

To: Members, Coos County Planning Board (by bcc)  
cc: Ed Brisson, Atty. Christine Johnston  
From: Tara Bamford, Contract County Planner  
Re: Balsams Ski Area Site Plan Application – Safety  
Date: February 7, 2023

As I noted in my 1/12/23 review comments, while the applicant has been working to develop a safety plan acceptable to the Board regarding potential ice throw by the wind turbines, no information has been provided yet to demonstrate safety from the wind turbines themselves, e.g. rotor fragments in the event of damage or failure. As a reminder, the manufacturer's manual for the Vestas V90 3MW wind turbines (Mechanical Operating and Maintenance Manual, Safety Regulations for Operators and Technicians, 9/11/2006) states: "Do not stay within a radius of 400m (1,300ft) from the turbine unless it is necessary." I've added this 1,300-foot line to the attached for reference.

As agreed I've emailed and called Vestas to inquire about the basis for the 1,300-foot recommendation but have not received a response. However, quite a bit of research regarding appropriate setbacks for wind towers is available on-line. As the industry has grown, so has the need of policymakers for guidance on appropriate setbacks. Here is a small sample of the research I found online:

*A method for determining wind turbine setback standards* by Jonathan Rogers at Georgina Institute of Technology and Nathan Slegers and Mark Costello at the University of Alabama ([Wind Energy](#), 2012) used modeling to take a closer look at probabilities of a fragment striking at various distances.

*Study and development of a methodology for the estimation of the risk and harm to persons from wind turbines*, published in 2013, was developed for the United Kingdom's Health and Safety Executive Select Committee on Wind Turbines. This paper provides a complex model for determining the risk at various distances.

Scott M. Larwood, University of the Pacific and C.P. Van Dam, University of California, Davis developed and tested a simpler model to address "unduly conservative setbacks" being a "deterrent to wind energy development" (*Wind turbine rotor fragments: impact probability and setback evaluation*, [Clean Technologies and Environmental Policy](#), 2015).

\*\*\*For a turbine with the height (410 ft) and tip speed (87 m/s) of the Vestas V90-3MW, this model can be used to estimate the distance at which a point has a one in one million chance of being hit by a wind turbine rotor fragment as between 738 feet and 991 feet. For comparison, the applicant's plans show a proposed ski trail just 575 feet from turbine #5.

*Analysis of blade fragment risk at a wind energy facility* by Scott Larwood at University of the Pacific and David Simms at the National Renewable Energy Laboratory (2018)

studied risks based on a previously developed model. The researchers recommended a setback from 2 times the turbine height to 3.5 times the height depending on the context.

\*\*\*The 1,300-foot recommendation in the Vestas V90 3MW operators manual is on the very conservative end of that range, about 3.3 times the height. Turbine #1 is approximately 1,175 feet from the top of proposed lifts 10 and 11 (2.87 times the height). The top of proposed lift #4 is about 1,200 feet from turbine #6 (2.93 times the height).

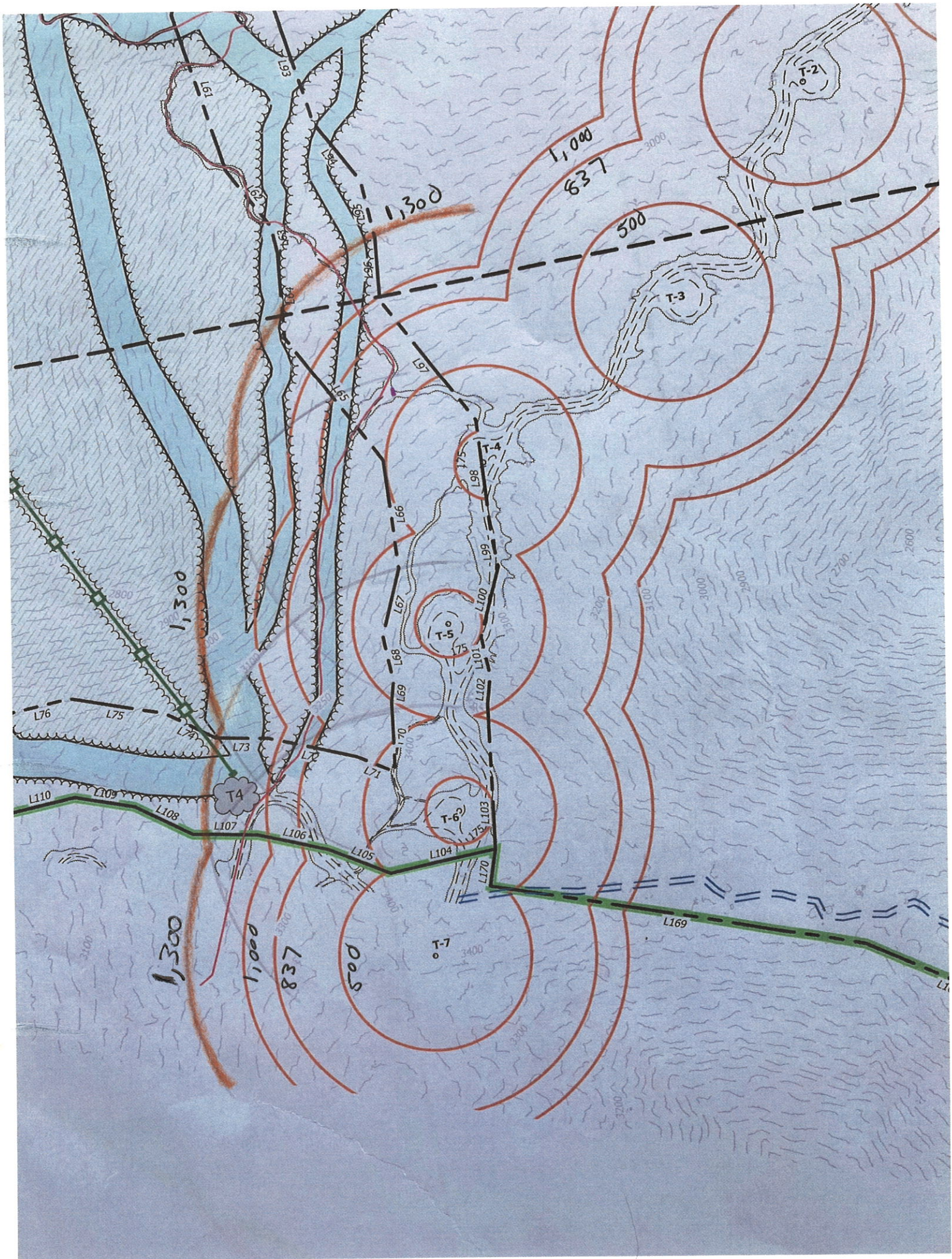
Each of the research papers noted contains an extensive reference list with other studies, data sources and the basis for their assumptions.

The burden of proof is on the applicant to demonstrate that the ski area development will result in a reasonable level of safety for employees and visitors. At the same time, as the applicant has stated, risk is measured as odds rather than being an absolute. Many of the studies compared the level of risk to other societal risks and considered categories such as “low,” “routine” and “acceptable.” The one in one million probability utilized by Larwood and Van Dam seems to be a common threshