject of wind turbines and health effects. Those reports included:

- Public Health Impacts of Wind Turbines, May, 2009, Prepared by the Minnesota Department of Health Environmental Health Division.[241]
- The Potential Health Impacts of Wind turbines, May, 2010, Chief Medical Officer of Health Report.[242]
- Wind Turbine Health Impact Study: Report of Independent Expert Panel, prepared for the Massachusetts Department of Environmental Protection, Massachusetts Department of Public Health, January 2012.[243]
- Knopper LD, Ollson CA, Health effects and wind turbines: a review of the Literature.[244]

429. In an answer to an information request from the KLG, the applicant explained that it provided these papers at its open house because they were in the nature of literature reviews, were open access and because they provided a good overview of the scientific evidence on the topic and included references to the scientific literature.[245] The Commission also understands that the applicant arranged to have Dr. Ollson attend one of the open houses to answer questions that stakeholders might have on the health effects of wind turbines.

430. As noted previously, it is the Commission's view that the applicant took reasonable steps to provide stakeholders with good information regarding the health effects of wind turbines. The Commission notes in this respect that the Ontario, Minnesota and Massachusetts studies were all prepared by or on behalf of a government agency. While some of the KLG experts argued that these documents could not be relied upon, the Commission does not share those concerns. In the Commission's view, these documents provided a reasonable overview of the issues and the scientific literature on the topic of health effects and wind turbines. The Commission also found that the conclusions of these reports were consistent with information reviewed by the respective panels and appeared generally reasonable. In the Commission's view, the information in these documents was objective and useful and would have provided a good starting point for landowners seeking information on the health effects associated with wind turbines.

431. Other features that may contribute to stress and annoyance for residents living near wind turbines, such as visual impacts and attitude towards wind farms are more subjective and more difficult to mitigate. In the Commission's view, some of the stress and annoyance associated with these features may abate over time as area residents become accustomed to the presence of the turbines. However, the potential for ongoing stress and annoyance associated with the project is one of the factors that the Commission must take into account when deciding whether approval of the project is in the public interest.

[241] Exhibit 110.17, Information Response Attachment 2009 Minnesota.
[242] Exhibit 110.19, Information Response Attachment 2010 Ontario.
[243] Exhibit 110.20, Information Response Attachment 2012 Massachusetts.
[244] Exhibit 110.18, Information Response Attachment 2010 Knopper and Ollson review.
[245] Exhibit 110.29, KLG-1646658 AB-95 (a).

432. Having regard to the foregoing, the Commission finds that it is likely that operation of the project may create stress and annoyance for some area residents. In the Commission's view that stress and annoyance can be partially mitigated through strict enforcement of the projects 40 dBA L_{eq} nighttime PSL and by the provision of objective information about the health effects of the project. The Commission recognizes that not all of the factors that contribute to annoyance may be mitigated and will take this into account when deciding on the application.

8.5.5 Shadow flicker

433. One of the issues raised by the KLG was the impact of shadow flicker and, in particular, the implications that shadow flicker might have for J.B. because of his epilepsy. The applicant did an engineering study that predicted the shadow flicker at J.B.'s house to be between 8.3 hours and 20.5 hours per year. The applicant proposed two options to mitigate the shadow flicker at J.B.'s residence: a) implement operational controls on all turbines with the potential to cast shadow flicker on J.B.'s residence; and b) adjust the location of three turbines to eliminate shadow flicker at J.B.'s residence.

434. The evidence before the Commission from Dr. Upton and Dr. McCunney was that shadow flicker from the wind turbines would not result in an increased health risk to J.B. Having regard to this evidence, the Commission finds that the minimal shadow flicker produced by the project at J.B.'s residence will not result in an increased health risk to J.B.

8.5.6 Conclusion

435. The Commission has carefully reviewed the evidence filed in this proceeding regarding the health effects of wind turbines. In the Commission's view, the evidence filed in the proceeding does not support the proposition that the audible and inaudible (low frequency noise and infrasound) that would be produced by the project would result in health effects for area residents. The Commission recognizes that operation of the project may result in annoyance for some area residents and that the more subjective elements of this annoyance may not be mitigated for all residents. Notwithstanding the potential for annoyance, the Commission is satisfied that adherence to AUC Rule 012, and the project's 40 dBA L_{eq} nighttime PSL will protect nearby residents, including children, the chronically ill and the elderly from sleep disturbance and other health effects related to turbine noise. In making this decision, the Commission specifically had regard to pre-existing medical conditions of J.B., C.H. and H.B. and their confidential medical evidence. To ensure compliance with AUC Rule 012 and the PSL, the Commission would include the conditions described in the previous section for noise monitoring that would include monitoring for low frequency noise at various locations, including the residences of J.B., C.H. and H.B.

9 Animal health

436. Members of the KLG expressed concerns that the project would create health problems for their animals. The Commission reviewed the studies presented in the proceeding on this topic and considers the views of the parties below.

9.1 Studies on the effects of wind projects on animal health

Flydal et al. 2004

437. This paper, referred to as the "reindeer paper" throughout the proceeding, is a report out of the University of Oslo, Norway analyzing the effects of wind turbines on the behavior of semi-domestic reindeer.[246] The authors stated that the study was undertaken because several wind turbine projects are planned in reindeer ranges in Norway, and there is concern about possible negative effects.[247] The paper describes a scientific experiment involving placing reindeer herds in various pens in and around wind turbine installations. The results indicated that when the wind turbines were turned on, approximately a third of the reindeer moved further away from the turbine, a third of the reindeer moved closer, and a third stood in the middle.[248] The authors concluded that semi-domestic reindeer in an enclosure showed no negative behavioural response and little or no aversion towards a wind turbine. However, the authors stated that "…future studies on possible effects of wind turbines on reindeer" should be conducted.

Nuno et al. 2010

438. Only the conclusion, or part of the conclusion from this paper was filed in the proceeding. The Commission understands that this paper published the results of a case study involving limb deformities in horses. The pattern of onset of the deformities before and after the installation of the wind turbines was examined. The authors stated that all three horses raised on a breeding farm in proximity to a wind project showed signs of low frequency noise induced pathology. The authors concluded that "…the results presented herein strongly suggest the presence of a LFN [low frequency noise]-generating WT [wind turbine] in the vicinity of this breeding farm can play a significant role in the triggering and onset of …deformities."[249]

Teresa Margarida Costa Pereira e Curto paper

439. Only the abstract for this paper was filed in the proceeding with a link to the English version of the paper included in a footnote. This paper published a summary of a case study which was the subject of a master's theses at the Faculty of Veterinary Medicine, Technical University of Lisbon.[250] The case study reported limb deformities for a group of horses living adjacent to a wind farm. The author concluded that there was no obvious cause for the development of this problem, therefore, the author stated that she hypothesized that unusual

[246] Exhibit 137.02, Charlene and Alan Hager Submission, page 298.
[247] *Kjetil Flydal, Sindre Eftestøl, Eigil Reimers, Jonathan E. Colman,* (2004) Effects of wind turbines on area use and behaviour of semi-domestic reindeer in enclosures, Rangifer, Volume 24, No 2 (2004) presented at The 11th Arctic Ungulate Conference, Saariselkä, Finland, 24-28 August, 2003.
[248] Transcript, Volume 4, page 1102, line 16.
[249] Nuno A. A. Castelo Branco et al (2010) Family with wind turbines in close proximity to home: follow-up of the case presented in 2007 14th International Meeting on Low Frequency Noise and Vibration and its Control Aalborg, Denmark 9 – 11 June 2010 as referenced in Exhibit 183.04, Hager Updated Submissions, page 319.
[250] Teresa Margarida Costa Pereira e Curto, (2012) as referenced in Exhibit 183.04, Hager Updated Submissions, page 319.

environmental conditions might have played an important role in the development of this condition.

9.2 Views of the interveners

440. Members of the KLG expressed concern that the project would seriously impair their quality of life by creating health problems for their animals.[251] The KLG sumbitted that, combined, they owned several thousand cattle.[252]

441. The KLG submitted that the report by Nuno et al. 2010 showed that industrial wind turbines are harmful to animals.[253]

9.3 Views of the applicant

442. The applicant submitted that it provided landowners with a copy of the reindeer paper which studied the effects of wind turbines on reindeer. Dr. Ollson stated that the reindeer paper was the only known peer-reviewed published study of the effects of wind turbines on livestock.[254]

443. Ms. Matheson-King stated that from her professional experience she was not aware of any concerns related to cattle health issues from wind energy projects.[255] Mr. Pinter also stated that he had experience with a wind turbine project located on a cattle ranch and that he had been in contact with the owner who had not reported any problems.[256]

444. Dr. Ollson submitted that he did not find the paper by Nuno et al., but if he had discovered this paper he would have provided it to the applicant.[257] Dr. Ollson stated that he was only aware of a handful of anecdotal reports and websites that indicated that wind turbine projects were harmful to animals.[258]

9.4 Commission findings

445. The Commission has reviewed the expert evidence and the reports submitted relating to animal health. The Commission accepts the applicant's submission that there is limited peer reviewed and government literature on this topic.

446. The Commission is not persuaded that the Nuno et al. 2010 paper demonstrates that the KLG members' cattle will experience deformities from the operation of the project. In making its determination, the Commission notes that only the conclusion of the Nuno et al. 2010 paper was submitted and neither the Commission nor the experts were able to view the entire report. Based on the conclusion, it is unclear to the Commission what level of low frequency noise was generated by the wind farm. Therefore, the Commission has given the conclusions of this paper no weight in making its determination on the application.

447. When assessing the Teresa Margarida Costa Pereira e Curto paper, the Commission considers that the conclusion as reported in the abstract stated that there was no obvious cause

[251] Exhibit 137.02, Charlene and Alan Hager Submission, page 12.
[252] Transcript, Volume 4, page 1101, line 5-25.
[253] Transcript, Volume 4, page 1101, lines 18-21.
[254] Transcript, Volume 4, page 1100, lines 21-25.
[255] Transcript, Volume 4, page 1102, line 4-6
[256] Transcript, Volume 4, page 1106, lines 6-25.
[257] Transcript, Volume 4, page 1102, line 16.
[258] Transcript, Volume 4, page 1106, lines 1-6.

for the development of the observed deformities. Also, the Commission considers that the author stated that "[f]or proof, it would be necessary to have means that are outside the scope of this thesis".[259] Further, the Commission observes that a review of the report indicated that the author hypothesized that both low frequency noise and mechanical vibration may be a cause of the deformities and that the level of low frequency noise emitted from the wind farm was not reported. The Commission finds that the Teresa Margarida Costa Pereira e Curto paper is not persuasive evidence that the project's operation would cause deformities in livestock.

448. Based on the forgoing, the Commission determines that, should the project be approved, there is insufficient evidence to demonstrate that there will be any adverse health impacts to domestic animals from the proposed wind turbines.

[259] Teresa Margarida Costa Pereira e Curto, (2012), Acquired flexural deformation of the distal interphalangeal joint in foals**,** Faculty of Veterinary Medicine, Technical University of Lisbon, page xci.

10 Safety

10.1 Pipeline corrosion

449. The KLG expressed concerns with respect to the interaction between the project and pipelines in the project area. The KLG noted that a network of pipelines is present in the project area. These pipelines transport oil and natural gas which may include high concentrations of hydrogen sulphide. Members of the KLG explained that the presence of dangerous substances in the pipelines increased their concerns about pipeline corrosion leading to the possibility of a pipeline leak, rupture or an explosion. This section discusses the project's potential to accelerate pipeline corrosion in the project area.

450. The KLG retained Dr. Charles Rhodes, chief engineer at Xylene Power Ltd., to present evidence on how the project may impact pipelines in the vicinity of the project. Dr. Rhodes expressed concern that if a pipeline contained high pressure natural gas, oil and/or hydrogen sulphide gas, a major public safety/property damage incident could result.[260]

451. Mr. Jim Pinter, vice-president of technology and engineering with BluEarth Renewables Inc., provided evidence on pipeline corrosion mitigation on behalf of the applicant.

10.1.1 Views of the interveners

452. Dr. Rhodes described pipeline corrosion as a process which can reduce the pipeline wall thickness. Dr. Rhodes submitted numerous pipeline corrosion concerns based on the proposition that pipelines near electrical facilities may experience electrical effects. Dr. Rhodes' concerns included:

- ground faults on the project
- the ground resistance levels at the turbines
- the collector system's buried common ground cable
- the harmonic voltage generated by the substation transformer
- the turbine transformer delta winding capacitance to ground
- the turbine tower ground mesh radius
- the setback distance between the turbines and pipelines
- the soil resistivity in the project area
- the pipeline coatings and bias voltages
- the protection systems including the project's sensors
- the applicant's operating practices

453. Dr. Rhodes' report examined wind turbine installations leading to electrically accelerated corrosion of nearby buried steel pipelines. According to Dr. Rhodes, the external corrosion on most buried pipeline is a result of a chemical interaction between the iron of the pipe and negative ions in the surrounding water or wet soil.[261] Dr. Rhodes stated that a transformer with a wye neutral to ground connection at every wind turbine introduces ground currents. He stated that if there are buried steel pipelines in the proximity of wind turbines, those ground currents can

[260] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 5.
[261] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 6.

trigger electrically accelerated pipeline corrosion. Dr. Rhodes explained that this could lead to a pipeline rupture and/or fire.[262]

454. Dr. Rhodes stated that turbines frequently incorporate direct current (DC) power supplies to allow for the adjustment of their magnetic fields.[263] He elaborated that wind turbines with wye neutral connections sometimes provide a path that inadvertently allows for the generation of a DC ground current. According to Dr. Rhodes, the DC ground current either makes the corrosion situation much worse or much better, depending on its polarity.[264]

455. In its reply evidence, the applicant stated that it would not use a wye configuration as initially assumed by Dr. Rhodes. The applicant clarified that it intended to use a collector system with a delta configuration at each turbine's padmount (step-up) transformer high/medium voltage winding. Dr. Rhodes subsequently explained that significantly accelerated pipeline corrosion could still occur, even with a delta configuration.

456. Dr. Rhodes explained that an unusual aspect of modern wind turbine transformers is the inclusion of an electrostatic shield between the low voltage and medium voltage windings. He stated that electrostatic shields are designed and installed to prevent harmonics generated in the wind generator control system from leaking over to the medium voltage collector system. Dr. Rhodes indicated that an unintended consequence of an electrostatic shield is additional delta winding capacitance to ground, which would increase the transformer's ground current in spite of there being no physical connection between the delta windings and the ground.

457. Dr. Rhodes stated that to minimize external corrosion, a dielectric coating on the outside of the steel pipe is used. This coating prevents water and oxygen from coming into contact with the outside surface of the pipe. He explained that if this dielectric coating is properly applied, and remained defect free, external pipe corrosion is prevented. Dr. Rhodes explained that in these circumstances, the only places where a current can flow are at imperfections in the dielectric coating. Dr. Rhodes stated that the external dielectric coating may have installation defects and would likely eventually get scratched by mechanisms beyond the control of the pipeline owner.

458. A secondary, electricity based mechanism (cathodic protection) may be employed to prevent external corrosion. Dr. Rhodes stated that cathodic protection can be defeated by the proximity of major grounded, but inadequately isolated electrical equipment, such as the proposed turbines.

459. Dr. Rhodes strongly recommended that the change in induced ground voltage with distance be measured before a major investment is made in a wind farm. He stated that it is critical that both the induced alternating current (AC) and DC ground voltages in ground water, in proximity to buried steel pipelines, be less than approximately 0.5 volts. Dr. Rhodes stated that these specifications should apply to all wind turbine power levels.[265]

460. Dr. Rhodes stated that a solution to the issue of wind turbines affecting pipeline corrosion is adequate setbacks from the pipelines to the turbines in combination with a reliable and sufficient negative bias voltage applied to the pipeline. He outlined that setbacks vary from 100 metres to 1,000 metres depending on local geography, including the conductivity of the soil.

[262] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 10.
[263] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 18.
[264] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 18.
[265] Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 16.

He stated that for less conductive soil, a farther setback would be required.[266] Dr. Rhodes concluded that the exact setback requirement is a function of the induced ground voltage, which, in turn, is proportional to the induced ground current. He added that induced ground current can be minimized by the use of suitably isolated distribution circuits, low capacitance isolation transformers, a common low resistance wind turbine ground and lightning protection.

461. Dr. Rhodes stated that there were human limitations to adequately implementing the applicant's proposed mitigation measures. According to Dr. Rhodes, only a small subset of service personal have the requisite knowledge about ground currents and how these currents may affect the corrosion of buried pipelines. Also, Dr. Rhodes did not believe that the authors of the "Alberta electric code"[267] and the GE wind turbine installation specifications contemplated installation of a wind farm directly on top of a maze of sour gas pipelines.[268] Dr. Rhodes also had additional concerns about the way the ground currents would be monitored and how the currents could be found and isolated.

462. Overall, the KLG emphasized:

> … that nothing should be done until after the decline in induced ground voltage with distance is actually measured from the proposed wind turbine locations to the nearby pipelines and until the actual bias voltages on the pipelines are determined. Only then can the substation and wind turbine transformers be properly specified. So in the event - in the unfortunate event that the Commission determines that this application should be approved, we would like that to be a condition of any approval.[269]

10.1.2 Views of the applicant

463. In response to the KLG's concerns, the applicant confirmed that it had never proposed to use a wye transformer configuration for the wind turbine transformers, as initially assumed by Dr. Rhodes. The applicant explained that the wind turbine manufacturer requires a delta connection on the padmount (step-up) transformer high/medium voltage winding. The applicant clarified that the delta configuration is different from the wye configuration because the delta configuration has no physical connection to the ground. The applicant explained that the turbines are electrically isolated by the delta winding, and therefore, any current that may arise from the output of the wind turbine would be confined to the turbine and associated padmount (step-up) transformer.[270]

464. The applicant stated that the proposed electrical configuration at the wind turbines achieves the ideal delta configuration initially recommended by Dr. Rhodes because each wind turbine is sufficiently electrically isolated to reduce the ground current to almost zero.

465. Mr. Pinter clarified that there are no high voltage windings on the wind turbine transformers but only low and medium voltages. He stated that sometimes the term high and

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266 Exhibit 186.02, Dr. Charles Rhodes Expert Report, page 13.

267 In Alberta the *Electrical Code Regulation*, Alta Reg 209/2006 adopts the Canadian Electrical Code, Part 1 (Twenty-second edition), being Canadian Standards Association standard C22.1-12, with the variations set out in the Schedule; (b) the Code for Electrical Installations at Oil and Gas Facilities, 4th Edition, 2012, published by the Safety Codes Council; (c) the Alberta Electrical Utility Code, 4th Edition, 2013, published by the Safety Codes Council.

268 Exhibit 275.01, Dr. Rhodes Opening Statement, page 14.

269 Transcript, Volume 10, page 2157, lines 3-15.

270 Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, Accelerated Pipeline Corrosion, page 10.

medium voltages are used interchangeably and that the medium voltage winding would be a delta.[271]

466. In response to Dr. Rhodes' concerns about the effects of electrostatic shields, the applicant clarified that the GE specifications for the transformer do not require an electrostatic shield.[272]

467. Mr. Pinter explained that the project, including its electrical system, would be designed by a professional engineer who would specify the configuration of that transformer and the equipment to match it.[273] The applicant stated that it would:

> …specify design and procure the turbine transformers during the detailed design stage of the project. The design of the transformer will incorporate engineering specifications as required to reduce any potential contribution to pipeline corrosion.[274]

468. Further, the applicant submitted that it hired Corrosion Service Company Ltd. to review the analysis prepared by Dr. Rhodes and to review the project's electrical system. The applicant stated that Corrosion Service Company Ltd. is very familiar with pipeline corrosion mitigation in Alberta and wind farms.[275] Mr. Pinter testified that Corrosion Services Company Ltd. reviewed the project's electrical information and concluded that there was a very low probability that the project would cause AC corrosion or DC interference. Corrosion Services Company Ltd. also stated that an AC interference study should be conducted and should any problems arise, mitigations measures would be recommended.[276] Mr. Pinter stated:

> …in speaking with Mr. Rookes of Corrosion Services, he indicated that […] mitigation measures shouldn't be too complicated and not very cost prohibitive. So we will just undertake whatever mitigation measures that they recommend.[277]

469. The applicant confirmed that it planned to complete an engineering study with respect to the proximity of the proposed turbines to the nearby pipelines. The applicant stated that the study would include both normal steady state and abnormal fault conditions. The applicant also stated it would conduct soil resistivity studies prior to the project's detailed design stage to support engineering calculations.

470. The applicant also made submissions regarding the timing of the studies to be undertaken. The applicant explained that, if it received the Commission's approval, it would invest substantial funds to complete the detailed final design for the project which would include the engineering and the pipeline studies. The applicant stated the timing of the studies corresponded to standard industry practice.[278]

471. The applicant stated that the project's collector system would consist primarily of underground cables which would pose no risk to pipeline corrosion. In addition, it submitted that the small amount of overhead conductor proposed for the project would pose a low risk to

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[271] Transcript, Volume 4, page 910.
[272] Transcript, Volume 10, page 2224.
[273] Transcript, Volume 4, page 911.
[274] Transcript, Volume 10, pages 1914-1915, lines 21-1.
[275] Transcript, Volume 4, page 921.
[276] Exhibit 203.06, BluEarth Bull Creek Wind Project - Pipeline Corrosion.
[277] Transcript, Volume 4, page 1120, lines 8-12.
[278] Transcript, Volume 4, page 952.

pipeline corrosion, equivalent to that posed by the existing electrical distribution system found throughout the province of Alberta.

472. The applicant explained that the proposed turbines would be at least 100 metres from any pipeline in the project area which would provide a safe distance between the project and the pipelines. The applicant further submitted that it consulted with local pipeline operators regarding the project and those operators raised no concerns.

473. The applicant concluded that after the studies and any proposed mitigation measures were complete, it did not expect that the project would contribute to accelerated pipeline corrosion.[279]

10.1.3 Commission findings

474. The Commission acknowledges the KLG's concerns regarding accelerated pipeline corrosion from the project, given the high hydrogen sulphide content in some pipelines in the area.

475. The concerns raised by Dr. Rhodes on the KLG's behalf relate to electrical interference on buried pipelines which is an issue that pipeline operators must frequently contend with. The Commission recognizes that without mitigation, electrical effects may impact safety as these effects can degrade the integrity of a pipeline. However, the Commission observes that pipeline corrosion is a well understood phenomenon and that pipeline operators employ a number of well understood and proven mechanisms to effectively mitigate pipeline corrosion.

476. It is clear to the Commission that the applicant appreciates that a pipeline corrosion analysis is necessary. The Commission acknowledges that the applicant has committed to conduct a detailed electrical study and to implement any necessary mitigation measures. The Commission accepts the applicant's evidence that it will work with Corrosion Services Company Ltd., or another qualified pipeline corrosion and safety specialist(s), to identify and mitigate against external pipeline corrosion. If the Commission approves the project, it would require the following condition:

> The applicant must perform a detailed electrical study and corrosion analysis and implement measures to prevent external pipeline corrosion prior to the project's completion. The applicant shall advise the Commission when this condition has been satisfied.

477. The Commission finds that the applicant's decision to conduct the detailed engineering studies following an approval was reasonable. The Commission recognizes that it could be impractical to perform detailed engineering studies prior to finalizing equipment choices. The Commission is satisfied that the applicant will perform the project's detailed engineering in a safe and reasonable manner.

478. The Commission also recognizes that there are existing standards that deal with pipeline safety, corrosion prevention and grounding including the NACE Standard 0177, from the National Association of Corrosion Engineers, Canadian Standard Association C22.3 No. 6 and IEEE 80, from the Institute of Electrical and Electronics Engineers. The Commission expects the applicant to comply with all required standards, as applicable, including those standards mentioned above.

[279] Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, Accelerated Pipeline Corrosion, page 10.

479. The Commission also considers it relevant that the pipeline operators in the area have not raised any concern with respect to the safety of the project as proposed by the applicant. The Commission considers it important that pipeline operators have an obligation to ensure that their assets are safe and to complete due diligence with respect to pipeline maintenance, including any required pipeline corrosion mitigation measures.

480. Based on the evidence provided by the applicant and the interveners, the Commission is satisfied that, with the corrosion mitigation measures available and the applicant's commitment to do whatever is required to implement such measures, the project will cause little to no electrical interference and resulting corrosion effects on pipelines.

10.2 Other safety concerns

481. The KLG members expressed concerns about safety issues related to wind turbines falling, throwing ice, catching fire and the applicant's lack of a detailed emergency response plan.

10.2.1 Views of the interveners

482. The KLG raised concerns regarding the collapse of wind turbines and its impacts on oil and gas infrastructure. Mr. Secord, the KLG's lawyer, argued that "… the pipelines are quite close to the turbines, and as I'm sure the Commission is aware, these turbines from time to time have incidents with, either falling over, blade throw, that sort of thing, and which my clients have expressed concerns about."[280]

483. The KLG was also concerned that ice throw posed a substantial safety risk to themselves and to other residents in the project area. The KLG contended that ice throw from the proposed turbines could damage oil and gas infrastructure and pipeline facilities in the area.

484. The KLG was also concerned that the turbines could catch on fire and that the applicant had not shown how it intended to protect the public if a turbine fire occurred. The KLG stated that fire was identified by a retired fire chief as the second most common wind turbine accident.[281] It was the KLG's opinion that the Provost and Wainwright fire stations do not have the capability and trained staff to put out a fire from a wind turbine. In addition, the KLG expressed that the distance from the fire stations to the project area would increase the response time and reduce the efficacy of any response to a wind turbine fire, including containment.[282]

485. The KLG was also concerned about the lack of emergency response and safety plans from the applicant in an event of an accident at the project site. The KLG submitted that the applicant does not have a plausible and defensible emergency preparedness and response plan.[283]

10.2.2 Views of the applicant

486. The applicant stated that the wind turbine towers and foundations for the project would be designed, fabricated and installed in accordance with professional engineering standards and that the collapse of a wind turbine is highly unlikely. It stated that the 100-metre setback from any pipeline in the project area would provide a safe distance between the project infrastructure

[280] Transcript, Volume 9, page 2124.
[281] Transcript, Volume 9, page 2128, lines 14-18.
[282] Transcript, Volume 9, page 2129.
[283] Transcript, Volume 9, page 2136.

and pipelines.[284] The applicant stated the probability of falling towers affecting oil and gas facilities in the area is remote given the 100-metre setback and the 85-metre height of the turbines. The applicant further added that most oil and gas infrastructure in the area is underground and there is minimal risk that damage would occur as a result of a turbine collapse.[285]

487. The applicant stated that there is low probability of ice throw from the project.[286] The applicant explained that multiple years of meteorological wind resources monitoring demonstrated that the dry climate and atmospheric conditions are not highly prone to the type of icing events that could produce ice accumulations on wind turbine blades. The applicant indicated that the project would be continuously monitored for conditions that might cause ice to form on the turbine blades. The applicant stated that the wind turbine's control software and hardware can automatically detect ice accumulation on the turbine blades and would initiate a turbine shut down in the event of blade icing.[287] The applicant stated that the turbines could be manually shut down by the operations control centre if a possible icing event is anticipated.

488. The applicant stated that the emergency procedure for a turbine fire would likely involve setting up a safe perimeter around the turbine and allowing the fire to burn itself out.[288] The applicant outlined that local fire departments are not expected to extinguish a wind turbine fire and do not require special training or equipment. The applicant stated that it consulted with fire chiefs in the project area and they did not raise any concerns regarding the project.[289]

489. The applicant stated that a project-specific emergency response plan would be prepared and the project currently has an emergency preparedness or response plan in draft format. The applicant stated that the final project emergency preparedness or response plan would be completed prior to operation.[290] The applicant committed that once its emergency preparedness or response plan document is finalized, it would provide a copy to stakeholders upon request.[291]

10.2.3 Commission findings

490. The Commission accepts that the turbines would be constructed to meet existing engineering standards and notes that the potential for a turbine fall is remote. The Commission recognizes that the wind turbines would be set back a minimum of 100 metres from any pipeline in the project area and the turbine height would be 85 metres. The Commission accepts the applicant's submission that should a turbine fall, there would still be a safe distance between the project infrastructure and pipelines given that the pipelines are underground.

491. With regard to the KLG's concern that the setback is inadequate to protect against potential blade throw, the Commission considers that the possibility of blade throw is remote and that the operators of the oil and gas infrastructure in the area did not raise any concerns.

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284 Transcript, Volume 10, pages 2225-2226.
285 Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, Accelerated Pipeline Corrosion, page 8.
286 Exhibit 110.29, Revised 1646658 Alberta Ltd. Information Request Responses to KLG, KLG-1646658 AB-87 (a) and (b), page 67.
287 Transcript, Volume 10, page 2226.
288 Transcript, Volume 10, page 2227.
289 Transcript, Volume 10, page 2227.
290 Transcript, Volume 10, page 2228.
291 Transcript, Volume 10, page 2228.

492. The Commission expects the applicant to uphold its commitment to continuously monitor the turbines for possible icing events and to have procedures and equipment in place to shut down the turbines if it becomes necessary. The Commission is satisfied that with the monitoring and safety measures, possible ice throw events from wind turbines can be mitigated.

493. In the event of fire, the Commission accepts the applicant's submission that it will have an emergency procedure in place. The Commission acknowledges that the applicant consulted with the local fire chiefs in the project area, and the fire chiefs did not raise any concerns. The Commission finds that the applicant's approach to a potential turbine fire to be reasonable.

494. The Commission recognizes the applicant's commitment to finalize and provide an emergency preparedness and response plan to stakeholders as the project progresses through development to construction. The Commission finds this to be a suitable practice. If the Commission approves the project, it would require the following condition:

> The applicant shall finalize its emergency preparedness and response plan and make copies available to members of the KLG prior to the project's operation. The applicant shall advise the Commission when this condition has been satisfied.

495. The Commission is satisfied with the safety measures proposed by the applicant to address falling turbines, ice throw, fire and its proposal to finalize and share with interested parties its emergency response plan prior to commencing operations.

11 Property impacts

496. The KLG raised concerns regarding the potential property impacts that the project may cause. This included impacts to property values and visual impacts. The KLG retained the services of Mr. Brian Gettel of Gettel Appraisals Ltd. who prepared a value impact assessment titled *Value Impact Assessment Adverse Effect Relating to a Wind Farm Blue Earth Renewable Inc. Bull Creek Wind Project Properties Within the M.D. of Wainwright, Alberta & M.D. of Provost, Alberta* (the Gettel Report).[292]

497. In response to the Gettel Report, the applicant submitted *The Review Report* (the Altus Report),[293] by Mr. Dave Simes from Altus Group Limited.

11.1 Property value

11.1.1 Views of the interveners

498. In Mr. Gettel's report, he submitted cost and direct comparison approaches to estimate the market values of two subject properties as of January 2013. He then estimated the damages or devaluation that could arise on KLG properties based on the proposed development of the project.

499. Mr. Gettel stated that the best uses of the properties in question "… involve that of continued agricultural and rural residential use"[294] and that a number of the properties in question represent potential building sites. However, Mr. Gettel also testified that even though there may not be a substantial market for rural residential subdivisions in the project area, one needs to take into consideration the future plans on how a family owned plot may be divvied up. He stated that developments such as the project may restrict the rights of development on these lands because of their proximity to a wind farm.[295] Mr. Gettel characterized this as sterilization of some parcels of land, thereby restricting future residential development on lands near the proposed project.[296]

500. The cost approach described in the Gettel Report estimated the present value of properties based on a professional appraisal and making adjustments for depreciation and extras such as additional buildings (quonsets, barns), services (such as utility hook-ups and road access) and landscaping.

501. Mr. Gettel also discussed issues associated with wind farms. Mr. Gettel stated that there was a lack of available Alberta data, and therefore referenced a report by Ben Lansink (Lansink Report)[297] that focused on the impacts of wind turbines in Melancthon Township, Ontario. The Lansink Report studied properties that were purchased by Canadian Hydro Developers and then resold following the development of a wind farm in the area. The Lansink Report estimated the resultant discount was in the range of 23 per cent to 59 per cent below the price paid by Canadian Hydro Developers Inc. prior to the development of the wind farm.

502. Mr. Gettel submitted that a forced acquisition scenario (such as that described in the Lansink Report) would often result in landowners being paid in excess of the market value to

[292] Exhibit 132.02, Gettel Report.
[293] Exhibit 203.04, Altus Report.
[294] Exhibit 132.02, Gettel Report, page 36.
[295] Transcript, Volume 7, page 1613, lines 1-24, and page 1617, lines 14-18.
[296] Transcript, Volume 9, page 2062, lines 1-3.
[297] Exhibit 98.16, Diminution in Value Wind Turbine Analysis.

induce a sale. Mr. Gettel estimated that the actual diminution range would be closer to 10 per cent to 25 per cent.[298]

503. Mr. Gettel stated that the direct comparison approach used in the Gettel Report was similar to a paired-sales analysis, as it involved comparing real estate sales between two or more properties and adjustments were made for location, building size, and features such as garages, developed basements, agricultural outbuildings, and overall condition.[299]

504. Mr. Gettel focused his valuation analysis on the Bonnefoy property and the Beatty property. He assigned the following values to each property using the cost and direct comparison approaches:[300]

	Cost approach	Direct comparison approach
Bonnefoy property	$349,000	$340,000
Beatty property	$636,000	$600,000

505. Mr. Gettel then referred to what he categorized as "other external nuisances", and cited case studies that examined the impact on property values arising from landfills, cattle feedlots, sewage lagoons, highway/railway proximity issues, and overhead power transmission lines. Mr. Gettel stated that based on his literature review, he projected the following value losses for improved residential properties and vacant agricultural land for the subject locale:[301]

	Residential	Vacant agricultural land
Adjacent / 0.5 mile	20%	10%
0.5 – 1 mile[302]	15%	7.5%
1 mile	10%	5%
1.5 – 2 miles	0% – 5%	0%
2 miles +	0%	0%

506. Based on his analysis, Mr. Gettel projected a loss of 20 per cent for the Bonnefoy property and 15 per cent for the Beatty property.[303]

507. In response to the criticism that the Gettel Report overlooked oil and gas activity as an external nuisance, Mr. Gettel submitted that he was fully aware of the active well sites and pipelines in the area, and noted that annual rentals are paid to landowners for well sites and access roads. Mr. Gettel submitted that such rentals are intended to cover loss of use and adverse effect of having to work around and reside next to such facilities. He submitted that because the rentals are paid it is unusual for value discounts to arise.[304]

508. Mr. Gettel expressed concerns about the paired-sales analysis used in the Altus Report. He suggested that time adjustments for paired sales where necessary because these sales were as much as 18 years apart. He also noted that many paired-sales transactions were between

[298] Exhibit 132.02, Gettel Report, page 55.
[299] Exhibit 132.02, Gettel Report, page 40 and Transcript, Volume 7, page 1597, lines 5-13.
[300] Exhibit 132.02, Gettel Report, pages 41-49.
[301] Exhibit 132.02, Gettel Report, page 66.
[302] Exhibit 197.02, KLG Responses to the Information Requests from the AUC, AUC-KLG-17.
[303] Exhibit 132.02, Gettel Report, page 67.
[304] Exhibit 279.01, Brian Gettel Opening Statement, page 3.

affiliated parties (i.e. not at arms-length).[305] Mr. Gettel concluded that "… no meaningful indication can be gained as to whether or not wind projects are impacting value" from the paired-sales analysis in the Altus Report.[306]

509. Mr. Gettel responded to the applicant's submission that additional reports should have been cited by the Gettel Report. Mr. Gettel reviewed the reports and testified that the reports raised the following concerns:

- The Renewable Energy Policy Project Report focused only on visual impact.
- The Hinman Report involved annual/good neighbour payments to landowners (an offsetting factor).
- The Canning & Simmons Report involved lakeside properties (whose view could offset the negative impacts of wind turbines).
- Only two per cent of the sales examined in the Berkeley Lab report were within one mile of the turbines.
- The Hoen Report was released six months after the Gettel Report was written in February 2013, and that it too had a limited number of homes examined within one mile of a turbine.[307]

11.1.2 Views of the applicant

510. The Altus Report was structured as a critique of the Gettel Report. In the Altus Report, Mr. Simes argued that the Gettel Report contained "… conclusions derived from its analysis [that] are misleading and did not provide support to its conclusions."[308]

511. Mr. Simes stated that the Gettel Report relied too heavily on the Lansink Report.[309] Mr. Simes described the Lansink Report as severely flawed. He declared that the methodology did not account for the differences between the rural Melancthon, Ontario real estate market with wind turbines and the urban setting of Orangeville, Ontario with no wind turbines. Mr. Simes submitted that one deficiency of the Lansink Report was that it analyzed wind turbine affected properties that did not transact on the open market, but were instead transfers of land by Canadian Hydro Developers as a result of settlements.[310] A second deficiency with the Lansink Report identified by Mr. Simes was that it did not include all comparable sales in Melancthon over the same time period.[311]

512. The Altus Report included a report by Mr. Jay Wong entitled "Review Engagement Report". In that report, Mr. Wong concluded that there were numerous papers/reports (the Renewable Energy Policy Project Report, the Hinman Report, the Canning & Simmons Report, the Berkeley Lab Report, the Hoen Report, and a report by the Pembina Institute) that should have also been cited by Mr. Gettel. Mr. Simes submitted that these reports, which were not cited

[305] Exhibit 279.01, Brian Gettel Opening Statement, pages 5-6.
[306] Exhibit 279.01, Brian Gettel Opening Statement, page 7.
[307] Exhibit 279.01, Brian Gettel Opening Statement, pages 4-5.
[308] Exhibit 203.04, Altus Report, page 5.
[309] Exhibit 98.16, Diminution in Value Wind Turbine Analysis.
[310] Exhibit 203.04, Altus Report, page 23.
[311] Exhibit 203.04, Altus Report, page 23.

by Mr. Gettel, "strongly contradict the opinions presented in the Gettel Report as a result of Gettel's reliance on the single Lansink Report."[312]

513. Mr. Simes submitted that there is very little residential development in the region. He further submitted that even though residential development may be physically and legally possible, it "… [does] not appear to meet the 'financially feasible' test".[313] Mr. Simes also stated that the negative population growth in Provost since 1996 suggested that the "economic environment is not conducive to residential development."[314]

514. The Altus Report included paired-sales data for four Alberta properties that sold pre and post-construction of two wind developments in the Halkirk and Pincher Creek areas. Mr. Simes submitted that based on this analysis "there is a clear indication of increased values, which contradicts the Gettel report."[315] Further Mr. Simes stated that other factors may have influenced the price per acre for the sales in the Pincher Creek area and acknowledged that the presence of turbines does not necessarily result in the higher price per acre (or vice versa).[316]

515. Mr. Simes submitted that landfill sites, sewage lagoons and cattle feed referenced in the Gettel Report "… share no common traits with a wind farm."[317] The Altus Report also questioned why oil and gas activity was not identified in the Gettel Report as an external nuisance given the strong presence of oil and gas activity in the area. Mr. Simes stated that this was an apparent "… contradiction by omission within the Gettel Report as to what constitutes a nuisance and what does not constitute a nuisance."[318]

516. In argument, the applicant submitted that comparing property value impacts from nuisances with, at most, slight similarities to wind farms, was unreasonable and that for property values in the vicinity of a proposed wind farm "… it is best to compare the project to other wind farms."[319] The applicant further submitted that the analysis of the Halkirk Wind Project "… found a clear indication of increased values over the holding period" and that the Berkeley Lab Report found "… no statistical evidence that home values near turbines were affected in post-construction or post-announcements pre-construction periods."[320]

11.1.3 Commission findings

517. In this section, the Commission must determine whether the project may have an impact on the property value of adjacent parcels.

518. The Commission has reviewed Mr. Simes' paired-sales analysis which estimated the project's property devaluation and makes the following observations.

[312] Exhibit 203.04, Altus Report, page 10.
[313] Exhibit 203.04, Altus Report, page 12.
[314] Exhibit 203.04, Altus Report, page 12.
[315] Exhibit 203.04, Altus Report, page 13.
[316] Transcript, Volume 4, pages 1173-1174.
[317] Exhibit 203.04, Altus Report, page 18.
[318] Exhibit 203.04, Altus Report, page 17-18.
[319] Transcript, Volume 9, page 1998, lines 8-12.
[320] Transcript, Volume 9, pages 1998-1999.

519. In Mr. Simes' paired sales analysis, the seller and the buyer were related parties.[321] The Commission is of the view that only arm's length sales should be analyzed to increase the likelihood that the sale price of each transaction used as a comparable reflects the fair market value at the time of sale. Mr. Simes submitted that he did not make adjustments for sales that took place more than a decade apart in his paired sales analysis.[322] The Commission is of the view that an ideal paired sales analysis would include sales that are directly comparable with little need for adjustment. However, if adjustments are necessary for sales that are not directly comparable, as in the case of a sale that takes place many years apart in a non-stagnant real estate market, then such adjustments should be made.

520. Due to the sales not being at arm's length and the timing of the sales in the paired sales analysis, the Commission has placed no weight on the Altus Report's paired-sales analysis.

521. The Commission has reviewed Mr. Gettel's report that used cost comparison and direct comparison approaches to estimate property devaluation if the project was constructed.

522. The studies used by Mr. Gettel reviewed the impact to homes that are less than 150 metres from highways and railway lines. By comparison, the residences on the Beatty and Bonnefoy properties are each approximately 1,000 metres from the nearest proposed wind turbine.[323] Given that the proposed turbines are approximately 10 times farther away than the nuisances cited by Mr. Gettel, the Commission did not find this evidence useful when deciding whether approval of the project may have an impact on the property values for the Beatty and Bonnefoy properties.

523. Mr. Gettel submitted a value losses table[324] based on an analysis of many facilities that he described as nuisances, including cattle feedlots, sewage lagoons, landfill sites, highways, railways, and overhead transmission lines.[325] The Commission observes that when questioned about the value losses table in the Gettel Report, Mr. Simes submitted that sewage lagoons, feedlots, landfill sites are not good comparables to wind farms.[326] The Commission considers that the value loss experienced by properties near landfills, feedlots, sewage lagoons, highways and railways are not cogently comparable to value diminution that could be associated with a wind farm. As such, the Commission does not accept the value losses table in the Gettel Report as a reasonable estimate of potential property value impacts arising from the project, and, has given this table no weight in making its findings on whether the project would impact property values.

524. The Commission is of the view that when attempting to estimate potential losses to property values arising from the construction of a wind farm, the best comparable would be studies of other wind farms. However, in the absence of direct comparables the Commission observes that devaluation associated with other facilities may be informative.

525. With respect to facilities used for comparison purposes, the Commission acknowledges Mr. Simes' submission that transmission towers would be the closest to wind turbines in terms of

[321] Transcript, Volume 4, page 880.
[322] Transcript, Volume 4, page 877, lines 4-16.
[323] Exhibit 132.02, Gettel Report, page 68.
[324] Exhibit 132.02, Gettel Report, page 66.
[325] Transcript, Volume 7, pages 1601-1605.
[326] Transcript, Volume 4, page 1171, lines 9-23.

similarity and structure.[327] When questioned about potential property impacts of the project when using transmission lines as an analogy for wind turbines, Mr. Gettel submitted the following:

> In a rural area, these lines or wind towers are highly visible for long stretches of ground, and what happens in a rural area is very different than in the urban area.[328]

526. Based on the comparables provided, the Commission finds that the closest comparable to wind turbines would be transmission towers. The Commission also agrees with Mr. Gettel that a transmission line in a rural setting is not comparable to an urban setting.

527. The Commission determines that the impact associated with distance from transmission lines to a property may be relatable to the effect that distance may have on property impacts from the project. When Mr. Gettel was questioned during the Heartland hearing on the property value impact of transmission lines on urban houses beyond the front row, he submitted:

> We tend to work in, say five per cent increments. I think when you are getting back on a line of this magnitude, maybe 500, 600 feet back, you're going to be seeing five per cent losses, possibly more. Once you get beyond that you'll diminish, but a lot depends on individual circumstances. Is there anything between you and the line, topography, and that kind of thing.[329]

528. Mr. Simes submitted that his own and other studies, including some studies submitted by Mr. Gettel in this proceeding, suggested that transmission towers have had very minimal to no effects on property values. He further stated that:

> … I also believe there's been some submissions to the AUC regarding property values in proximity to transmission lines. And that coincides with the studies that I've done or researched in terms of finding no negative effects on property values, and certainly within .71 and .75 miles of the turbine, which is what the Killarney group properties are, so no negative effects.[330]

529. The Commission finds that property value impacts are expected to diminish with distance from both transmission lines and wind turbines. The Commission notes that none of the proposed wind turbines would be constructed on the KLG members' properties, but on adjacent parcels, and that the nearest KLG residence would be located more than 890 metres from the proposed wind turbines. The Commission notes that landowners with turbines proposed to be on their lands raised no concerns to the property impact of the project. Based on the comparison to transmission lines, the Commission agrees with Mr. Simes' view that there would likely be minimal, if any, property value impacts from the project on KLG members.

530. The Commission has reviewed the evidence relating to the KLG's claim that the project would limit their rights as landowners because the project may limit their ability to subdivide.[331]

531. Consistent with past decisions, the Commission will consider developments that have received approval or are in the process of obtaining approval as a part of the decision process. However, the Commission considers that future developments and residences that are in the

[327] Transcript, Volume 4, page 1171, lines 9-23.
[328] Transcript, Volume 7, page 1625, lines 11-24.
[329] Exhibit 265.01, Heartland Transmission Project Decision 2011-436, page 166.
[330] Transcript, Volume 4, pages 1171-1172, lines 22-10.
[331] Transcript, Volume 7, page 1617, lines 6-18.

concept stage or that are at the idea stage, are not certain and may change depending on the economy, change of circumstances for the landowner and/or potential developer, amendments to municipal bylaws regarding development or inability to secure municipal approval.[332]

532. The Commission has not been presented evidence to indicate that any contemplated future developments or subdivisions by the KLG have received approval or are in the process of receiving approval. Therefore, the Commission considers that there is a great deal of uncertainty as to whether such projects would ever proceed and if so, the timing and the potential impacts. To consider the impact of the project on future developments or subdivisions on KLG land would be speculative.

533. The Commission has not been presented with sufficient cogent evidence in this proceeding to suggest that the project will result in an adverse impact on property values of parcels adjacent to the project and finds that any limitations on subdivision potential is too speculative.

11.2 Visual impact

11.2.1 Views of the applicant

534. The applicant submitted photomontages that were comprised of a series of photo simulations of the proposed wind turbines from several view points in the region to show the expected visual change to the landscape.[333] These simulations were done at multiple locations in the project area, including near several KLG landowners.

11.2.2 Views of the interveners

535. The KLG noted that the proposed turbines are 136.5 metres at their tallest height, have a hub height of 85 metres and a rotor radius of 51.5 metres.[334] The KLG argued that "… the Bull Creek project will destroy the [a]esthetics and visual beauty of their environment, which cannot be replaced."[335]

536. Ms. Bonnefoy explained that "[d]ue to our land location, we will see about 21 turbines from our residence. I am trying to the best of my ability to understand how this company thinks that it is able to come in and do as they wish with no regard to the people that live there."[336] Mr. Bonnefoy added that the wind turbines would be visible from every side and every direction of his family home.[337] Mr. Bonnefoy further explained that:

> … we will have 22 of these wind turbines within a radius of 3400 metres. All but one of these 22 turbines will be visible from our property. ...

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332 EUB Decision 2007-055: Bearspaw Petroleum Ltd. Application for Two Pipeline Licences, Crossfield Field, Application No. 1453533, July 24, 2007, EUB Decision 97-1: Renaissance Energy Ltd., Applications for Well Licences, Applications for Pipelines, March 11, 1997, Decision 2009-028: AltaLink Management Ltd. Transmission Line from Pincher Creek to Lethbridge, Application No. 1521942, Proceeding ID No. 19, March 10, 2009, and Decision 2012-327: AltaLink Management Ltd., Western Alberta Transmission Line Project, Proceeding ID No. 1045, December 6, 2012

333 Exhibit 10, Application Attachment 7 – Photomontages.

334 Transcript, Volume 9, page 2079, lines 1-6.

335 Transcript, Volume 9, page 2079, lines 21-23.

336 Transcript, Volume 5, page 1293, lines 8-12.

337 Exhibit 262.04, Opening Statement of Daniel Bonnefoy, page 2.

> 13 of these turbines will be under 2,000 metres from our home, of which six will be less than 1500 metres from our home, of which of those three will be just over 1100 metres from our home.[338]

537. Ms. Beatty had similar concerns with respect to visual impact and stated:

> Our home was designed and custom built in 2001 for its particular site on a knoll situated in the open valley. There are views of the beauty of nature all around us. In our home we have windows looking out in all directions. 17 sets of windows in total.
>
> The photo montage taken and sent to us by BluEarth without our permission, I may add, showed us that out of ten sets of windows, we would look out on to the turbines. These would be turbines Number 1 through 11 as far as we know.[339]

538. Ms. Beatty also expressed concerns with Transport Canada flashing lights at the top of the turbines:

> Even at night, when on a clear evening, we now see all the wonderful constellations of stars, especially when checking calving cows, for example, we would now see flashing red lights.
>
> Of the 11 turbines we would see from our house and farm, only two of these would not have red flashing lights on them. They would have -- these would have red flashing lights on them, flashing 20 to 40 times a minute.[340]

539. In his opening statement, Mr. R. Hager expressed the following visual concerns:

> I believe that I will see at least nine turbines that are within 3900 metres of my home...
>
> I have an excellent view of Leane Lake from my living room window as well as for many high hills on my land. I can see Cody, Killarney, Spring and even Dillberry Lake across Highway 17. Dillberry Lake Provincial [Park] butts up against the east side of my property as well.
>
> I will see the turbines to the southwest and southeast of both my home and other properties, a total of 12 quarters which ruin my view causing a complete loss of enjoyment for me. My house is surrounded on every side by hills except to the north.[341]

540. Ms. Buck explained her concerns about the visual impact of the turbines:

> Our house and land would be impacted greatly by wind turbines 400 feet high and on 300-feet ridges. 2,200 metres to the closest proposed wind turbine to the northeast will be visible. I believe that the Turbines 13, 17, 18, 19, 20, 22, 23, 24, 27, 31, 35, 38 will be visible from my lands. Our view, tranquillity, livelihood of working to have diversified production, pride of property, Doug's occupational standing, and my health issues would all be in jeopardy by this project.[342]

541. Ms. Buck also expressed concerns with the flashing lights on top of the turbines.

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[338] Transcript, Volume 5, pages 1308-1309, lines 23-9.
[339] Transcript, Volume 5, page 1261, lines 5-14.
[340] Transcript, Volume 5, page 1261, lines 15-24.
[341] Transcript, Volume 5, page 1240, lines 10-21.
[342] Transcript, Volume 5, pages 1281-1282, lines 21-4.

11.2.3 Commission findings

542. The Commission has viewed the photomontage prepared by the applicant and finds that it provided a reasonable representation of the turbines and the project layout.

543. The assessment of visual impacts is subjective in nature, however, the Commission recognizes that the wind turbines proposed for the project are large and would change the landscape of the project area. However, the Commission notes that the project area is already disturbed by the extensive oil and gas activity. The Commission took these considerations into account when assessing the incremental visual impact of the project.

544. With regard to visual impacts stemming from the lights associated with the project, the Commission notes that the applicant committed to use the minimum number of lights required by Transport Canada on the turbines, along with the minimum number of synchronized flashes per minute and flash duration.[343]

545. Based on the forgoing, the Commission does not find that any addition visual mitigation measures by the applicant would be necessary.

[343] Exhibit 157.22. Applicant's response to IR AUC-1646658 AB-34, page 8.

12 Environmental issues

546. The applicant retained Golder Associates Ltd. (Golder) to prepare an environmental evaluation for the project (the environmental evaluation report).[344] The applicant concluded that the project complied with provincial requirements and guidelines, including wildlife setbacks and that these setbacks are adequate to protect wildlife.[345] Three Golder employees, Mr. Stephen Glendinning, Mr. Doug Pelly and Mr. John Wozniewicz testified at the hearing. Mr. Stephen Glendinning is a professional biologist wildlife ecologist and wind power specialist.[346] Mr. Doug Pelly and Mr. John Wozniewicz testified on matters relating to geotechnical engineering and hydrogeology respectively.[347]

547. The KLG said that the environmental issues associated with the project included the conservation and reclamation of native grasslands and the effects of the project on wildlife, particularly birds, bats, and species at risk. Professional biologists Mr. Cliff Wallis and Mr. Cleve Wershler (Wallis and Wershler) of Cottonwood Consultants Ltd. and Sweetgrass Consultants Ltd., respectively, filed evidence and testified at the hearing on behalf of the KLG on environmental matters.[348]

12.1 Views of the applicant

548. The applicant's environmental evaluation report described the environmental setting of the project area including designated areas, wetlands and waterbodies, soils and terrain, vegetation, and wildlife. It also discussed the potential adverse effects of the project on these environmental components and identified mitigation measures that would eliminate or reduce the potential effects of the project on these components.

549. The environmental evaluation report was based on desktop information and vegetation and wildlife field work completed between 2008 and 2011. The environmental evaluation report acknowledged that the project has the potential to impact various groups of wildlife, including birds, bats, mammals, amphibians, and species at risk, but predicted that, with implementation of the proposed mitigation measures, the impacts of the project on wildlife would be low to medium in magnitude and importance.[349]

550. The applicant was required to receive approval from the Fish and Wildlife Division of Alberta Environment and Sustainable Resource Development (AESRD) for the project. In its application, the applicant included an AESRD sign-off letter for the project.[350] The Sign-off Letter Referral Report, dated June 20, 2012, itemized several mitigation and monitoring measures for the project, and is attached as Appendix I.

[344] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project.
[345] Transcript, Volume 9, pages 1902-1903.
[346] Transcript, Volume 1, page 15, lines 21-25.
[347] Transcript, Volume 2, page 220, lines 6-12.
[348] Exhibit 133.02. Evidence of Cliff Wallis and Cleve Wershler.
[349] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 9.0, page 50.
[350] Exhibit 42, AESRD Fish and Wildlife Division Project Sign-off Letter Project Referral Report.

Vegetation, native pasture and wetlands

551. Golder completed vegetation surveys that concentrated on portions of the project area with the potential to support rare plant species and communities. Golder observed no rare or listed plant species or communities.[351]

552. The project area is located in the Parkland Natural Region of Alberta. Golder explained that it is home to a variety of native grass species (referred to as native pasture) including the plains rough fescue grass species which is more likely to be used by wildlife than cultivated areas.[352] The environmental evaluation report identified that approximately 538 hectares (ha) of the project area (14.9 per cent) is characterized as native pasture, and 14.7 ha (17.4 per cent) of the project footprint (the area to be traversed or disturbed by turbines the collector system and other project components) is classified as native pasture.[353] Nine turbines would be located on native pasture.

553. The applicant submitted that it avoided siting project components on native pasture and moved turbines from preferred locations to avoid impacts to native pasture.[354] For example, it stated that turbines 47 and 49 were both moved from their original proposed locations.[355]

554. The applicant indicated that the siting of turbines on native pasture was unavoidable. The applicant described the various land use setbacks and constraints, including wetland setbacks, wildlife habitat setbacks, energy facility setbacks, road allowance setbacks, residence setbacks, noise assessment constraints, and wind resource constraints, that led the applicant to site the turbines on native pasture.[356]

555. The applicant stated that 31.3 per cent of the project area is characterized as either treed area or native pasture, however treed areas and native pasture combined comprise only 21.4 per cent of the project footprint.[357] The applicant stated that in the Parkland Natural Region, it is important to recognize the significance of treed areas on wildlife habitat and to minimize effects on treed areas. The applicant explained that this was why it chose to site turbines on native pasture rather than treed areas.[358]

556. The applicant suggested that areas of treed areas and native pasture are more common in the northeastern portion of the project area, where several of the proposed turbines have been sited. The applicant observed that these native habitat areas are disturbed and fragmented and that there is extensive energy development (wells, seismic lines, pipelines, access trails), which reduces the value of this native habitat.[359]

557. The applicant submitted that it has experience in the successful restoration of native pasture in Alberta, and understands the time and resources required to ensure successful re-

[351] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 7.0 and 9.0.
[352] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, pages 13-16.
[353] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 3.3.1, page 15; Exhibit 157.24. applicant's response to IR KLG-1646658 AB-41, page 35.
[354] Transcript, Volume 1, page 33, lines 20-25, and Transcript, Volume 9, page 1905, lines 1-4.
[355] Transcript, Volume 9, page 1905, lines 10-14.
[356] Transcript, Volume 4, page 1128, line 24.
[357] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 3.3.1, page 15; Exhibit 203.11. Evidence Environmental Reply Evidence, Section 1.3, page 6; Transcript, page 475, lines 3-9.
[358] Transcript, Volume 9, page 2221, lines 14-25 and Exhibit 287.01, Undertaking- turbine location page 4.
[359] Exhibit 203.11, Environmental Reply Evidence, Section 1.4, page 7.

establishment of native grass species.[360] To minimize adverse effects on native pasture the applicant further submitted that it would:

- utilize existing access trails/roads where possible
- conserve the integrity of the topsoil and subsoil in-situ where stripping was not required
- limit the amount of topsoil stripping and grading[361]

558. The applicant submitted that the Government of Alberta's *Wildlife Guidelines for Alberta Wind Energy Projects* do not prohibit siting wind power facilities on native pasture. It argued that these guidelines direct proponents of wind energy projects to seek to minimize disturbance to native pasture and other natural features such as treed areas.[362] The applicant stated that it did not contravene these guidelines.

559. Golder conducted wetland surveys in June and August 2010 to classify and delineate wetlands in the project area. Golder identified 128 total wetlands and 95 ha of wetlands in the project area. It stated that none of the proposed turbines would be located within the 100-metre plus rotor length (152 metres) setback recommended by AESRD.[363] Where project components such as access roads and collector lines encroached onto the 100-metre setback, Golder stated that these closer approaches were discussed with AESRD.[364]

560. The applicant proposed to complete construction activities during dry ground conditions, and to employ other measures as appropriate to protect wetlands. The applicant stated that following construction, temporary access roads and workspace in the vicinity of wetlands would be re-vegetated as quickly as feasible.[365] The environmental evaluation report predicted that, with implementation of the proposed mitigation measures, the impacts of the project on wetlands would be low in magnitude and importance.[366]

Designated areas

561. Golder identified several parks, protected areas, environmentally significant areas, and important bird areas of Canada located north of the project.[367] Golder noted that environmentally significant areas contain elements of conservation concern and important wildlife habitat.[368]

562. Golder recognized that the Killarney, Dillberry and Leane Lakes Important Bird Area was categorized as having global significance for the presence of congregatory species and concentrations of shorebirds and national significance for the presence of threatened species, notably piping plovers which nest and breed in the area.[369]

[360] Exhibit 203.11, Evidence Environmental Reply Evidence, Section 1.8, page 13.
[361] Exhibit 157.22, Applicant's response to IR AUC-1646658 AB-34, page 8.
[362] Exhibit 203.11, Evidence Environmental Reply Evidence, Section 1.7, page 12 and Transcript, Volume 2, page 474, lines 12- 22.
[363] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 5.
[364] Transcript, Volume 2, pages 497-498, lines 1-15.
[365] Exhibit 157.22, Applicant's response to IR AUC-1646658 AB-34, page 7.
[366] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 5.
[367] Exhibit 9.00, Environmental Evaluation Bull Creek Wind Power Project, Section 4.
[368] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 4.3.2.
[369] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 4.3.3 and Transcript, Volume 2 pages 465-466.

563. The applicant stated that the proximity and nature of the environmentally significant areas near the project were discussed with AESRD and was an important consideration in the design of the environmental evaluation report and wildlife studies.[370] The applicant asserted that the project's proximity to the various environmentally significant areas, important bird areas of Canada, and other designated areas was acceptable because it received sign-off from AESRD.[371]

Studies

564. Golder conducted wildlife field work which was incorporated into the environmental evaluation report. The field work included a winter wildlife survey, migratory bird surveys, waterfowl surveys, breeding bird surveys, a raptor nest survey, a sharp-tailed grouse lek survey, a Richardson's ground squirrel survey, a borrowing owl survey and bat surveys. The results of the various wildlife surveys are summarized in the environmental evaluation report.[372]

565. The applicant explained that its wildlife surveys were designed to satisfy the recommendations in the Government of Alberta's *Wildlife Guidelines for Alberta Wind Energy Projects.*[373] The applicant submitted that the types, methods and number of wildlife surveys conducted for the project were sufficient because they:

- were consistent with the relevant guidelines and wildlife survey protocols
- were similar in scope and scale to other wind power projects in Alberta
- were developed with input from the wildlife biologist of the Vermillion region of the Fish and Wildlife Division of AESRD and
- the applicant received sign-off from AESRD[374]

566. Golder conducted migratory bird surveys, waterfowl[375] surveys, breeding bird surveys, a sharp-tailed grouse survey, and a burrowing owl survey to assess bird presence, behavior and habitat in the project area. The applicant stated that bird surveys targeting shorebirds were not conducted based on guidance provided in the Government of Alberta's *Wildlife Guidelines for Alberta Wind Energy Projects*. However, it stated that observations of shorebird species were documented during the migratory bird, waterfowl and breeding bird surveys.[376] The results of the various bird surveys are summarized in the environmental evaluation report.[377]

567. Overall, 16 provincially or federally listed bird species were observed during the various 2008 to 2011 bird surveys, with green-winged teal, northern pintail, least flycatcher, horned grebe, lesser scaup, northern harrier, and sora being the most commonly recorded.[378] The applicant stated that three provincially or federally listed species, Golden eagle, Swainson's

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370 Transcript, Volume 2, page 459, lines -10.
371 Exhibit 203.11, Evidence Environmental Reply Evidence, Section 1.1(f), page 4.
372 Exhibit 9.00, Environmental Evaluation Bull Creek Wind Power Project, Appendix F.
373 Exhibit 157.24, Applicant's response to IR KLG-1646658 AB-31(b), page 29.
374 Exhibit 157.13, Applicant's response to IR AUC-1646658 AB-15, page 19; Exhibit 203.11, Evidence Environmental Reply Evidence, Section 1.2, page 5, Section 1.5, pages 8-9, Section 1.6, pages 10 -11, Section 1.7, pages 11-12, and Section 1.9, page 14; Transcript, Volume 2, page 463, lines 11-17; Transcript, Volume 2, page 473, lines 6-17.
375 Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Appendix F, Section 6.0, page 47.
376 Exhibit 157.24, Applicant's response to IR KLG-1646658 AB-33(a), page 30 and Transcript, Volume 2, page 487, lines 10-11.
377 Exhibit 9.00, Environmental Evaluation Bull Creek Wind Power Project, Appendix F.
378 Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Appendix F, Section 5.0, page 46.

hawk and northern harrier, were observed flying within the turbine rotor-sweep zone,[379] but all of the provincially or federally listed species observed had very low collision risk index values.[380] The environmental evaluation report contains more details on the types and abundance of the listed bird species observed during the surveys.[381]

568. From the flight behavior data collected, Golder derived a turbine collision risk index value for migratory bird species. The results indicated that the Canada goose had the highest collision risk index followed by the snow bunting, mallard, and snow goose.[382]

569. Golder completed its first set of bat surveys in the spring and fall of 2009. Golder stated that an average of 0.41 bat passes per detector night were recorded during the spring 2009 survey with bat activity the greatest during the end of May.[383] Golder further stated that the most common species detected during spring activity peaks were big brown bats and silver-haired bats. Golder submitted that during the fall 2009 surveys, an average of 2.02 bat passes per detector night were recorded with bat activity greatest during the last half of August. Golder stated that the most common species detected during fall activity peaks were hoary bats, silver-haired bats, and big brown bats.[384]

570. The environmental evaluation report was supplemented by a second set of bat surveys completed in the spring and fall of 2012. Those surveys indicated that an average of 0.54 bat passes per detector night were recorded during the spring 2012 surveys with the most common species detected being big brown bats, silver-haired bats, and small myotis bats. The fall 2012 surveys reported an average of 4.03 bat passes per detector night with the most common species detected being: hoary bats, silver-haired bats, and big brown bats.[385] It further stated that little brown bats, a federally listed endangered species, were detected seven times in the 2012 surveys.[386]

571. Based on its experience conducting post-construction monitoring programs at wind power facilities in Alberta, Golder stated that the bat mortality rate for wind power facilities in Alberta averaged 3.9 fatalities per turbine per year.[387] Golder explained that in Alberta migratory bat species such as hoary, silver-haired and red bats typically experienced the greatest impacts from wind power projects, while impacts to Myotis species such as the little brown bat and northern long-eared bat are lower. Golder further explained that hoary and silver-haired bats accounted for approximately 90 per cent of all wind power related bat mortalities.[388]

572. The bat surveys also indicated that there was a negative correlation between bat activity levels and wind speed. That is, when the wind speed increased bat activity decreased.[389] While

[379] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Appendix F, Section 3.6, pages 23-24.
[380] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Appendix F, Section 3.7, pages 32-33.
[381] Exhibit 9.00, Environmental Evaluation Bull Creek Wind Power Project, Appendix F,
[382] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Appendix F, Section 3.7, pages 32-33.
[383] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 8.4.1.
[384] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, Section 8.4.1.
[385] Exhibit 250.01, Hearing Exhibits Bat Data, page 1.
[386] Exhibit 250.01, Hearing Exhibits Bat Data, page 1.
[387] Exhibit 203.11, Evidence Environmental Reply Evidence, Section 2.2, page 16.
[388] Exhibit 157.24, Applicant's response to IR KLG-1646658 AB-43, page 36; Exhibit 203.11, Environmental Reply Evidence, Section 2.2, page 16.
[389] Exhibit 9, Environmental Evaluation Bull Creek Wind Power Project, page 45.

the applicant acknowledged that wind turbines interact with birds and bats, it indicated that fatality rates from wind projects has been well studied in Alberta and Canada.[390]

573. The applicant submitted that it would develop a post-construction monitoring program for the project in consultation with AESRD and the Canadian Wildlife Service to assess the impact of the project's operation on birds and bats. The applicant further submitted that the program would include multiple years of bat activity and fatality data collection and implementation of mitigation measures which may include curtailment or feathering of turbine blades during low wind speeds if issues are identified.

574. The applicant stated that it will work with AESRD to develop and implement appropriate bat mitigation measures if post-construction monitoring reveals higher that acceptable fatality rates.[391] According to the applicant, should the project be approved, bat surveys would continue throughout 2014, in parallel with construction activities, and be publically disclosed.[392] During the hearing, the applicant committed to complying with AESRD's *Bat Mitigation Framework for Wind Power Development*.[393]

575. To minimize adverse effects experienced by bats and birds, the applicant committed to use the minimum number of lights required by Transport Canada on the turbines, along with the minimum number of synchronized flashes per minute and flash duration.[394]

576. The applicant submitted that amphibian surveys were not necessary because:

- The proposed turbines would be located at least 100 metres from wetlands.
- The local Vermillion region of the Fish and Wildlife Division of AESRD did not identify amphibians surveys as a requirement and provided sign-off for the project.
- Pre-construction surveys would identify amphibians, including the northern leopard frog, if present.[395]

577. The applicant committed to conducting additional pre-construction wildlife surveys in the spring to ensure that no new wildlife features have appeared. The applicant submitted that it would report the results of these surveys to the Fish and Wildlife Division of AESRD and implement additional mitigation measures as required.[396] The applicant also submitted that it would prepare an environmental protection plan for the project in consultation with AESRD prior to construction.[397] The applicant confirmed that the environmental protection plan would

[390] Transcript, Volume 9, page 1906, lines-1-12.
[391] Exhibit 157.22, Applicant's response to IR AUC-1646658 AB-34, page 9; Exhibit 203.11, Environmental Reply Evidence, Section 2.2, page 16; Transcript, Volume 9, pages 1907 to 1908; Transcript, Volume 9, page 1909, lines 9-17.
[392] Transcript, Volume 2, page 464, lines 10-15 and Transcript, Volume 9, page 1908, lines 21-24.
[393] Transcript, Volume 4, pages 1121 -1122; Transcript, Volume 9, page 1909, lines 4 to 8; Transcript, Volume 10, page 2222, lines 7-14.
[394] Exhibit 157.22. Applicant's response to IR AUC-1646658 AB-34, page 8.
[395] Exhibit 203.11, Evidence Environmental Reply Evidence, Section 1.5, pages 8-9 and Section 1.6, page 10 and Transcript, Volume 2, pages 484 -486 and Transcript, Volume 2, page 499, lines 7-21.
[396] Exhibit 203.11, Environmental Reply Evidence, Section 1.7(e), page 12 and Transcript, Volume 9, page 1908, lines 9-8 and Transcript, Volume 9, page 2220, lines 14-19.
[397] Exhibit 157.13, Applicant's response to IR AUC-1646658 AB-20, page 26; Exhibit 157.22, Applicant's response to IR AUC-1646658 AB-34, page 9 and Transcript, Volume 9, page 1908, lines 20-22.

contain all of the mitigation measures and monitoring activities recommended or required by AESRD in its Sign-off Letter Referral Report.

Groundwater resources (hydrogeology)

578. The environmental evaluation report did not include hydrogeology as one of the environmental components assessed for the project. In response to concerns from the KLG about the effects of the project on hydrogeology, Golder prepared a supplementary report addressing these concerns.[398]

579. One of the concerns expressed by the KLG was that vibrations from the project could cause consolidation of the underlying sand and sediments which could impact aquifers. Golder stated that vibrations caused by the turbines would be very small, 1/125th of normally accepted civil engineering thresholds, compared to typical anthropogenic sources of ground vibrations. When asked to compare vibrations from the proposed turbines with other activities in the area, Mr. Pelly responded that vibrations from turbines are:

> … very small in comparison to normal surface vibrations that we experience on a day-to-day basis. [399]
>
> …
>
> The order of magnitude of vibrations from normal oil and gas operations, which includes trucks on roads and ---- you know, familiar things like that, vibrations from pump jacks or compressors, would be measured in millimetres per second most likely, whereas the turbines, the unit that's measured in the report is nanometres per second.[400]

580. Golder further stated that the anticipated magnitude of ground vibrations generated by the proposed turbines would be well below the threshold that could lead to consolidation of the sand and sediments in the project area. Golder explained that due to the likely density of the sediments, these sediments would not be subject to further consolidation due to ground vibrations.[401]

581. Golder submitted that there were no known case studies or reports that attribute a decrease in groundwater aquifer yield to seismic waves generated by wind power projects.[402] Therefore, Golder concluded that it would be unnecessary for the applicant to conduct either a baseline groundwater data collection or an ongoing groundwater monitoring program for the project.[403]

582. Golder also addressed the KLG concerns with respect to the project disrupting overland water flow. Golder stated that the planned infrastructure would not be materially different from

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398 Exhibit 202.07, Golder Associates Reply Evidence to Geotechnical Aspects of HCL Report Titled "Groundwater Review – Proposed Bull Creek Power Project".

399 Transcript, Volume 2, page 243, lines 6-14.

400 Transcript, Volume 2, page 244, lines 5-13.

401 Transcript, Volume 2, page 224, lines 14-18.

402 Exhibit 202.07, Golder Associates Reply Evidence to Geotechnical Aspects of HCL Report Titled "Groundwater Review – Proposed Bull Creek Power Project", pages 2 to 3 and Transcript, Volume 9, pages 1910-1911.

403 Exhibit 202.07, Golder Associates Reply Evidence to Geotechnical Aspects of HCL Report Titled "Groundwater Review – Proposed Bull Creek Power Project", page 4.

other access routes. Golder acknowledged that access routes and drainage ditches associated with roads, could impact or re-direct overland flow. Golder stated that this impact could be mitigated through the use of appropriate siting of roads along with the installation of ditches and culverts to enable the existing surface flow patterns to be maintained. The applicant committed to follow industry best practices to help maintain the natural surface flows, with site specific measures, as appropriate.[404]

Historical resources

583. The applicant completed a historical resources impact assessment for the project, and obtained a conditional *Historical Resources Act* clearance from the Historic Resources Management Branch of Alberta Culture on August 25, 2011. One of the conditions of the clearance was that any change in the project footprint, including temporary workspace, would require a new *Historical Resources Act* clearance.[405] The applicant confirmed that it designed the project layout to avoid the historical resources identified in the historical resources impact assessment and it anticipated receiving unconditional *Historical Resources Act* clearance.[406]

12.2 Views of the interveners

General views and conclusions

584. The KLG expressed a number of environmental concerns for the project, including:

- the environmental evaluation report completed for the project
- impacts to migratory birds and bats, including endangered species
- impacts to native pasture
- impacts to groundwater[407]

Vegetation, native pasture and wetlands

585. On behalf of the KLG, Wallis and Wershler asserted that the project has not avoided grassland habitats and contended that those habitats would be disproportionately impacted by the project. Wallis and Wershler stated that the project contravened AESRD's *Wildlife Guidelines for Alberta Wind Energy Projects*, which recommended avoidance of native pasture because 14.7 ha of the project footprint is proposed to be on native pasture.

586. Wallis and Wershler submitted that fescue grasslands, including Aspen Parkland, are one of the most threatened natural regions in Canada and any remaining areas should be considered endangered. They further submitted that remnant native parkland habitats, especially the larger contiguous patches in the northeastern portion of the project area, are locally or regionally significant. Wallis and Wershler stated that although native grasslands only comprise about five per cent of Alberta's lands, it supports 50 per cent of the rare ecological communities, 40 per cent of rare plants, and 70 per cent of mammal, bird, reptile and amphibian species at

[404] Exhibit 202.07, Golder Associates Reply Evidence to Geotechnical Aspects of HCL Report Titled "Groundwater Review – Proposed Bull Creek Power Project", page 4.
[405] Exhibit 8, August 25, 2011 Letter from the Historic Resources Management Branch, Schedule B.
[406] Exhibit 157.03, Revised application blackline, Section PP10) and TS39), page 6.
[407] Exhibit 143.02,.KLG-1955, The KLG Written Submissions, pages 8-9.

risk.[408] Wallis and Wershler suggested that there is insufficient field survey information to conclude that native grassland habitats in the project area are of marginal value to wildlife.[409]

587. Wallis and Wershler asserted that the significance of plains rough fescue and the difficulty of restoring this native vegetation is not recognized in Golder's environmental evaluation report. They stated that any decline of rare plant communities such as those dominated by plains rough fescue should be considered significant.[410] Wallis and Wershler reported that there has been limited success in restoring plains rough fescue grasslands in Alberta.[411]

588. Wallis and Wershler criticized Golder's wetland assessment for not comprehensively inventorying wetlands in the project area. They also critiqued Golder for not surveying wetland use by wildlife to find out which wetlands in the project area are more important for biodiversity. During their field work, Wallis and Wershler identified and confirmed 29 wetlands in the project area that were not inventoried by the applicant.[412] Wallis and Wershler testified that a portion of these wetlands could have been identified had Golder reviewed recent aerial photography.[413] Wallis and Wershler also identified, but did not confirm through field work, another 75 potential wetlands in the project area that were not inventoried by Golder.[414] Wallis and Wershler contended that the lack of attention to wetlands and biodiversity is the greatest deficiency in Golder's environmental evaluation report.

Bats and birds

589. Wallis and Wershler critiqued the bird surveys conducted by Golder and they submitted that there are internationally significant concentrations of shorebirds using the project region and flying from one waterbody to another.[415] Wallis and Wershler stated that monitoring studies at wind power developments indicated that shorebirds are among the most susceptible bird species to collide with turbines due to their tendency to fly at low altitudes at night and during poor weather conditions. Wallis and Wershler concluded that the bird surveys inadequately assessed shorebird presence and habitat in the project area.[416]

590. Wallis and Wershler criticized the sharp-tailed grouse lek survey for not following AESRD protocols, not using a large enough buffer area and not surveying for the presence of sharp-tailed grouse nesting, feeding and wintering habitat.[417]

591. Wallis and Wershler indicated that hoary bats, silver-haired bats and red bats inhabit the project area and are designated as a sensitive species in Alberta. They stated that the little brown bat inhabits the project area and is a species with a federally endangered status. Wallis and

[408] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, page 8.
[409] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, pages 20-22.
[410] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, pages 20-22.
[411] Exhibit 197.02, KLG's response to IR AUC-KLG-3, page 5.
[412] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, page 15.
[413] Transcript, Volume 7, page 1655, lines 1-11.
[414] Transcript, Volume 7, page 1498, lines 11-20; Transcript, Volume 7, page 1500, lines 12-18 and Transcript, Volume 6, page 1654, lines 5-22.
[415] Transcript, Volume 7, page 1496, lines 1-9; Transcript, Volume 7, page 1567, lines 7-12; Transcript, Volume 7, page 1572, lines 4 -18 and Transcript, Volume 7, page 1657, lines 5 -19.
[416] Transcript, Volume 7, page 1497, lines 2-17 and Transcript, Volume 9, pages 2035-2036.
[417] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, pages 24-26.

Wershler recommended that further studies be completed to determine the effects of the project on bat species over the long-term.

592. Wallis and Wershler expressed concerns with the 2012 bat survey data results, which indicated a potentially high risk of migratory bat fatalities from the project. They stated that AESRD's *Bat Mitigation Framework for Wind Power Development* indicates that greater than two migratory bat passes per detector night indicates a potentially high risk of bat fatalities. Wallis and Wershler noted that the fall 2012 bat survey data showed that all the detectors surpassed two migratory bat passes per detector night, with an average of 3.76.[418] The KLG emphasized that the applicant did not mention or file the 2012 bat survey results with the AUC or AESRD until requested to do so by the KLG.[419] Wallis and Wershler were dismayed by the applicant's failure to disclose this information sooner.[420]

593. Wallis and Wershler criticized the project's environmental assessment report for not including amphibian surveys to identify amphibian species of conservation concern that potentially occur in the project area such as the northern leopard frog. According to Wallis and Wershler, amphibian species are vulnerable to vehicle traffic and disturbances of wetland breeding habitat.[421] Wallis and Wershler recommended that amphibian surveys be conducted at wetlands located near project components such as proposed access roads.[422]

Wallis and Wershler's recommendations

594. Wallis and Wershler suggested several recommendations for the project, including that the applicant should:

- Adjust the layout to avoid locally important habitat and species of concern and increase the setback of turbines from ESAs, especially in the northeastern part of the project area.
- Collect additional data on the movements of waterbirds and shorebirds in the project area, including longer-term studies of their use of wetlands and modify the project operation as necessary.
- Complete additional field work in native wildlife habitats in the project footprint prior to construction and adjust the project layout if necessary.
- Complete more bat survey work and mitigation to address the high risk of bat fatalities.[423]
- Complete amphibian surveys at wetlands located near project components.[424]

595. Wallis and Wershler asserted that the applicant's determination that the residual effects of the project would be low is not supported by the evidence and does not reflect the project's

[418] Transcript, Volume 9, page 2037, lines 2-17.
[419] Transcript, Volume 9, pages 2039 - 2041; Transcript, Volume 9, page 2047, lines 6-11.
[420] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, pages 23-26 and Transcript, Volume 7, pages 1658-1659.
[421] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, page 24 and Transcript, Volume 7, page 1496, lines 13-18 and Transcript, Volume 9, pages 2033-2034.
[422] Transcript, Volume 7, pages 1656-1657, lines 17-6.
[423] Transcript, Volume 7, pages 1509-1510 and Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, pages 34-35 and Transcript, Volume 7, pages 1655-1656, 1662, 1668-1670 and Transcript, Volume 9, pages 2042-2043.
[424] Transcript, Volume 6, pages 1656-1657, lines 17-6.

potential impact on endangered native habitats, species of concern and migratory birds and bats.[425]

596. Wallis and Wershler submitted that the project's environmental evaluation report should be redone because many of the wildlife field surveys are more than two years old.[426]

597. Wallis and Wershler contended that a precautionary approach for the project is warranted both in data collection and mitigation because of the presence of the rough fescue grassland, the results of the 2012 bat surveys and the importance of wetlands surrounding the project area for shorebirds.[427]

598. The KLG concluded that the project is not in the public interest from an environmental perspective because the project does not satisfy the precautionary principle and the applicant has failed to provide reasonable mitigation measures to address the impacts of the project on wetlands, wildlife habitat, native grasslands, migratory shorebirds and bats.[428]

Groundwater resources (hydrogeology)

599. Mr. Clissold suggested that seismic waves generated by the proposed turbines travelling below the ground have the potential to rearrange sediment grains in unconsolidated aquifers, which would reduce the permeability of the aquifers, the yield of water wells and overland flow. Mr. Clissold explained that:

> In this part of Alberta, we have a lot of issues with trying to keep the sediment out of the water wells. Usually in the unconsolidated sediments, we'll use a water well screen to accomplish this. In the bedrock, we also require the completion to involve, if not a water well screen, then it will require a slotted casing with a sand pack to keep the sand out of the water.[429]

600. Mr. Clissold was also concerned that the project infrastructure has the potential to disrupt overland flow and the supply of surface water to some dugouts. He stated that the infrastructure proposed for the project would have a significant footprint on the watersheds' tributaries.[430]

601. Mr. Clissold recommended that baseline data should be collected for all water wells and dugouts in the project area and that the applicant conduct an ongoing groundwater monitoring program.[431]

Historical resources

602. Ms. Marion Kelch, a member of the KLG, expressed concerns that the project's historical resources impact assessment omitted the Bull Creek School site, which was operated from

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[425] Exhibit 133.02, Evidence of Cliff Wallis and Cleve Wershler, page 3 and Transcript, Volume 6, page 1506, lines 13-18.
[426] Exhibit 187.02, KLG Updated Master Submission Letter, page 8 and Transcript, Volume 10, page 2022, lines 3-6 and Transcript, Volume 9, page 2024, lines 2-20.
[427] Transcript, Volume 6, page 1507, lines 8-14.
[428] Transcript, Volume 9, pages 2044-2047, lines 20-10.
[429] Transcript, Volume 5, pages 1203-1204, lines 18-10.
[430] Exhibit 142.02, Groundwater Review – Proposed Bull Creek Wind Farm, page 4.
[431] Exhibit 142.02, Groundwater Review – Proposed Bull Creek Wind Farm.

1915 to 1938 and whose foundation remains in the northeast corner of the NW22-41-1.[432] Ms. Kelch explained that an internationally recognized Canadian ceramist named Mary Borgstrom attended this school in the late 1920s.[433] Ms. Kelch submitted that it is important that the integrity of the historic Bull Creek School site is not compromised and overshadowed by the close proximity of towering wind turbines.[434]

12.3 Commission findings

603. The Commission heard significant evidence and testimony from expert witnesses and members of the KLG on the subject of environmental impacts.

604. The Commission notes the testimony and written submissions regarding the potential adverse effects from siting the project on native grasslands. During the hearing the terms "native pasture", "native prairie" and "native grasslands" were used interchangeably to describe native grasses on lands within the project area. The Commission considers that these terms may be used interchangeably for the purposes of this decision.

605. A primary concern from the KLG was that the *Wildlife Guidelines for Alberta Wind Energy Projects* would not be followed. Specifically, Wallis and Wershler were concerned that the project had not avoided native grasslands.

606. The Commission has reviewed the siting constraints that prevented the applicant from being able to move the nine turbines located on native pasture to nearby cultivated lands. The Commission is satisfied that where a turbine would be located on native pasture, the site was chosen due to the presence of other siting constraints.

607. The Commission observes that the applicant took the following steps before siting turbines on native pasture. First, the applicant attempted to avoid placing project components on native pasture, while maintaining the project's viability with respect to the wind resource. The Commission accepts that the applicant moved turbines from preferred locations to avoid impacts to native pasture.[435] Second, the applicant chose to site turbines on native pasture instead of on treed areas. The Commission accepts that the *Wildlife Guidelines for Alberta Wind Energy Projects* require the applicant to avoid native grasslands as well as other natural habitats. The Commission notes that AESRD did not raise any concern with the applicant's interpretation of these guidelines. The Commission observes that Mr. Wershler agreed that it is more important to preserve treed areas than native pasture.[436] The Commission finds that the applicant's choice to selectively avoid treed areas, rather than native pasture, is consistent with the *Wildlife Guidelines for Alberta Wind Energy Projects* and the expert evidence.

608. In the Commission's view, sign-off by AESRD suggests that the impact to native pasture was acceptable from its perspective. With regard to the foregoing, the Commission concludes that the applicant's approach to siting turbines was reasonable in the circumstances. However, the Commission encourages the applicant to continue to work to find ways to mitigate impacts to native prairie including those that may occur during construction.

[432] Exhibit 138.04, Evidence of Marion Kelch.
[433] Transcript, Volume 5, page 1238, lines 1-3.
[434] Exhibit 138.04, Evidence of Marion Kelch.
[435] Transcript, Volume 1, page 33, lines 20-25 and Volume 9, page 1905, lines 1-4.
[436] Transcript, Volume 7, page 1667, lines 10-16 and Transcript, Volume 7, page 1558, line 4.

609. With respect to the timing of the wildlife surveys, the Commission accepts that it is preferable for surveys to be performed within two years to identify wildlife presently inhabiting the area. The Commission notes that AESRD has the discretion to request additional surveys if the surveys were conducted outside the two year period. The Commission determines that the purpose of the initial surveys and the pre-construction surveys is to identify wildlife in the project area. The Commission notes that AESRD was satisfied that wildlife would be identified by the pre-construction surveys and chose not to require the applicant to update its initial surveys. In the Commission's view, should the project be approved, the wildlife in the area would be identified by the pre-construction surveys. As such, the Commission finds that the applicant would not be required to update its initial wildlife surveys if the project is approved.

610. The Commission has reviewed the evidence presented by each party on the wetland surveys and determines that Wallis and Wershler identified wetlands and potential wetlands not included in Golder's environmental evaluation report. The Commission makes no specific finding on the adequacy of Golder's wetland evaluation, but notes that AESRD did not take issue with Golder's approach.

611. For the potential wetlands identified by Wallis and Wershler, the Commission expects the applicant to conduct investigations to determine if the identified areas are wetlands suitable to provide wildlife habitat, to submit the results of its investigations to AESRD and to complete any additional field work required by AESRD. The Commission considers that the following condition would be required if the project is approved:

> If the project encroaches upon newly identified wetlands, the applicant must re-site the offending project component(s) or receive AESRD's approval to site the project within the wetland setback.

610 The Commission notes that the applicant recognized that the project would have an effect on birds and bats. The Commission recognizes that bird surveys were performed by the applicant and that AESRD prescribed specific recommendations to protect birds within the project area. The project was not sited near ridgelines or other terrains that concentrate migratory bird (and bat) species. The Commission also recognizes that the applicant has committed to complete construction activities on native grassland outside the critical breeding period of birds nesting in the area. The Commission observes that AERSD has indicated that this will ensure that bird nests, including species at risk, are not damaged as per the Alberta *Wildlife Act* and the *Migratory Bird Conventions Act*.

612. The Commission observes that the AESRD sign-off addresses bird use of neighbouring designated areas and that the geographic separation between the project and the neighbouring designated areas is anticipated to be sufficient to protect birds.[437]

613. The Commission notes that bird mortality can increase when power lines are present. The Commission notes that the project's collector system is primarily situated underground and that post-construction surveys of the above ground portion would be completed. The Commission notes that if the post-construction surveys determine that avian species are colliding with the above ground collector system line, AESRD will require the installation of visibility enhancement devices to reduce the risk of collisions.

[437] Exhibit 42, Updated-AESRD Sign-off, page 6.

614. The Commission notes that the applicant made several commitments related to minimizing the impact of the project on birds and bats, should the impact on birds and bats be determined to be too high, including: (a) altering cut in speeds at turbines; (b) preventing unnecessary lighting at night; and (c) imposing any mitigation that is deemed appropriated based upon the site specific circumstances following consultation with AESRD.

615. The Commission recognizes that AESRD, in its sign-off, would require the applicant to complete post-construction surveys to determine changes to bird and bat use in the areas associated with turbines and related infrastructure over a minimum of two years. The surveys would be conducted using the methods described in Canada Wildlife Services *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.* The Commission finds that performing these studies should mitigate the concerns of Wallis and Wershler to perform long-term bird studies. Should the Commission application, the following would be a condition of approval:

> The applicant shall conduct a post-construction monitoring program for birds and bats in consultation with AESRD. The applicant shall advise the Commission when this condition has been satisfied.

616. With respect to the project's potential impact on bats, the Commission expects the applicant to uphold its commitment to follow AERSD's *Bat Mitigation Framework*. The Commission observes that the implementation of this framework may include implementing mitigation measures prior to the project's initial operation, such as pre-emptive blade feathering and curtailment for lower wind conditions if the pre-construction surveys anticipate that the project will have a high impact on bats. The Commission is of the view that the KLG's concerns with respect to this issue could be mitigated if the following condition was placed on the project's approval:

> The applicant shall continue to complete pre-construction bat monitoring; submit the results of its pre-construction bat monitoring data to AESRD prior to operation of the project; and comply with all direction received from AESRD, including any recommended or required mitigation measures to protect bats. The applicant shall advise the Commission when this condition has been satisfied.

617. The Commission acknowledges that the applicant committed to develop and implement an environmental protection plan for the project in consultation with AESRD.[438] The Commission accepts the applicant's representations that it will implement those mitigation measures required by AESRD and considers that any approval from the Commission would be conditional on the applicant's compliance with all AESRD direction.

> The applicant shall develop and implement an environmental protection plan in consultation with AESRD. The applicant shall advise the Commission when this condition has been satisfied.

618. The Commission recognizes that pursuant to AUC Rule 007, applicants may shift the location of their wind turbines up to 50 metres from the coordinates stated in the application without having to reapply to the Commission for approval. The Commission is of the view that this flexibility provided in AUC Rule 007 was not intended to permit applicants to contravene

[438] Exhibit 157.13, The Applicant's response to IR AUC-1646658 AB-20, page 26.

environmental setbacks. Should the project be approved and a relocation results in the project infringing upon an environmental setback or other natural feature (such as native pasture), the Commission expects the applicant to inform AESRD.

619. Based on the approval received from AESRD, the Commission is satisfied that the wildlife surveys conducted by the applicant were reasonable in the circumstances. The Commission expects the applicant to abide by its commitment to hold ongoing discussions with AESRD and to complete further wildlife surveys as outlined.[439]

620. The Commission observes that the applicant has received approval from the Fish and Wildlife Division of AESRD. As stated previously, the Commission regards compliance with the existing regulatory requirements administered by other public or government departments or agencies to be important elements when deciding if potential adverse impacts are acceptable and approval of a project is in the public interest.

621. In line with the above approach, the Commission considers that sign-off from AESRD is strong evidence that the project's environmental effects would be acceptable. However, given the evidence presented by Wallis and Wershler, the Commission finds that conditions, as outlined above, are necessary to adequately protect the environment. The Commission is of the view that these conditions and the AESRD sign-off would indicate the project's environmental effects can be mitigated to an acceptable degree.

622. With respect to the KLG's concerns that ground vibrations and seismic waves from the project may affect aquifers, the Commission accepts the applicant's submission that ground vibrations caused by the project are likely much lower than normally accepted civil engineering thresholds for concern with vibrations. The Commission recognizes that these vibrations would be far lower than those produced from existing infrastructure in the project area. The Commission notes that Mr. Clissold was not able to quantify what level of vibrations may be concerning. The Commission observes that there is considerable oil and gas in the project area and that none of the KLG members identified any water well related concerns as a result of that activity, which included seismic. Given how low the vibrations from the turbines are expected to be, the Commission finds that the project is extremely unlikely to be detrimental to aquifers. The Commission does not find that there would be a need to require the applicant to perform baseline water well testing for the members of the KLG.

623. The Commission accepts the applicant's evidence that the Bull Creek School site is not listed as a historical site by the Historical Resources Management Branch of Alberta Culture. The Commission makes no specific finding as to the historic value of the Bull Creek School site but notes that the site is on privately owned land. The Commission accepts the applicant's submission that the construction and operation of project would not disturb the Bull Creek School's foundation. Accordingly, the Commission does not expect the project to adversely impact the Bull Creek School site.

624. Therefore, the Commission concludes that, with diligent application of the proposed mitigation strategies outlined, the environmental effects from construction and operation of the project can be adequately mitigated.

[439] Transcript, Volume 9, page 1903.

13 Project decommissioning

625. The KLG raised concerns with the applicant's corporate structure and longevity, decommissioning and the possibility of the project becoming abandoned without adequate reclamation. The KLG also expressed concerns that the project's insurance was insufficient.

13.1 Views of the applicant

626. The applicant stated that 1646658 Alberta Ltd. is a wholly owned subsidiary of BluEarth. It outlined that this structure was partially created based on how financing for the project was expected to proceed. The applicant stated that the project would be financed using non-recourse project financing which requires that it be developed within a single purpose vehicle. In addition, the applicant submitted that its corporate structure would facilitate potential partnerships with participating school boards. [440]

627. The applicant explained that it was incorporated on December 14, 2011. It stated that its shares are owned by BluEarth, and BluEarth's two major shareholders, ARC Energy Fund 6 and the Ontario Teacher's Pension Plan Board. The applicant outlined that, at that time, its assets were comprised of three meteorological monitoring masts, as well as rights to develop the project, it had no employees and had not filed any financial statements.

628. The applicant explained that the project would be decommissioned at the end of the project's useful life, in accordance with the relevant rules and regulations in force at that time. It stated that the costs for removal of project infrastructure would be the responsibility of the owner of the project.

629. The applicant explained that generally its project decommissioning plans would include the following:

- removal of wind turbines, padmount transformers and associated ground grid
- removal of wind turbine foundation to approximately one metre below grade in consultation with the host landowner
- removal of project substation and ground grid
- removal of overhead electrical lines
- removal of gates, sound barriers and fencing
- removal of meteorological tower, anchors and guy wires
- removal of operations and maintenance building(s) (if applicable)
- site rehabilitation in consultation with the host landowner and local environmental authorities[441]

630. The applicant explained that its approach to project decommissioning would be to remove all above ground infrastructure and remove all underground infrastructure up to one metre in depth. It stated that underground collector cables would not be removed since their excavation would cause greater environmental impact than leaving the cables in place.

[440] Exhibit 107.01, BluEarth Response to BTPS letter 12103.
[441] Exhibit 203.07, 1646658 Alberta Ltd. Reply Evidence, page 6, paragraphs 6-10.

631. The applicant explained that the project roads would be removed and reclaimed on an as required basis as instructed by each individual landowner. At the landowner's option, the road may be left in place or removed and reclaimed.

632. The applicant stated that it had not put any money aside for decommissioning. On behalf of the applicant, Ms. Matheson-King stated:

> …based on some preliminary estimates, we believe that the value of the scrap iron in the turbine towers is expected to offset the cost of decommissioning:
>
> …
>
> [T]here's a lot of iron -- scrap iron in the towers and copper and aluminum and other metals. So, you know, we did a calculation based on today's prices, and it sort of nets out that the cost of that scrap iron would offset the cost of cranes and equipment to remove the wind farm components.[442]

633. Ms. Matheson-King also added that the applicant is well capitalized and committed to working with stakeholders throughout the life of the project.

634. Ms. Matheson-King testified that the applicant would carry wrap-up liability insurance during construction and commercial general liability insurance through the operation of the project, and that the amount of these insurance policies would each be approximately $25 million.[443]

635. In response to the KLG's argument that it should carry decommissioning insurance, the applicant stated:

> … BluEarth can confirm that the cost for removal of a project infrastructure will be the responsible of the owner of the project. Mr. Secord's statement that BluEarth was asked repeatedly by the Municipal District of Provost Municipal Planning Commission to post a bond for decommissioning, which they refused, is incorrect. There's nothing on the record to support this statement. Therefore, BluEarth asserts this should be given no weight.[444]

13.2 Views of the interveners

636. The KLG stated that the applicant has not undertaken to ensure that decommissioning would occur, nor has the applicant obtained any insurance to ensure that it would have adequate funds to carry out the decommissioning.[445]

637. The KLG questioned whether the value of the steel in the towers and other salvageable materials is likely to exceed all costs associated with decommissioning and reclamation of the site. The KLG argued that:

> [t]he decision for the Commission, then, is whether, from the evidence, there is actual commitment from BluEarth to decommission the project at the end of its useful life and,

[442] Transcript, Volume 4, pages 954-955, lines 17-8.
[443] Transcript, Volume 10, pages 2229, lines 20-25.
[444] Transcript, Volume 10, pages 2228-2229, lines 16-1.
[445] Transcript, Volume 9, page 2141, lines 5-11.

> two, whether in the absence of bonds, insurance and adequate plans from BluEarth, BluEarth will actually have the capacity and the legal and moral obligation to decommission the project.[446]

638. The KLG expressed concerns with the applicant's corporate structure and its relation to BluEarth. In its final argument, the KLG stated "So you have a shell company with no employees, no assets to speak of, and we just looked at the issue of decommissioning and who is going to pay for that."[447] The KLG requested the applicant post a security bond if the application receives an approval from the AUC.[448]

13.3 Commission findings

639. To be eligible to receive a permit or license from the Commission, an applicant must meet the requirements of the *Hydro and Electric Energy Act*. Section 23 of the *Hydro and Electric Energy Act* specifies the types of entities that may receive an approval from the Commission. Section 23 provides that one permissible form for a corporate entity is to be registered, incorporated or continued under the Alberta *Business Corporations Act*. The applicant was incorporated and is currently registered under the *Business Corporations Act* and therefore meets the requirement to be eligible to receive an approval for a power plant from the Commission. The Commission observes that there are no other legislative requirements that applicants must meet to be eligible to obtain a license from the Commission and that applicants are not required to demonstrate financial capability.

640. In the addendum to Decision 2002-089,[449] the AUC's predecessor, the Alberta Energy and Utilities Board, made the following remarks regarding applicants' corporate structures:

> In the Board's view, proponents of energy projects may use legitimate and legally recognized forms of business organization in order to advance their commercial interests. Corporate configurations such as limited partnerships, limited companies, and joint ventures are common examples of business organization and, in the absence of compelling reasons to reject such arrangements, are generally acceptable to the Board. The existence of limited liability for limited partners, for example, will not of itself be sufficient reason to deny such an applicant's project. A similar restriction on liability is afforded shareholders of a limited company.
>
> However, the government and public are entitled to have successful proponents provide a financial mechanism for the funding of broad public/environmental liability for contingencies that may arise during construction and operation of …[a] project, as well as for the reclamation and decommissioning of the site and plant at the end of the project's life. This is especially important where applicants have limited assets at the time of the application for approval and the financial strength of the final ownership structure is unknown.
>
> …
>
> Depending on the specific circumstances before the Board, proponents may also be required to post performance bonds, make security deposits, establish internal or external accounts in which funds from revenue are deposited on an ongoing basis for reclamation,

[446] Transcript, Volume 9, page 2143, lines 12-18.
[447] Transcript, Volume 9, page 2145, lines 8-10.
[448] Transcript, Volume 10, page 2164, lines 11-15.
[449] EUB Decision 2002-089: Truenorth Energy Corporation – Application to Construct and Operate an Oil Sands Mine and Cogeneration Plant in the Fort McMurray Area, Applications No. 1096587 and 2001202, October 22, 2002.

> abandonment, and decommissioning, and obtain both third-party and environmental damage insurance coverage. In some cases, the Board may ask for security instruments to also be provided by an applicant's corporate parent or affiliate.[450]

641. The corporate relationship between BluEarth and the applicant is a commercial matter. In the Commission's view, the applicant is entitled to arrange its corporate structure and affairs in a manner that most effectively advances its business interests as long as it complies with Section 23 of the *Hydro and Electric Energy Act*.

642. With respect to the KLG's concerns regarding ongoing liabilities associated with the project, the Commission notes that the applicant has committed to obtaining wrap-up liability insurance during construction and commercial general liability insurance through the operation of the project. The Commission considers that the maintenance of adequate insurance is important to protect against potential liability. Accordingly, should the Commission approve the project it would be conditional on the applicant obtaining and maintaining adequate insurance to cover reasonably foreseeable liabilities.

> The applicant shall, at all times during the construction and operation of the project, maintain insurance coverage that is sufficient to protect against any reasonably foreseeable liabilities. The applicant shall advise the Commission when this condition has been satisfied.

643. Sections 21 and 22 of the *Hydro and Electric Energy Act* address the decommissioning of power plants. Pursuant to Section 22, the owner of a power plant must notify the Commission and the Independent System Operator prior to decommissioning. Section 22 states:

> **Notice of discontinuance of operations required**
>
> **(2)** A person who holds an approval for a power plant under this Part, and a person who operated a power plant on June 1, 1971, shall provide written notice to the Commission and the Independent System Operator established under the *Electric Utilities Act* before permanently discontinuing the operation of, or permanently dismantling or removing any works or installations forming part of, the power plant.

644. Under the current legislative framework, the applicant would not be required to seek the Commission's approval to decommission the project and, thus, the Commission would not assess the adequacy of any proposed decommissioning plan.

645. Section 134 of the *Environmental Protection and Enhancement Act*, RSA 2000, c E-12 requires that the owner or operator of certain activities defined in that Act obtain a reclamation certificate. At present, wind power generators are not specifically listed as an activity governed by the *Environmental Protection and Enhancement Act*.

646. The Commission notes that the applicant has committed to comply with the requirements of the AESRD sign-off, which imposes a duty upon the applicant to reclaim the project site to an equivalent land capability and to consult with AESRD as to the adequacy of the reclamation. Reclaiming the project site to an equivalent land capability, as outlined by AESRD, would allow

[450] Decision 2002-089, TrueNorth Energy Corporation, Application Nos. 1096587 and 2001202 October 30, 2002. Page 3. See also 2001-101, AES Calgary, ULC, 525-MW Natural Gas - Fired Power Plant Application No. 2001113, December 2001.

the land to support various land uses after conservation and reclamation, similar to the ability that existed prior the project being constructed.

647. The Commission expects that at the end of the project's life, it is likely that the applicant will be subject to reclamation requirements under the *Environmental Protection and Enhancement Act* or similar legislation. However, if at the time of decommissioning there is no statutory reclamation scheme in place for wind power generators, the applicant would be required to submit to the Commission a reclamation plan that is consistent with the requirements contained in the AESRD sign-off and further requirements by the standards then current. The Commission will then decide whether to approve the reclamation plan or direct any further steps that it considers necessary. Accordingly, should the Commission approve the project it would be subject to the following condition:

> The applicant shall comply with applicable reclamation standards current at the time of decommissioning, or if there are no legislative requirements in place, submit a reclamation plan to the Commission for approval.

648. Having regard to the foregoing, the Commission would not find it necessary for the applicant to post a security bond to cover future costs of the project's decommissioning.

14 Municipal issues

649. The project area is in the MD of Wainwright and in the MD of Provost. The MDs of Provost and Wainwright are the development authorities for the project components located in their respective boundaries pursuant to the *Municipal Government Act*, RSA 2000, c M-26.[451]

650. Both municipal districts were included in the applicant's consultation process.[452]

14.1 MD of Provost

651. In the MD of Provost, re-zoning was required to allow for the development of wind power projects. The MD of Provost held public meetings and passed a formal re-zoning process for "Wind Energy Conversion Systems" as a land use bylaw amendment in March 2011.

652. The first public meeting which related to the re-zoning applications for the project were held by the MD of Provost on September 13, 2012;[453] the re-zoning applications were unanimously approved. Further meetings related to the development permit applications took place on October 11, 2012, and on October 15, 2012. On December 13, 2012, the Municipal Planning Commission (MPC) of the MD of Provost held a final hearing regarding the 27 development permit applications for the turbines proposed to be located within its boundaries. All 27 applications were denied.[454]

14.2 MD of Wainwright

653. On March 24, 2010, the MD of Wainwright passed Bylaw #1491, an amendment to its land use bylaw, which outlined the requirements for development permit applications for wind projects. Re-zoning of the project's land was not required. The MD of Wainwright approved 18 development permits for the project. Ten of the 18 development permits were appealed to the Subdivision and Development Appeal Board. The applicant subsequently withdrew the applications relating to the pending appeals.[455]

654. The MD of Wainwright requested that certain conditions be placed on the project and indicated that it wished to ensure that there were no inconsistencies between an approval that may be granted by the AUC and the municipal development permits issued by the MD of Wainwright.[456] The requested conditions were as follows:

- All provincial regulations shall be adhered to.
- Building, electrical, plumbing, heating, private sewer and gas permits shall be obtained as required.
- The work will be in compliance with the MD of Wainwright Bylaw #1491.
- The work will be in compliance will all provincial and federal legislation governing the construction and operation of a wind energy facility.

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451 *Municipal Government Act*, RSA 2000, c M-26,s. 624, s.632-632 and s. 640.
452 Exhibit 157.03, Revised Application blackline, page 12.
453 Exhibit 157.03, Revised Application blackline, page 12.
454 Exhibit 157.03, Revised Application blackline, page 12.
455 Exhibit 72.01, Municipal District of Wainwright No. 61 letter to AUC, page 2 and Transcript, Volume 10, page 2160, lines 5-20.
456 Exhibit 157.03, Revised Application blackline, page 12.

- Prior to work beginning the applicant shall enter into a road use agreement covering the local roads that will be used during construction.[457]

14.3 Views of the parties

655. Both the applicant and the KLG made submissions on the weight the Commission should give to the MPC of the MD of Provost's denial of the development permits.

656. The applicant indicated that the project would benefit the community of Provost as a whole through increased tax revenues[458] and indicated that the project is supported by the nine families seeking to host turbines on their properties.

657. The KLG submitted that, while the MPC of MD of Provost's denial of the development permits was not binding on the Commission, the Commission ought to consider that the project does not have the MD of Provost's support when deciding whether the project is in the public interest. The KLG submitted that the MPC of MD of Provost's denial of the development permits should be an important consideration when deciding if approval of the project is in the public interest.[459]

14.4 Commission findings

658. The Commission acknowledges that a portion of the project has been approved by the MD of Wainwright, but that all approvals have been denied by the MD of Provost. The Commission considers that the denial of the development permits in the MD of Provost by the MPC suggest that the project may not have support from parts of the community in the Provost area. A similar situation exists in Wainwright for the development permits that were appealed.

659. An approval granted by the Commission prevails over a development decision of either the MD of Provost or the MD of Wainwright, pursuant to sections 619 and 620 of the *Municipal Government Act*. The Commission agrees with the KLG that the MPC's decision to deny the requested development approvals is a factor that it may take into account when deciding whether approval of the project is in the public interest because it reflects that some members of the community are opposed to the project. However, the Commission may also take into account the letters of support for the project filed in this proceeding.

660. With respect to the conditions requested by the MD of Wainwright, the Commission notes that some of the requested conditions are not under the Commission's jurisdiction. However, should the project be approved, the Commission would encourage the applicant to continue to work with the MDs of Provost and Wainwright to facilitate the execution of the project.

457 Exhibit 157.03, Revised Application blackline, page 12.
458 Transcript, Volume 9, page 1900, lines 21-25.
459 Transcript, Volume 10, page 2164, lines 17-23.

15 Summary of findings and conclusion

661. In Section 3 of this decision, the Commission explained the legislative scheme in place for the consideration and approval of power plants in Alberta. In this section, the Commission applies that legislative scheme in light of the findings it has made above.

662. In accordance with Section 17 of the *Alberta Utilities Commission Act*, the Commission must decide whether approval of the project is in the public interest having regard to its social and economic effects and its effects on the environment.

663. Regarding the social effects of the project, the Commission finds that the construction and operation of the project will not affect the health and safety of area residents.

664. The Commission is satisfied that the applicant's estimated daytime and nighttime predicted cumulative sound levels for the project meet the requirements of AUC Rule 012. The Commission concludes that compliance with daytime and nighttime PSLs for the project, which is mandatory, will protect nearby residents from noise related health effects, including those residents with pre-existing medical conditions. The Commission has imposed conditions on its approval of the project to ensure the project strictly complies with AUC Rule 012 and its PSL.

665. While the Commission recognizes that a segment of the community may be annoyed by the operation of the project, it finds that this annoyance may be partially mitigated by adherence to the 40 dBA PSL and by the provision of objective and credible information regarding the health effects associated with wind turbines. The Commission also observes that a number of area residents filed letters of support for the project.

666. The Commission is also satisfied any safety concerns about the project in close proximity to oil and gas pipelines can be effectively mitigated. In making this finding, the Commission observes that pipelines, including oil and natural gas pipelines which may include high concentrations of hydrogen sulphide operate in the vicinity of electric facilities throughout Alberta and the world. The Commission also notes that there are effective and proven mitigation measures to address any pipeline corrosion issues that may arise when such facilities are cited near each other. Given the studies and resulting mitigation measures that the applicant committed to take, the Commission is of the view that the project's construction and operation would not create a material safety risk to members of the public.

667. Regarding the economic effects of the project, Section 3 of the *Hydro and Electric Energy Act* states that when performing its analysis under Section 17, the Commission cannot consider whether the project is an economic source of electric energy or if there is a need for the electric energy that would be produced by the project. Section 3 further requires the Commission to have regard for the purposes of the *Hydro and Electric Energy Act* and the *Electric Utilities Act*.

668. Based on the evidence, the Commission finds that approval of the project would provide some economic benefit for the community. If the project is approved, the applicant stated that it would hire local employees and use local services for construction and operation of the project. The project may also benefit the Alberta Schools Commodities Purchasing Consortium by providing it long-term predictability of electricity costs and limiting its exposure to electricity price volatility. The Commission also finds that approval of the project will result in increased tax contributions to the MD's of Provost and Wainwright.

669. The KLG asserted that one of the negative impacts of the project would be a decrease in area property values. The Commission found otherwise and determined that approval of the project would have little, if any, negative impact on value of properties owned by the KLG given the distance of their properties from the project's wind turbines.

670. Regarding the environmental effects of the project, an important consideration for the Commission was the applicant's compliance with various AESRD guidelines applicable to the project. As stated previously, the Commission regards compliance with the existing regulatory requirements administered by other public or government departments or agencies to be an important element when deciding if potential adverse impacts are acceptable. Accordingly, AESRD's decision to provide its "sign-off" on the project including the measures proposed by the applicant to mitigate its environmental effects is compelling evidence that the project's environmental impacts fall within the range of acceptability.

671. With respect to the concerns expressed by the KLG regarding the project's impact on area water supplies, the Commission is satisfied that operation of the project will not result in adverse effects to area aquifers or overland flow.

672. Having regard to the foregoing, the Commission finds that the negative effects of the project, which include visual impacts, noise, annoyance and impacts to the environment, can be mitigated to an acceptable degree. The Commission further finds that, with this mitigation, the positive benefits of the project outweigh its negative impacts. The Commission is satisfied that approval of the project is consistent with the purposes of both the *Hydro and Electric Energy Act* and the *Electric Utilities Act* in that it will result in the safe, economic, orderly and efficient development of a new generation facility that will contribute to an efficient electricity market based on fair and open competition.

16 Decision

673. For the reasons provided above, the Commission finds that the approval of the project is in the public interest having regard to the social and economic effects of the project, and its effects on the environment. The Commission's approval of the project is subject to the following power plant approval conditions:

i. Within three months subsequent to approval, the applicant must re-measure the outstanding 2010 facilities in the evaluation of their sound power levels. The applicant must then provide the Commission with the updated field noise measurement data including the calculated sound power levels produced by these facilities. The Commission requires a table comparing the 2010 calculated sound power levels with the re-calculated sound power levels. The Commission also requires a summary table comparing the 2013 NIA predicted cumulative sound levels for the project at all receptors with the updated predictions and a written summary of the findings. If there is a material difference between the re-measured data and results and the 2013 NIA, the Commission will determine whether further process is required to consider that information.

ii. The applicant must ensure that all noise mitigation measures proposed in the application are implemented, if necessary, to ensure compliance with the permissible sound level at all receptor locations in the study area. The noise control measures proposed in the application included: implementing Noise Reduced Operation (NRO) modes, shutting down of wind turbine(s) at nighttime, installation of noise attenuation barriers and additional means of reducing noise levels of the third-party facilities.

iii. The applicant shall:

   a) Conduct baseline (pre-construction or post-construction with no turbines operating) and post-construction comprehensive noise studies, including an evaluation of low frequency noise, at receptors R052, R063, R086, R141 and the receptor located in NW 31-40-1-W4M under representative conditions, in accordance with AUC Rule 012.

   b) Conduct post-construction comprehensive noise studies and an evaluation of low frequency noise at receptors R004, R055, R064, R065 and R070 under representative operating conditions, in accordance with AUC Rule 012.

   c) File all studies and reports relating to the pre-construction and post-construction noise survey with the Commission within one year of connecting the power plant to the Alberta Interconnected Electric System.

iv. The applicant must perform a detailed electrical study and corrosion analysis and implement measures to prevent external pipeline corrosion prior to the project's completion. The applicant shall advise the Commission when this condition has been satisfied.

v. The applicant shall finalize its emergency preparedness and response plan and make copies available to members of the KLG prior to the project's operation. The applicant shall advise the Commission when this condition has been satisfied.

vi. If the project encroaches upon newly identified wetlands, the applicant must re-site the offending project component(s) or receive AESRD's approval to site the project within the wetland setback.

vii. The applicant shall conduct a post-construction monitoring program for birds and bats in consultation with AESRD. The applicant shall advise the Commission when this condition has been satisfied.

viii. The applicant shall continue to complete pre-construction bat monitoring; submit the results of its pre-construction bat monitoring data to AESRD prior to operation of the project; and comply with all direction received from AESRD, including any recommended or required mitigation measures to protect bats. The applicant shall advise the Commission when this condition has been satisfied.

ix. The applicant shall develop and implement an environmental protection plan in consultation with AESRD. The applicant shall advise the Commission when this condition has been satisfied.

x. The applicant shall, at all times during the construction and operation of the project, maintain insurance coverage that is sufficient to protect against any reasonably foreseeable liabilities. The applicant shall advise the Commission when this condition has been satisfied.

xi. The applicant shall comply with applicable reclamation standards current at the time of decommissioning, or if there are no legislative requirements in place, submit a reclamation plan to the Commission for approval.

674. These conditions are designed to enhance the effectiveness of mitigative plans. These conditions become an essential part of the approval, and breach of them may result in suspension or rescission of the approval.

675. Pursuant to sections 11, 14, 15 and 18 of the *Hydro and Electric Energy Act*, the Commission approves the application and grants Power Plant Approval No. U2014-64 and Substation Permit and Licence No. U2014-65 to the applicant. The approval documents will be distributed separately.

Dated on February 20, 2014.

The Alberta Utilities Commission

(original signed by)

Tudor Beattie, QC
Panel Chair

(original signed by)

Neil Jamieson
Commission Member

(original signed by)

Kate Coolidge
Acting Commission Member

Appendix A – Proceeding participants

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Name of organization (abbreviation) counsel or representative
1646658 Alberta Ltd. (BluEarth) T. Oleniuk J. Barretto
Alberta Schools Commodity Purchasing Consortium F. Gagnon
Benign Energy Canada II Inc. Allan Kettles
Buffalo Trail Public Schools D. Eddleston
ConocoPhillips Canada B. Nixdorf
Graham Hager Farms. Ltd., G. Hager, Susan Hager, Chris Hager, Amanda Hager, Shelby Hager, J. Arbuthnott, Sandy Hager, E. Genc
Killarney Lake Group (KLG) R. Secord
D. Levitt
C. and T. Mailer
A. Merriman
Municipal District of Provost No. 52 T. Lawrason
Municipal District of Wainwright No. 61 J. Grundberg, J. Klasson
Riseley, A.
B. Skinner and R. Mitchell-Skinner
M. and J. Skinner

The Alberta Utilities Commission

Commission Panel
- Tudor Beattie, QC Panel Chair
- Neil Jamieson, Commission Member
- Kate Coolidge, Acting Commission Member

Commission Staff
- J. P. Mousseau (Commission Counsel)
- S. Sinclair (Commission Counsel)
- A. Anderson
- K. Elkassem
- J. Davis
- J. Mikal
- A. Drolet
- K. Wyllie
- J. Law
- E. Neuhart
- S. McCallum

Appendix B – Oral hearing – registered appearances

Name of organization (abbreviation) counsel or representative	Witnesses
1646658 Alberta Ltd. T. Oleniuk J. Barretto	P. Ashtiani D. Da Silva S. Glendinning G. Leventhall K. Matheson-King R. McCunney C. Ollson D. Pelly J. Pinter D. Simes J. Wozniewicz
Killarney Lake Group R. Secord Y. Cheng I. Okoye	D. Bonnefoy T. Bonnefoy E. Beatty K. Beatty H. Buck Alan Hager B. Hager Charlene Hager R. Hager M. Kelch K. Nickel H. Nickel D. Read M. Read L. Skinner V. Skinner R. Clissold J. Farquharson B. Gettel C. Hanning R. James S. Laurie C. Phillips A. Upton C. Wershler C. Wallis

Appendix C – Abbreviations

Abbreviation	Name in full
μPa	microPascal
1999 guidelines	World Health Organization 1999 Guidelines for Community Noise
2009 guidelines	World Health Organization 2009 Night Noise Guidelines for Europe
AC	alternating current
Aercoustics	Aercoustics Engineering Ltd.
AESRD	Alberta Environment and Sustainable Resource Development
Altus Report	The Review Report, Altus
applicant	1646658 Alberta Ltd.
AUC	Alberta Utilities Commission
AUC Rule 007	AUC Rule 007: *Applications for Power Plants, Substations, Transmission Lines and Industrial System Designations*
AUC Rule 012	AUC Rule 012: *Noise Control*
Bigelow study	Paller, Bigelow, et al. Wind Turbine Noise, Sleep Quality and Symptoms of Inner Ear Problems
BluEarth	BluEarth Renewables Inc.
Commission	Alberta Utilities Commission
CONCAWE	CONservation of Clean Air and Water in Europe.
dB(A) or dBA	the A-weighted decibel scale
dB(C) or dBC	the C-weighted decibel scale
dB (Lin) or dB	the linear weighted scale
DC	direct current
environmental evaluation report	Environmental Evaluation: Bull Creek Wind Power Project
FDI Acoustics	FDI Acoustics Inc.
G	ground attenuation factor
GE	General Electric Ltd.
Gettel Report	Value Impact Assessment Adverse Effect Relating to a Wind Farm Blue Earth Renewable Inc. Bull Creek Wind Project Properties Within the M.D. of Wainwright, Alberta & M.D. of Provost, Alberta
Golder	Golder Associates Ltd.
ha	hectares
Husky	Husky Energy Inc.
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization

KLG	Killarney Lake Group
kV	kilovolt
Lansink Report	Case Study: Diminution in Value Wind Turbine Analysis
LOAEL	lowest observed adverse effect level
Massachusetts report	Massachusetts Departments of Public Health and Environmental Protection Independent Expert Panel Report
MD of Provost	Municipal District of Provost No. 52
MD of Wainwright	Municipal District of Wainwright No. 61
MPC	Municipal Planning Commission
MW	megawatt
NIEHS	National Institute of Environmental Health Sciences
Nissenbaum study	M. Nissenbaum, J. Aramani, C. Hanning 2012
NRO	Noise Reduced Operation
project	Bull Creek Wind Project
PSL	permissible sound levels
Salt and Hullar	Alec N. Salt and Timothy E. Hullar 2010
Shirley Wind Farm study	A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin – December 24, 2012
WHO	World Health Organization
Windlab	Windlab Developments Canada

Appendix D – Commission ruling on standing

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Appendix D - Ruling on standing.pdf

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Appendix E – Commission ruling on confidentiality request by the Killarney Lake Group

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Appendix E -
Commission ruling on

(consists of 5 pages)

Appendix F – Commission ruling on motion by the Killarney Lake Group requiring BluEarth to disclose new technical noise specifications for its proposed turbines

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Appendix F -
Commission ruling on

(consists of 2 pages)

Appendix G – Commission ruling on motion by the KLG for a Commission site visit

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Appendix G -
Commission ruling on

(consists of 1 page)

Appendix H – Commission ruling on the qualification of expert witnesses in Proceeding ID No. 1955

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Appendix H - Ruling on the qualification of

(consists of 7 pages)

Appendix I – AESRD sign-off

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Appendix I - Exhibit 42 AESRD Signoff.pdf

(consists of 9 pages)

AUC
Alberta Utilities Commission

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Phone 403-592-8845 Fax 403-592-4406
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Electronic Notification

November 15, 2012

To: Interested Parties

1646658 Alberta Ltd.
Bull Creek Wind Project
Application No. 1608556
Proceeding ID No. 1955

Ruling on standing:

1 Overview and nature of the issue to be decided

1. 1646658 Alberta Ltd., a wholly-owned subsidiary of BluEarth Renewables Inc., filed an application with the Alberta Utilities Commission (AUC or the Commission) for the Bull Creek Wind project. The Bull Creek Wind project is a 115-megawatt wind power plant which consists of forty-six 2.5-megawatt wind turbines, a substation and a 34.5-kilovolt collector system. The project site is approximately 20 kilometres northeast of the town of Provost, Alberta, and 15 kilometres south of Chauvin, Alberta, south of Killarney and Leane Lakes. It is located on private lands, distributed on approximately 3,600 hectares (9,000 acres) of land within Townships 41-1 and 41-2 (W4M). The Commission received 18 submissions from interested persons in response to a notice issued for the project. Of the submissions received, 15 were objections, one was a letter of support, one was a letter of non-objection and one was a letter from the Municipal District of Wainwright.

2. In this ruling the Commission must decide if the persons who filed a submission on the Bull Creek Wind project have demonstrated that they have rights that may be directly and adversely affected by the Commission's decision on the project application. A person who demonstrates the potential for direct and adverse effect is said to have "standing".

3. The Commission asked me to write to you to provide its ruling and reasons for its ruling on the standing of those persons that filed submissions on the Bull Creek Wind project.

2 Objections and statements of intention to participate

4. The Commission received objections to the Bull Creek Wind project from: Kevin and Eiri Beatty, Dan and Tracy Bonnefoy, Marjorie Hager, Alan and Charlene Hager, Richard Hager, Russell J. Riseley, Kim Olson and Laurie Olson (for D Frank Farms Inc.), Doug and Heather Buck, Allan Riseley, Vernon and Lorraine Skinner, Harry and Karen Nickel, Ron and Ann Angeltuedt, Martha Read, Fern Dixon and Robert Beatty. All of these persons, except Kim and

Laurie Olson, Doug and Heather Buck, Martha Read and Ron and Ann Angeltuedt, own lands within two kilometres of the Bull Creek Wind project.

5. These persons expressed a number of concerns about the Bull Creek Wind project. The concerns raised include: impacts to health and safety, visual impacts, environmental impacts, land value impacts and noise. Many of these persons also raised concerns about the consultation program for the Bull Creek Wind project.

6. The MD of Wainwright (MD) also wrote to the Commission about the Bull Creek Wind project. The MD stated that it issued development permits for 18 of the proposed turbines. The MD requested the Commission to place certain conditions on the project if the Commission decides to approve it.

7. One person, Mr. Graham Hager, expressed his support for the Bull Creek Wind project. ConocoPhillips Canada advised that it had no objection to the project.

3 Commission findings

3.1 How the Commission determines standing

8. Under Section 9 of the *Alberta Utilities Commission Act* the Commission must hold a hearing on an application if a person shows that he or she has rights that may be directly and adversely affected by the Commission's decision on the application.

9. A person who demonstrates the potential for direct and adverse effect has standing. There is a two-part test for determining standing. First, a person must demonstrate that the right he or she is asserting is recognized by law. Second, a person must provide some information that shows that the Commission's decision on the application may directly and adversely affect his or her rights. The first part of the test is legal; the second part of the test is factual. For the factual part of the test, the Alberta Court of Appeal has stated that "some degree of location and connection between the work proposed and the right asserted is reasonable."[1]

10. Persons with standing have a right to have their concerns about an application considered in a hearing. As a part of this right, the Commission must give persons with standing a reasonable opportunity to understand the application and the positions of other parties in the proceeding. It is the Commission's practice to allow persons with standing to file and present evidence, cross-examine the applicant and to make argument.

11. In the past the Commission has allowed persons without standing the opportunity to provide a brief statement to the Commission that describe their views on the application. In exceptional circumstances the Commission may also allow parties without standing to fully participate in a hearing by filing evidence, cross-examining the applicant and giving argument. However, where all persons with standing withdraw their objections the Commission may cancel the hearing even if parties without standing have expressed a desire to participate in that hearing.

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[1] *Dene Tha' v. Alberta (Energy and Utilities Board)* 2005 ABCA 68, paragraph 14.

3.2 Ruling on Standing

12. The Commission is satisfied that Kevin and Eiri Beatty, Dan and Tracy Bonnefoy, Marjorie Hager, Alan and Charlene Hager, Rick Hager, Russell J. Riseley, Allan Riseley, Vernon and Lorraine Skinner, Harry and Karen Nickel, Fern Dixon and Robert Beatty have standing to participate in a hearing to consider the Bull Creek Wind project application. These persons own and occupy lands within two kilometres of the proposed project. Given the scope of the project and the size of the proposed towers, the Commission finds that there is a sufficient degree of connection between the ownership and occupation rights asserted by these parties and project-associated concerns that they raised in their objections.

13. As noted earlier, these persons raised similar concerns about the Bull Creek Wind project in their objections. The Commission encourages these persons to work together as a group and, if possible, bring forward a single intervention that addresses the group's collective concerns. The participation of a group with shared interests allows group members to share the work of preparing for and participating in a hearing. This approach makes hearings more efficient and reduces the risk of having intervener costs disallowed for duplication of effort.

14. The Commission also finds that Mr. Graham Hager has standing to participate in the proceeding given the proximity of his land to the project. Further, the MD of Wainwright has standing because 18 of the proposed turbines are located in that municipal district.

15. The Commission finds that Martha Read, Ron and Ann Angeltuedt and Kim and Laurie Olson, do not have standing to participate in the Bull Creek Wind project proceeding. In the Commission's opinion, Ms. Read, the Angeltuedts and the Olsons have not demonstrated that they have rights that may be directly and adversely affected by the Commission's decision on the project application.

16. While Ms. Read clearly expressed the issues she wants the Commission to address in the Bull Creek Wind project proceeding she did not describe the rights she was asserting or how those rights could be affected by the Commission's decision on the application. Ms. Read also stated in her objection that she lives more than two kilometres from the proposed project.

17. Ron and Ann Angeltuedt stated that the right they are asserting was the right to use recreation areas in the project area. They stated that they live more than two kilometres from the Bull Creek Wind project but stated that they did not want turbines close to them like they are at Halkirk. Leaving aside the issue of whether the Angeltuedts have a legally recognized right to use local recreation areas, the Commission finds that they have not demonstrated how that right may be affected by the Commission's decision on the application.

18. Kim and Laurie Olson state in their submission that they own lands near the proposed Bull Creek Wind project. However, they also state that the project is located more than two kilometres from their land. Attached to the Olsons' submission were two signed "form" letters that generally express concerns about the project. However, the Olsons did not explain what rights they were asserting or how those rights may be directly and adversely affected by the Commission's decision on the Bull Creek application given its distance from the lands they own.

19. While Ms. Read, Ron and Ann Angeltuedt, and Kim and Laurie Olson do not have standing, they have two options for participation in the Bull Creek Wind project proceeding. First, if some or all of the persons with standing form an intervener group, Ms. Read, the Angeltuedts and the Olsons, may join that group and participate as part of that group. Second, the Commission is prepared to allow Ms. Read, the Angeltuedts and the Olsons, to provide a brief submission in the hearing to express their views on the project. Regardless of how they choose to participate, Ms. Read, the Angeltuedts and the Olsons will not be eligible to recover the costs of their participation in the hearing.

20. Doug and Heather Buck state in their submission that they reside approximately 3.2 kilometres from the proposed project. They also state that Doug Buck will be working in and around the proposed turbines for eight hours a day at a battery site. Heather Buck described a number of medical issues that she suffers from and stated that her symptoms will be magnified by the wind turbines. The Bucks also expressed concern about the health impacts of the turbines on their sheep and goats.

21. The Bucks reside a considerable distance from the proposed project and the Commission finds that they have not demonstrated that the land rights that they appear to be asserting may be directly and adversely affected by the Commission's decision on the application. However, the Bucks have also sought standing on the basis that Mr. Buck will be working in close proximity to the proposed turbines. The Commission has insufficient information about the nature of Mr. Buck's work and the location of that work in relation to the proposed turbines and cannot make a decision on his standing based on the information available to it.

22. Heather and Doug Buck may participate in the Bull Creek Wind project proceeding in accordance with the two options described above. Alternatively, the Bucks can provide the Commission with additional information regarding Mr. Buck's employment and how that employment may be directly and adversely affected by the Commission's decision on the application. The Commission asks that the Bucks file any additional information regarding their standing to participate in the Bull Creek Wind project proceeding by no later than December 3, 2012. The Commission would then decide on the Bucks' standing for the proceeding.

3.3 Conclusion: standing

23. The Commission finds that Kevin and Eiri Beatty, Dan and Tracy Bonnefoy, Marjorie Hager, Alan and Charlene Hager, Rick Hager, Russell J. Riseley, Allan Riseley, Vernon and Lorraine Skinner, Harry and Karen Nickel, Fern Dixon, Robert Beatty, Graham Hager and the MD of Wainwright all have standing to participate in a hearing on the Bull Creek Wind project application.

24. The Commission finds that Martha Read, Ron and Ann Angeltuedt, Kim Olson and Laurie Olson, do not have standing to participate in a hearing on the Bull Creek Wind project application. Notwithstanding this conclusion, the Commission is prepared to allow Ms. Read, the Angeltuedts and the Olsons to participate in the Bull Creek Wind project hearing either as a

member of an intervener group that includes members with standing or by making a brief statement to the Commission in the hearing.

25. The Commission finds that it has insufficient information to assess the standing of the Bucks, specifically with respect to Mr. Buck's employment. The Bucks can choose to participate in the proceeding as a member of a larger group, by making a brief submission at the hearing or by filing additional information about their standing.

Yours truly,

JP Mousseau
Commission Counsel

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February 20, 2013

To: Parties registered in Proceeding ID No. 1955

1646658 Alberta Ltd.
Bull Creek Wind Project
Application No. 1608556
Proceeding ID No. 1955

Commission ruling on confidentiality request by the Killarney Lake Group

1. In this ruling the Commission must decide whether to grant a request by the Killarney Lake Group (KLG) for confidential treatment of the medical records of three of its members that it intends to file as evidence in this proceeding. The Commission has ruled on this motion and has directed me to write to interested parties to advise them of its reasons for this ruling.

Background

2. On January 16, 2013, the KLG advised the Commission that it intended to file medical records relating to three of its members, Jude Bonnefoy, Charlene Hagar and Heather Buck, as evidence in this proceeding. The KLG requested that the Commission treat these medical records as confidential pursuant to Section 13 of AUC Rule 001: *Rules of Practice* (AUC Rule 001).

3. The KLG explained that the medical records for which confidential treatment is sought include laboratory test results, chart notes, history of medical conditions, consultation and examinations. The KLG stated that these records are currently protected by privacy legislation and, absent an order for confidential treatment by the Commission, those records would be available in the public domain with little or no protection.

4. On February 5, 2013, 1646658 Alberta Ltd. (the applicant) advised the Commission that it did not object to the KLG's request for confidential treatment of the medical records in question.

Ruling

<u>The test for confidential treatment</u>

5. Subsection 13(4) of AUC Rule 001 describes when the Commission may issue a confidentiality order. That subsection states:

> **13.4** The Commission may, with or without a hearing, grant a request for confidentiality on any terms it considers appropriate
>
> (a) if the Commission is of the opinion that disclosure of the information could reasonably be expected

(i) to result in undue financial loss or gain to a person directly affected by the hearing or other proceeding, or

(ii) to harm significantly that person's competitive position,

or

(b) if

(i) the information is personal, financial, commercial, scientific or technical in nature,

(ii) the information has been consistently treated as confidential by a person directly affected by the hearing or other proceeding, and

(iii) the Commission considers that the person's interest in confidentiality outweighs the public interest in the disclosure of the proceeding.

6. When deciding whether to issue a confidentiality order, in addition to applying the test established in Section 13, the Commission must also bear in mind the direction of Canada's courts on such matters. In *Sierra Club of Canada v. Canada Minister of Finance,* 2002 SCC 41, the Supreme Court of Canada found that a confidentiality order under the Federal Rules of Court should only be granted when:

(a) such an order is necessary in order to prevent a serious risk to an important interest, including a commercial interest, in the context of litigation because reasonable alternative measures will not prevent the risk; and

(b) the salutary effects of the confidentiality order, including the effects on the right of civil litigants to a fair trial, outweigh its deleterious effects, including the effects on the right to free expression, which in this context includes the public interest in open and accessible court proceedings.[1]

7. The Commission considers that a confidentiality order should only be issued in limited circumstances because it is part of the system of administrative justice and must uphold an open public system. There is a strong presumption in favour of the open court principle in AUC proceedings to ensure the transparency of the Commission's process from the inception of an application. AUC Rule 001 reflects this presumption.[2]

8. Based on the nature of the information and the KLG's request, the Commission is satisfied that the information subject to the request warrants consideration under subsection 13(4)(b) of the rules of practice.

9. Section 13(4)(b) of AUC Rule 001 requires the KLG to demonstrate that:

(a) the information is personal in nature;

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[1] *Sierra Club of Canada v. Canada Minister of Finance*, 2002 SCC 41 at paragraph 53

[2] AUC Decision 2010-210: Application for Approval of a Settlement Agreement between the Market Surveillance Administrator and Syncrude Canada, at paragraphs 11 and 12.

(b) the information has been consistently treated as confidential by the KLG members in question; and

(c) the KLG members' interest in confidentiality outweighs the public interest in the disclosure of that information in the proceeding.

10. All three criteria must be satisfied and are assessed in the following paragraphs.

Do the KLG medical records meet the test for confidential treatment?

11. The Commission accepts that the medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck are personal in nature. The KLG did not specifically address the second part of the test under Section 13(4(b), i.e., whether the information has consistently been treated as confidential. However, the Commission assumes, based upon the KLG's concern that this information would be publically available absent a confidentiality order, that this information has been consistently treated as confidential.

12. The third criteria that must be established if a confidentiality order is to be issued is that the KLG's interest in confidentiality must outweigh the public interest in disclosure. Although the KLG did not specifically address this part of the test in its request for confidentiality, it did advise that the three group members would not consent to have their medical records considered in the proceeding absent a confidentiality order.

13. The Commission recognizes that granting the confidentiality order will have a negative effect on the open hearing principle, as any person who does not sign and agree to be bound by the terms of a confidentiality undertaking will be denied access to the documentation provided and the oral hearing process in which those documents will be tested.

14. However, the Commission has also considered the court's comments at paragraphs 75, 76 and 77 in the Sierra case:

> [75] Underlying freedom of expression are the core values of (1) seeking the truth and the common good, (2) promoting self-fulfillment of individuals by allowing them to develop thought and ideas as they see fit, and (3) ensuring that participation in the political process is open to all persons…
>
> [76] Seeking truth is not only at the core of freedom of expression, but it has also been recognized as a fundamental purpose behind the open court rule, as the open examination of witnesses promotes an effective evidentiary process….
>
> [77] However, as mentioned above, to some extent the search for truth may actually be promoted by the confidentiality order[…] If the order is denied, […] that evidence which may be relevant to the proceedings will not be available to […] the court.[…]In addition, the court will not have the benefit of this cross-examination or documentary evidence, and will be required to draw conclusions based on an incomplete evidentiary record. This would clearly impede the search for truth in this case.[3]

15. One of the issues raised by the KLG in this proceeding is the potential health effects of wind turbines on nearby residents. To that end, the KLG hired expert witnesses to prepare

[3] *Supra* note.

reports and give testimony on the potential for such health effects. The Commission understands that the medical records in question will be reviewed by those experts and, if necessary, attached to their respective reports.

16. The Commission observes that this will be one of the first proceedings to include expert evidence regarding the potential for health effects associated with wind turbines. However, the Commission understands that the KLG is not prepared to file the medical records in question without a confidentiality order. It is important to the Commission, and to all participants, that all relevant evidence on this topic be filed and tested. In the Commission's view, granting the requested confidentiality order will allow the Commission and participants to fully examine and test potentially relevant evidence that would otherwise be unavailable to it.

17. The Commission concludes that the interests of Jude Bonnefoy, Charlene Hagar and Heather Buck in keeping their personal medical information confidential outweigh the public interest in the disclosure of this information. Permitting limited public disclosure of the material to those parties who wish to test the evidence, and to the Commission and its staff, ensures that the Commission will have a more complete evidentiary record than it would if the documents in question are not included on the record of this proceeding.

What documents should be confidential?

18. In its January 16, 2013, request, the KLG noted that the medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck are "extensive". The Commission understands that it is not the KLG's intention to file all of these records. Rather, those records will be reviewed by the KLG's experts and the KLG will decide which of those records that are referred to in the expert reports, if any, will be filed with the Commission.

19. The applicants are entitled to file rebuttal evidence in response to the KLG's expert reports. To that end, it may be necessary for the applicant and its experts to review all of the medical records, and not just those that are filed with the medical reports prepared by the KLG's experts. Should the applicant file its own expert medical reports as rebuttal evidence, those reports may also have excerpts from the medical records appended to them.

20. Having regard to the foregoing, the Commission orders that all of the medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck filed in this proceeding by the KLG group or the applicant shall be treated as confidential in this proceeding.

21. Both the KLG and the applicant intend to file expert medical reports in this proceeding. If the medical reports filed by the KLG or the applicant specifically refer to, or quote from, the medical records that are the subject of this confidentiality order, those portions of the medical reports must also be confidential. Should any of the medical reports filed by the KLG or the applicant include confidential information (excerpts from the medical reports) two versions of the report must be filed with the Commission: a confidential report that includes all references to and quotes from the medical records and a public report in which those passages of the report that specifically refer to or quote from the medical records are redacted. The public (redacted) versions of the medical reports will be placed on the public record. The confidential reports will be subject to the same undertaking requirements as the medical records.

22. If the applicant's medical report includes confidential information, it shall provide counsel for the KLG with copies of its confidential and public reports prior to filing them with the Commission. Counsel for the KLG will review the redacted report and advise counsel for the applicant of any further requests for redaction from the public report.

Next steps

23. The Commission has prepared two confidentiality undertakings to address the medical records and medical reports that are the subject of this ruling: one for participants, and one for the Commission and its staff. Participants in the proceeding who wish to receive copies of the medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck or of the confidential medical reports (if any) prepared by the KLG's experts or the applicant's experts must sign the confidentiality undertaking and file it on the record of this proceeding by no later than 5 p.m. on February 22, 2013.

24. The KLG shall provide its confidential medical report(s) (if any) and the medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck to those participants who have signed the Confidentiality Undertaking of Participant attached as Schedule A to this agreement by no later than **5 p.m. on February 25, 2013**.

25. The KLG shall file its confidential medical report(s) and those medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck that are referenced or quoted in the confidential medical report(s) with the Commission by no later than **5 p.m. on February 25, 2013**. The KLG shall file with the Commission ten (10) paper copies of the confidential medical report and those medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck that are referenced or quoted in the confidential medical report(s) and one electronic copy of that document on a USB flash drive. The paper and electronic versions of the confidential medical report(s) should be addressed to Mr. Allan Anderson at #400, 425 First Street S.W. Calgary, Alberta T2P 3L8. The KLG shall file its public medical report on the Commission's electronic proceeding system by no later than **5 p.m. on February 25, 2013**.

26. The applicant shall file its confidential medical report(s) and those medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck that are referenced or quoted in the confidential medical report(s) with the Commission by no later than **5 p.m. on April 15, 2013**. The applicant shall file with the Commission ten (10) paper copies of the confidential medical report and those medical records of Jude Bonnefoy, Charlene Hagar and Heather Buck that are referenced or quoted in the confidential medical report(s) and one electronic copy of that document on a USB flash drive. The paper and electronic versions of the confidential medical report(s) should be addressed to Mr. Allan Anderson at #400, 425 First Street S.W. Calgary, Alberta T2P 3L8. The applicant shall file its public medical report on the Commission's electronic proceeding system by no later than **5 p.m. on April 15, 2013.**

Yours truly,

JP Mousseau
Commission Counsel

Attachments

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March 27, 2013

To: Parties registered in Proceeding ID No. 1955

1646658 Alberta Ltd.
Bull Creek Wind Project
Application No. 1608556
Proceeding ID No. 1955

Commission ruling on motion by the Killarney Lake Group requiring BluEarth to disclose new technical noise specifications for its proposed turbines

1. In this ruling, the Alberta Utilities Commission (AUC or the Commission) must decide on a motion brought by the Killarney Lake Group (KLG) seeking an order from the Commission directing 1646658 Alberta Ltd. (BluEarth) to file new technical noise specifications it recently received from its turbine manufacturer. The Commission has ruled on this motion and directed me to write to interested parties to advise them of its reasons for this ruling.

Background

2. On March 13, 2013, BluEarth advised the Commission that it had received updated technical noise specifications from General Electric Ltd., (GE) the manufacturer of the project's turbines. BluEarth stated that because of this new information it is now necessary to file an updated noise impact assessment and other consequential amendments to their application. BluEarth estimated that it would be filing the updated noise impact assessment and amendments within four weeks and asked the Commission to suspend the current hearing schedule.

3. On March 14, 2013, the KLG filed a motion seeking an order from the Commission directing BluEarth to immediately file the updated technical specifications that it had received from GE. The KLG stated that it wanted to review that information immediately rather than have to wait four weeks before seeing it for the first time.

4. On March 15, 2013, the Commission granted BluEarth's request to suspend the proceeding and set out a process schedule for the consideration of the KLG's motion.

Views of the parties

5. On March 18, 2013, BluEarth responded to the KLG's motion and asked the Commission to deny the motion. BluEarth stated that the turbines proposed for its project were introduced by GE in 2012. It explained that when it prepared its noise impact assessment for the project GE had not completed its standard noise testing for this new model. As a result, BluEarth decided to use

noise specifications provided by GE for similar turbines. It explained that while the two turbine types used different internal technology, they shared the same capacity (2.5 megawatts), size, height, blade diameter and other physical characteristics.

6. BluEarth stated that GE completed its standard noise testing for the new turbine and issued a new noise specification document after BluEarth completed its NIA. BluEarth explained that it did not become aware of the new noise specification document until it began reviewing the intervener's noise evidence. It stated it received the new noise specifications from GE in March 2013.

7. BluEarth argued that the purpose of the KLG's motion is unclear given the Commission's decision to suspend the proceeding. It noted that the revised process schedule for the proceeding provides the KLG with a fair opportunity to review and respond to the evidence it intends to file as a result of the new technical specifications it received from GE. BluEarth submitted that the KLG has not demonstrated that it will be prejudiced by having to wait until BluEarth files its new evidence before reviewing the revised technical specifications.

8. The KLG replied to BluEarth on March 21, 2013. The KLG submitted that the prejudice it is suffering is being provided with insufficient information. It noted that while BluEarth undertook to provide a new noise impact assessment and to make related amendments to its application, it did not undertake to file the updated noise specifications for its proposed turbines. The KLG stated that it should not be a surprise to anyone that it would like to review the new technical specifications to see what has changed since the noise impact assessment was completed nine months ago. It stated that it requires this information to decide if it agrees with the need for a new noise impact assessment.

Commission ruling

9. The Commission has decided to deny the KLG's motion. The Commission finds that the KLG has not demonstrated how it will be prejudiced by having to wait until BluEarth files its amendments before having an opportunity to review the new technical noise specifications provided to BluEarth by GE in March 2013. In the Commission's view, the process for the resumption of the proceeding set out in its letter to interested parties dated March 15, 2013, will ensure that the KLG will have a reasonable opportunity to review the new noise impact assessment and related amendments being prepared by BluEarth and to effectively respond to that new evidence. The Commission expects that BluEarth's amended evidence will include the new technical noise specifications it recently received from GE. However, to eliminate any uncertainty in this regard, the Commission directs BluEarth to file those specifications with its amended evidence in accordance with Section 18.1 of its Rule of Practice.

Yours truly,

JP Mousseau

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September 19, 2013

To: Interested parties currently registered on Proceeding ID No. 1955

1646658 Alberta Ltd.
Bull Creek Wind Power Project
Application No. 1608556
Proceeding ID No. 1955

Ruling on motion by the KLG for a Commission site visit

1. On September 10, 2013, the Killarney Lake group (KLG) filed a motion with the Alberta Utilities Commission (AUC or the Commission) requesting that the Commission panel members assigned to Proceeding ID No. 1955 view the project area before the hearing and preferably within the next month. The KLG submitted that viewing the project area when it is green and vibrant is important. It noted that the local landscape changes in the winter and observed that the Farmers' Almanac calls for snow at the end of September. The KLG concluded that viewing the project and surrounding area will greatly assist the Commission members in their deliberations.

2. The Commission has considered the KLG's motion and asked me to write to interested parties and provide its decision on the motion.

3. The Commission will conduct a view of the project area without the parties in accordance with Section 5 of AUC Rule 001: *Rules of Practice*. The Commission members' schedules do not permit them to conduct the site visit within the next month, but they will view the project area either before or during the course of the proceeding.

4. Should you have any questions, please contact the undersigned by telephone at 403-592-4452 or by email to jp.mousseau@auc.ab.ca.

Yours truly,

JP Mousseau
Commission Counsel

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October 25, 2013

To: Interested parties

1646658 Alberta Ltd.
Bull Creek Wind Energy Project
Application No. 1608556
Proceeding ID No. 1955

Ruling on the qualification of expert witnesses in Proceeding ID No. 1955

Introduction and background

1. On October 3, 2013, the Alberta Utilities Commission (AUC or the Commission) directed parties to submit the names of each of their experts and a description of the areas of expertise for which qualification was sought. Submissions for the qualification of experts were due on October 10, 2013, objections to the proposed qualifications were due on October 17, 2013, and responses to those objections were due on October 24, 2013.

2. 1646658 Alberta Ltd. (BluEarth) proposed to qualify nine experts witnesses and the Killarney Lake Group (KLG) proposed to qualify eleven expert witnesses.

3. The purpose of the above requirement is for parties and the Commission to understand the foundation of the opinions being offered by the proposed experts, and for the Commission to determine whether the proposed experts hold the appropriate qualifications to opine to certain subject matters. In this ruling, the Commission must decide whether to qualify the expert witnesses tended by BluEarth and the KLG. The Commission has ruled on this matter and has directed me to write to interested parties to advise them of the Commission's reasons for its ruling.

4. In reaching the determinations set out in this ruling, the Commission considered all relevant materials on the record of the proceeding, including submissions provided by each party.

5. BluEarth objected to the qualification of four of the KLG's eleven proposed expert witnesses. Specifically, BluEarth objected to the qualification of the following KLG witnesses: Dr. Chris Hanning, Dr. Carl Phillips, Mr. Richard James and Dr. Sarah Laurie. BluEarth expressed two primary concerns with the qualification of the above witnesses. The first concern related to the ability of the witnesses to provide objective opinions about the subject matter. Specifically, BluEarth submitted that membership in anti-wind organizations and positions taken on past wind turbine projects indicated that the witnesses were acting as advocates for the KLG and were not able to present evidence in an unbiased manner. The second concern submitted by BluEarth was that the qualification sought for Dr. Phillips, Mr. James and Dr. Laurie went beyond the witnesses' respective areas of expertise.

6. The KLG did not object to the qualification of any of BluEarth's witnesses.

7. The KLG responded to BluEarth's objections on October 24, 2013.

Ruling

8. The question the Commission must ask when considering the qualification of experts is whether the proposed experts have the requisite amount of education, training, experience or a combination thereof to support their qualification. The Commission's decision on the qualification of the proposed experts was made in the context of AUC Rule 001: *Rules of Practice* and Section 20 of the *Alberta Utilities Commission Act* which provide considerable flexibility on evidentiary matters.

9. The Commission has reviewed the submissions on the qualification of experts and finds that, for the following experts tendered by BluEarth and the KLG, each has the necessary qualifications to meet the test of admissibility as an expert in this proceeding:

Experts tendered by BluEarth:

- Danny Da Silva
- Payam Ashtiani
- Geoffrey Leventhall
- Chris Ollson
- Robert McCunney
- Stephen Glendinning
- Doug Pelly
- John Wozniewicz
- Dave Simes

Experts tendered by the KLG:

- Roger Clissold
- James Farquharson
- Brian Gettel
- Charles Rhodes
- Adrian Upton
- Cliff Wallis
- Cleve Wershler

10. Accordingly, the Commission accepts the qualifications of these witnesses and lists the experts qualified, and their respective areas of expertise in Appendix 1. In making its determination, the Commission considered that no objections were made by any of the parities to the proceeding and that each of the experts proffered by both the KLG and BluEarth have the requisite amount of education, training, experience or a combination thereof to support his qualification.

11. With respect to Dr. Hanning, Dr. Phillips, Mr. James and Dr. Laurie, the Commission considered all of the submissions made by the parties and is satisfied that each of the above KLG experts is sufficiently experienced in the subject matter at issue to meet the test of admissibility. Accordingly, Dr. Hanning, Dr. Phillips, Mr. James and Dr. Laurie are qualified in their respective fields as discussed below and listed in appendix 1.

12. The Commission finds that Dr. Hanning is a medical doctor with expertise in sleep and its disorders. Accordingly, Dr. Hanning is qualified as a medical doctor in the field of sleep and its disorders, with expertise to provide opinion evidence on the effects of industrial wind turbine noise on sleep, sleep quality and sleep disturbance.

13. The Commission accepts that Mr. James, as an acoustical engineer and acoustician, has the necessary experience to be qualified in the field of sound, with expertise to provide opinion evidence on the noise impacts and effects of wind energy projects including, *inter alia* the sounds emitted from industrial wind turbines, including low frequency noise, infrasound and human response to noise.

14. The Commission has reviewed the submissions made with respect to Dr. Phillips' qualifications and is prepared to qualify Dr. Phillips in the field of public health with knowledge of epidemiology and related health sciences, and scientific epistemology and methodology with expertise to provide opinion evidence on the proper interpretation of the epidemiologic evidence regarding the health effects of industrial wind turbine noise.

15. The Commission finds that Dr. Laurie is a medical doctor. Accordingly, as a medical doctor, Dr. Laurie is qualified to give evidence in the field of human health.

16. Due to the nature of the objections received, the Commission will comment on the weight given to opinion evidence received from expert witnesses. The fact that an expert is permitted to give evidence on a particular point is not a determination by the Commission of the credibility or weight to be accorded to that evidence

17. In Decision 2011-436,[1] the Commission outlined the factors taken into account when determining the weight afforded to opinion evidence as follows:

> … When deciding what weight to give to the evidence provided by an expert witness, an important factor the Commission will consider is whether the expert witness provided an independent or objective opinion. The role and duties of an expert witness was considered in an English case known as *The Ikarian Reefer*.[7] That case and its implications were extensively discussed in *1159465 Alberta Ltd. v. Adwood Manufacturing Ltd.*, a recent decision of the Alberta Court of Queen"s Bench. The court summarized in part the duties and obligations of an expert witness, as described in *the Ikarian Reefer*, as follows:
>
> > 1. Expert evidence presented to the Court should be and should be seen to be the independent product of the expert uninfluenced as to form or content by the exigencies of litigation ...

[1] Decision 2011-436, AltaLink Management Ltd. and EPCOR Distribution & Transmission Inc. – Heartland Transmission Project, Application No. 1606609, Proceeding ID No. 457, November 1, 2011.

> 2. An expert witness should provide independent assistance to the Court by way of objective unbiased opinion in relation to matters within his expertise ... An expert witness in the High Court should never assume the role of advocate…
> [Emphasis added in the court's decision.][8]

The court stated that "The duties identified in *Ikarian Reefer* place a special onus on an expert witness. That witness is less a 'witness for a party' than a 'witness for the court'."[9]

The court went on to consider whether a determination that an expert witness lacked independence is grounds to exclude the evidence, or simply a factor that the court must take into account when weighing the evidence. The court reviewed the law on the topic and concluded as follows:

> 2.28 While an expert witness is not an officer of the court, any expert witness is expected to be scrupulous, honest, and independent. Courts hold expert witnesses to a high standard, and a part of the expert witness role is to fully disclose the kind of relationships and history that might lead to concerns towards bias. Where those deficiencies are detected only during cross-examination, such as what happened in ***Frazer v. Haukioja***, the court may very properly conclude that expert has not discharged his or her duties to the court. That would generally lead to an adverse inference on the impartiality and non-biased character of that expert witness.
>
> 2.29 It is my opinion that the public policy approach taken by the Alberta courts, mandated for Alberta judges by the Alberta Court of Appeal, is a pragmatic one that allows a person the opportunity to present an expert, but that expert may be so weakened by the attachment to one of the parties that every nuance and each element of his report may not survive the trial judge's ruling, especially when the suspect expert is challenged by a more independent expert. In this way, the legal literature has empowered the judiciary to consider these elements as part of the weighing of the evidence of the expert, as opposed to preventing all access to that witness' expertise.[2]

18. The Commission, considers that should aspects of experts' evidence extend beyond the limits of their expertise the Commission will follow the approach outlined in Decision 2012-303[3]:

> … evidence provided by [an expert] in areas where he was clearly not qualified to opine, will be given the weight of a lay witness rather than the weight of a properly qualified expert in these areas. Where that evidence diverges from the evidence of a properly qualified expert witness, the evidence of the qualified expert witness will be preferred.[4]

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[2] Decision 2011-436, paragraphs 89 to 91.
[3] Decision 2012-303: ATCO Electric Ltd. – Eastern Alberta Transmission Line Project, Applications No. 1607153 and No. 1607736, Proceeding ID No. 1069, November 15, 2012.
[4] Decision 2012-303, paragraph 128.

19. In accordance with the above approach adopted by the Commission in its prior decisions, the Commission determines that the comments made by BluEarth, with respect to the KLG experts' lack of objectivity, will go to the weight afforded to the opinion evidence.

20. The Commission also notes that questions about the scope of a witness' evidence vis-à-vis the area in which the expert was qualified and the weight of that witness' opinion will be considered by the Commission in light of any further submissions made by the parties during the proceeding.

21. With regards to the foregoing, the Commission has qualified the witnesses listed in appendix 1 in their respective fields in Proceeding ID No. 1955.

Yours truly,

Shanelle Sinclair
Commission Counsel

Appendix 1 - qualified experts

Experts tendered by BluEarth:

Expert	Qualification
Danny Da Silva	a professional engineer with expertise in noise acoustics and vibrations
Payam Ashtiani	a professional engineer with expertise in noise acoustics and vibrations
Geoffrey Leventhall	noise, acoustics vibrations, infrasound and human response to noise
Chris Ollson	environmental health science, risk assessment and environmental toxicology
Robert McCunney	a medical doctor with expertise in medicine, occupational and environmental medicine, epidemiology, and the epidemiology of health effects of noise emissions from wind turbines
Stephen Glendinning	a professional biologist with expertise in wildlife biology, environmental surveys and assessments related to wind turbines, baseline biophysical studies, post-construction monitoring, and provincial permitting
Doug Pelly	geotechnical engineering
John Wozniewicz	hydrogeology
Dave Simes	land valuation, subdivision analysis, with expertise on the Canadian uniform standard of professional appraisal practice, technical review

Experts tendered by the KLG:

Expert	Qualification
Roger Clissold	a professional geologist qualified in the field of hydrogeology, with expertise in groundwater and hydrogeological and hydrological impacts
James Farquharson	noise, noise impacts and noise impact assessments
Brian Gettel	a property appraiser qualified in property values and property appraisals
Chris Hanning	a medical doctor with in the field of sleep and its disorders, with expertise to provide opinion evidence on the effects of industrial wind turbine noise on sleep, sleep quality and sleep disturbance
Rick James	an acoustical engineer and acoustician with expertise in the field of sound including noise, low frequency noise, sounds emitted from industrial wind turbines and human response to noise
Sarah Laurie	a medical doctor qualified in the field of human health
Carl Phillips	an epidemiologist qualified field of public health with knowledge of related health sciences, scientific epistemology and methodology with expertise to provide opinion evidence on the proper interpretation of the epidemiologic evidence regarding the health effects of industrial wind turbine noise.
Charles Rhodes	a professional engineer qualified in the fields of electrical engineering, mechanical engineering and electricity, electronics and energy systems, with expertise to provide an expert opinion on electrical equipment, pipeline infrastructure, pipeline corrosion, setbacks, construction and engineering
Adrian Upton	a medical doctor qualified in the field of neurology, with expertise to provide an opinion on epilepsy and the effect of noise, shadow flicker and light pollution on health
Cliff Wallis	a professional biologist qualified in the fields of environmentally significant areas and biodiversity, with expertise on the effects of wind projects on environmentally significant areas, species at risk, wetlands and other matters related to biodiversity
Cleve Wershler	a professional biologist qualified in the fields of wildlife, species at risk and biodiversity, with expertise on the effects of wind projects on terrestrial vertebrates

Government of Alberta

Wind Energy Referral Report - Fish and Wildlife Division (FWD)

A. Alberta Fish and Wildlife Division Review:

The project Bull Creek Wind Power Project was reviewed by the Regional Wildlife Contact (Appendix 1-Wind Energy Wildlife Contact map). Environment and Sustainable Resource Development – Fish and Wildlife Division (ESRD-FWD) has reviewed the proposal (including turbine locations) and is satisfied with the monitoring and mitigation of impacts to wildlife and their associated habitats, including Species at risk. ESRD-FWD has reviewed the proposed location, proposed mitigation strategies, including associated infrastructure and construction plans, and post construction monitoring program, as detailed below.

ESRD- FWD Office: Vermilion

The Bull Creek Wind Power Project Wind energy environmental evaluation plan for Bull Creek Wind Power Project meets with the recommended pre construction mitigation strategy.

Signature: *Dave Moore* Date: June 20, 2012

Printed Name: Dave Moore, Senior Wildlife Biologist, Vermilion

B. Project Details

Project Name: Bull Creek Wind Power Project

Company name: BluEarth Renewables Inc. **AUC Application #**: _____

Location of Project: Section:Various TWP:41 RGE:1, 2 Meridian**:** W4

Project Details: Area: 36 km^2 Turbines #:46 Height:85 m Blade Length**:**50 m

Bull Creek Wiind Power Project

April 2012

Turbine ID	Easting (Zone 12 NAD 83)	Northing (Zone 12 NAD 83)
1	556277	5820007
2	556770	5819689
3	558159	5821413
4	558700	5820806
5	558783	5820039
6	558715	5819693
7	559142	5810437
8	559515	5821340
9	559747	5820856
10	560002	5819754
11	559907	5820473
12	560325	5821275
13	560560	5817153
14	560615	5819063
15	560558	5818762
16	560841	5818126
17	560457	5817584

18	561220	5817162
19	561407	5818307
20	561588	5817388
21	562225	5818025
22	562018	5817595
23	562005	5819144
24	562186	5818379
26	561945	5822381
27	562236	5818784
30	562381	5822492
31	562448	5819167
33	563110	5822365
34	562860	5818168
35	562941	5818442
36	562950	5819251
37	563233	5821682
38	562984	5817580
39	563192	5819607
41	563228	5820463
42	563639	5820074
43	565342	5816843
44	565458	5818096
45	565581	5818420
46	565732	5817223
47	566478	5818066
48	566316	5818476
49	566360	5818906
51	566942	5818464
52	567348	5818065

C. Wildlife Issues to be addressed (list current impacts)**:**

Site Selection:

Pre-development Planning and Surveys

Please refer to attached report, Environmental Evaluation, Bull Creek Wind Power Project. Submitted to BluEarth Renewables Inc. 200, 4723 1 Street SW Calgary, Alberta T2G 4Y8. Golder Associates, report number: 11-1334-0085. Received by ESRD-FWD April 2012, for details.

Impacts to Native Grasslands

ESRD-FWD identified the potential negative impacts of siting wind turbines in areas of native grasslands on wildlife, in particular on species at risk. Negative impacts may include, but are not limited to; habitat fragmentation, site abandonment, and loss of foraging/breeding/rearing habitat. ESRD-FWD recommends siting all wind turbines and associated infrastructure on cultivated lands to significantly reduce the majority of negative impacts on wildlife.

Wildlife Impacts:

ESRD-FWD identified concerns over the potential of negative impacts on wildlife caused by wind turbines or related infrastructure including access roads, and collection lines. ESRD-FWD recommends that areas immediately adjacent to key wildlife habitats be avoided by appropriate setbacks as outlined in the *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta (http://srd.alberta.ca/FishWildlife/WildlifeLandUseGuidelines/documents/WildlifeLandUse-SpeciesHabitatGrasslandParkland-Apr28-2011.pdf).*

Specific to the Bull Creek Wind Project the following issues were identified by ESRD-FWD:

1. *Collector lines between Turbine 44 and Turbine 46:* This collector line runs between two wetlands and falls within the recommended 100 meter buffer from both wetlands.
2. *Red-tailed hawk nest:* a red-tailed hawk nest was found in close proximity to proposed Turbine 35 but outside the ESRD-FWD recommended 100 meter buffer.
3. Sharp-tailed grouse lek: a sharp-tailed grouse lek was found in close proximity of proposed Turbine 26, its access road and connector lines.
4. *Proximity to Piping Plover Critical Habitat*: Killarney lakes has been identified as Critical Habitat for piping plover, which is ranked as Endangered in Alberta and Canada.
5. *Proximity of the project to an Important Bird Area (IBA)*: the project is sited adjacent to the Killarney Dillberry Lakes (KDL) IBA. ESRD-FWD recommends that the IBA and a minimal buffer be maintained between the project and this IBA.
6. *Proximity to wintering range*: ESRD-FWD identified concerns over the proximity of the development to critical winter range for both mule deer and moose. While ESRD-FWD generally recommends that timing conditions (Jan 15th to April 30th) identified under the Recommended Land-use Guidelines: Key Wildlife and Biodiversity Zones. (http://srd.alberta.ca/FishWildlife/WildlifeLandUseGuidelines/documents/WildlifeLandUse-KeyWildlifeBiodiversityZones-Dec03-2010.pdf) it is recognized that winter conditions are preferred time of construction to lessen the impacts on breeding birds and native vegetation.
7. *Construction Timing and breeding birds*: The primary concern for grassland birds is related to construction during critical breeding, nesting and rearing stages, April 1st-July 15th. ESRD- FWD recommends that all activities on native grassland occur outside the critical breeding period. This will ensure that grassland bird nests, including species at risk, are not destroyed or damaged as per the *Alberta Wildlife Act* and the *Migratory Bird Conventions Act*. Refer to Section E for detailed mitigation plans.

Avoidance of Migration Routes for Birds and Bats

A large number of bird species and bat species in Alberta migrate between overwintering habitat south of the Canadian Border and their breeding grounds here in Alberta. During these migrations species may form large groups and may migrate along the same route year after year. Wind energy projects that are built within these migration routes present a large hazard and an increased mortality risk. ESRD-FWD recommends that wind farms not be sited along migration routes.

D. Industry Submission of Wildlife Monitoring Program *(*submission to *Fisheries and Wildlife Management Information system*-FWMIS*)*

Research License #:

A research license was not required at the time that BluEarth Renewables Inc. conducted the pre-construction wildlife surveys. A research permit is to be obtained in conjunction with Post Construction Monitoring Plan which BluEarth Renewables Inc. has committed to develop with ESRD-FWD.

Pre-construction survey data submitted within 2 years of project construction:
Note: If no construction has occurred with 2 years, new data may be requested. Survey dates are identified in attached report.

All required surveys were completed as part of the pre-construction assessment however a number of surveys including all the bird migration surveys were completed more than 2 years ago. Please refer to attached report, Environmental Evaluation, Bull Creek Wind Power Project. Submitted to BluEarth Renewables Inc. 200, 4723 1 Street SW Calgary, Alberta T2G 4Y8. Golder Associates, report number: 11-1334-0085. April 2012, for details.

BluEarth Renewables Inc. has committed to complete additional wildlife surveys prior to construction of the project. As per standard protocol, a pre-construction wildlife survey of the turbine sites and associated infrastructure will occur in the spring preceding construction to ensure that no new wildlife conflicts have appeared, and results reported to the ESRD-FWD representative. This may require additional mitigative measures, developed through consultation with ESRD-FWD.

Post-construction Survey dates:

To be determined in conjunction with Post Construction Monitoring Plan which BluEarth Renewables Inc. has committed to develop with ESRD-FWD. Please refer to the Wildlife Monitoring section of this letter.

Annual Due date for Post construction Survey data submittal (dd/mm): 01 / April

D. ASRD-FWD recommendations (noting accepted deviations from existing Guidelines and based upon proposed mitigation plan)***:***

Recommendations Relating to Site Selection (List strategies and documents –setbacks based from tip of turbine blade)**:**

Impacts to Native Grasslands

To minimize negative impacts to wildlife, 37 of the 46 turbines are located in cultivated or previously disturbed lands. ESRD-FWD recommends avoidance of siting wind turbines and associated infrastructure on native grasslands.

Nine of the 46 turbines are proposed on native grasslands. These grasslands are considered marginal with significant disturbances including altered range communities, and increased numbers

of human developments throughout. This project lies outside the range of many species at risk that rely on native grasslands as key breeding and rearing habitat. BluEarth Renewables Inc. has taken efforts to site turbines, roads and collections lines within existing disturbances on native grasslands to the extent possible. Due to these factors ESRD-FWD has agreed to this turbine layout. BluEarth Renewables Inc. has agreed to the following additional mitigation measures during the construction and operation of these nine turbines on native grasslands:

1. Activities on native grasslands will be limited within the project footprint (turbine lease, interconnection right of way, construction and operations access routes, substation and workspaces).
2. That all turbines, road collection system and substation construction should occur outside the critical grassland bird breeding period (April 1st- July 15th) in areas of native grasslands. Construction should either be completed before April 1st or after July 15th of the construction year.
3. All equipment will be cleaned and decontaminated to prevent the spread of weeds and other invasive species to the project area.
4. Areas not containing permanent facilities or operational access roads will be reclaimed to an equivalent land use capability in accordance with regulatory requirements.
5. All activities on native grasslands should occur during dry or frozen conditions and follow the mitigation as outlined in the Environmental Protection Plan that will be developed in consultation with ESRD-FWD.
6. Roads, fencing and other infrastructure on native prairie will be limited.
7. Topsoil will be stripped, salvaged, for use during reclamation.
8. Minimal disturbance techniques (i.e. plough in) will be used for underground collector lines.
9. Sod salvage and replacement will be attempted in areas of short duration and small footprint size.
10. Reclamation on native pasture will use certified inspected native seed mixtures.

Above ground power lines to avoid strikes and electrocution of birds

Information provided to ESRD-FWD indicates that the collection system power lines for the wind turbines will be primarily underground. However the proponent has not indicated which lines may differ from this plan. See attached report (section 1.1.3).

ESRD-FWD recommends that all collection lines on native prairie be placed underground. If above ground lines are used in the project, than post-construction wildlife surveys of the above ground powerlines should be completed. If it is determined through post-construction wildlife surveys that avian species are colliding with above ground lines, visibility enhancement devices will be installed to reduce the risk of collision with the line. These devices may include marker balls, bird diverters or other line visibility devices.

Wildlife Impacts

All ESRD-FWD Wildlife Guidelines for Alberta Wind Energy Projects (Sept 19, 2011) have been considered and applied to site by BluEarth Renewables Inc.. BluEarth Renewables Inc. has submitted preliminary mitigation measures. Further input and consultation with ESRD-FWD will occur in order to finalize an Environmental Protection and Reclamation Plan (EPRP).

Special mitigation was developed between ESRD-FWD and BluEarth Renewables Inc. at specific wildlife sites, this includes:

1. **Raptor nests:** All turbines, access roads, collector lines, work areas and the substation have been located over 180 meters from any raptor nest. This is consistent with ESRD-FWD recommendations. BluEarth Renewables Inc. has committed to monitoring all known nests sites and to complete raptor nest search annually until the project is constructed. If additional sites are found BluEarth Renewables Inc. will consult with ESRD-FWD to determine appropriate mitigation for these sites.
2. **Proximity of the wind farm to Killarney Lake**: ESRD-FWD identified potential concerns with the siting of the project due to its proximity to Killarney Lake, which has been identified as Critical Habitat for Piping Plover. The current project layout is outside the 200 meter setback from piping plover, 2.7 km from nearest turbine, and is south of the lake. The piping plover typically moves east to west through this region. Therefore, it is not expected that the development will impact migration of the species to its nesting grounds. Based on the current project design and biology of the piping plover this project is not deemed to be significant concern.
3. **Proximity of project to the KDL IBA:** No turbines will be constructed within 800 meters of the KDL IBA. This geographic separation is anticipated to allow birds the room for unobstructed approach and or departure flight paths over the area.
4. **Sharp-tailed Grouse Lek:** A sharp-tailed grouse lek was found near Turbine 26 and Turbine 30. These turbines, access roads and collector lines are outside the 500 meter setback recommended by ESRD-FWD.
5. **Wetlands: Amphibian Setbacks:** All turbines are a minimum of 156 meters from any wetland. The collector line between 44 and 46 runs between two wetlands. This line occurs on a high point of the land within 30 meters of these wetlands. The landholder has developed this high point as an access road between their land holdings and it is used regularly to transport farm equipment. This road was deemed by ESRD-FWD to be an existing road and in efforts to limit new infrastructure the current collection line layout was accepted by ESRD-FWD with the following conditions
    a. The collection line be installed outside the critical breeding period for breeding birds of April 1st-July 15th.

    Additional mitigation for wetlands proposed by BluEarth Renewables Inc. and accepted by ESRD-FWD include:

    1. All equipment will be routed around wetlands
    2. All project activities will follow BMP for sedimentation and spill prevention.
    3. All disturbed areas no used for subsequent operation will be reclaimed following construction to minimize erosion and siltation.

Bird and Bat Migration Routes

- Migration surveys were completed in the 2008 and 2009. The Bull Creek Wind Farm was not sited near ridgelines, or other terrains that concentrate migratory bird and bat species. However, as the bat activity rate during the fall migration experienced some highs, especially from Aug 10th to Aug 28th (potential bat migrational timing), ESRD-FWD expects a intermediate risk to bats.

The post-construction monitoring program for the Bull Creek site will need to gather additional data on activity and fatality levels which can be used to further examine the relationship between activity and fatality rates. Mitigation will be required if post-construction fatality assessment reveals a higher than acceptable bird or bat fatality rate. A firm commitment for implementing mitigation and adaptive management has been made by BluEarth Renewables Inc. and they will conduct post construction monitoring to assess bird and bat mortality and implement mitigation measures if deemed necessary by ESRD-FWD due to excessive bat mortality. ESRD-FWD recommends that mitigation measures for excessive mortality may include but are not limited to:

- Alter cut in speeds at turbines with high mortality rates.
- Ensuring check and balances are in place to prevent unnecessary lighting at night.
- Any mitigation that is deemed appropriated based upon the site specific circumstances or incidents following consultation with ASRD-FWD.

Results of the post-construction monitoring will be provided annually to ESRD-FWD.

Mitigation for Decommissioning of Wind farm

BluEarth Renewables Inc. has identified the following mitigation strategies for use during decommissioning of the Bull Creek Wind Farm project:

1. All areas will be reclaimed to equivalent land use capabilities.
2. In areas of wetlands:
    a. Underground cabling will be left in situ
    b. All project activities will follow BMP for sedimentation and spill prevention
3. All decommissioning activities will be restricted to the access ROWs, leases and temporary work areas.
4. All connection points for collector lines will be excavated and buried powerlines removed to 1 m below surface.
5. Buried connection lines will be left in place below the cultivation layer to prevent soil disturbance.
6. Above ground lines and poles will be removed, holes will be filled and covered with topsoil.
7. Soil will be ploughed as necessary to repair any compaction.
8. Disturbed areas on native or tame pastures will be seeded with the appropriate seed mixtures.
9. Ally spills will be remediated and reclaimed.
10. All waste will be removed.
11. Turbine foundations will be removed to 1 meter below grade and turbine footprint will be returned to original land use.
12. Reclamation of native pasture will use certified inspected native seed mixtures.
13. All decommissioning activities will be scheduled to avoid sensitive breeding periods and areas.

ESRD-FWD recommends that BluEarth Renewables Inc. or the project owners at time of decommissioning contact ESRD-FWD for consultations.

Wildlife Monitoring Requirements (List strategies and documents)**:**

To be determined through consultation with ESRD-FWD and BluEarth Renewables Inc.

BluEarth Renewables Inc. have committed to develop a Post Construction Monitoring Plan (PCMP) in consultation with ESRD-FWD. Post-construction follow-up surveys will be completed over a minimum of 2 years to determine changes to bird and bat use of the areas associated with turbines and related infrastructure. Specifically monitoring will occur during the bird and bat migration periods (March 1st- October 31st).

Carcass searches will be completed within blade diameter plus ten meters of the turbines at a representative sample of 1/3 of the turbine sites. Surveys will be conducted using the methods described in "*Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds*" (Canadian Wildlife Service 2007). Each searcher will be tested for search efficiency. Additionally a scavenger removal study will be carried out. Individual carcasses will be collected, labeled and submitted to ESRD-FWD. A detailed report of the post-construction monitoring will be provided to ESRD-FWD annually.

If a site (turbine or other infrastructure) is found to have a higher than accepted rate of mortality (as determined by ESRD-FWD), mitigation measures will be employed. ESRD-FWD recommends that mitigation measures for excessive mortality may include but are not limited to:

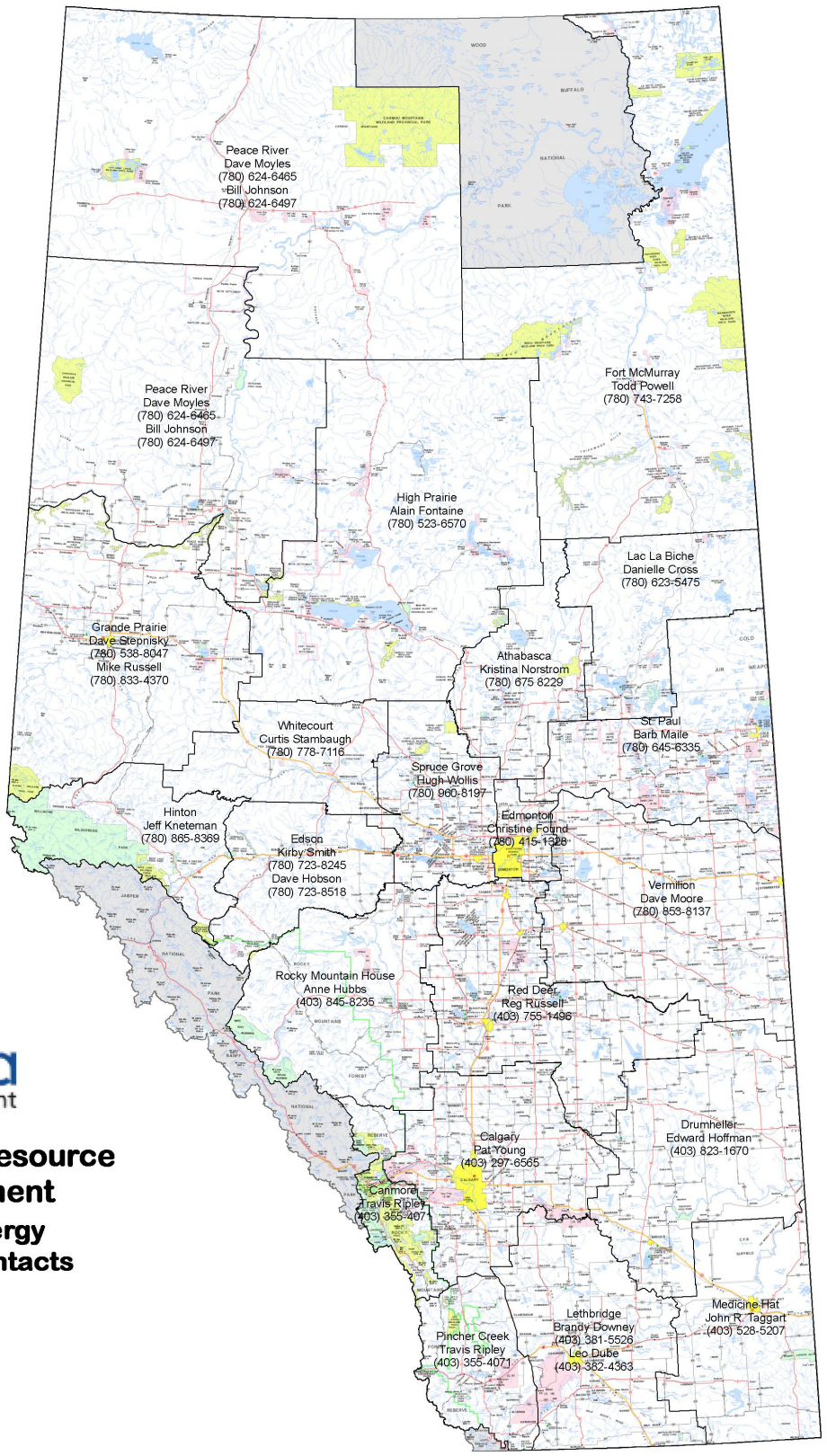
- Alter cut in speeds at turbines with high mortality rates.
- Ensuring check and balances are in place to prevent unnecessary lighting at night.
- Any mitigation that is deemed appropriated based upon the site specific circumstances or incidents following consultation with ASRD-FWD.

Specific attention to native prairie and wildlife impacts will also be assessed by BluEarth Renewables Inc. in the post-construction monitoring plan to be developed with ESRD-FWD. Staff from ESRD-FWD will have opportunity to provide detailed input into monitoring and mitigation strategies contained in the post construction monitoring plan.

If above ground lines are used in the project, than post-construction wildlife surveys of the above ground powerlines should be completed. If it is determined through post-construction wildlife surveys that avian species are colliding with above ground lines, visibility enhancement devices will be installed to reduce the risk of collision with the line. These devices may include marker balls, bird diverters or other line visibility devices.

Prior to commencement of the PCMP, BluEarth Renewables Inc. must ensure that proper regulations are followed and appropriate research and collection licenses are obtained. Information collected under the authority of the licenses will be submitted annually to ESRD FWD to be entered into the FWMIS database.

As discussions on PCMP development have not occurred yet, survey time lines will be determined in consultation with ESRD-FWD at a later date.



Alberta Government

Sustainable Resource Development

Wind Energy Wildlife Contacts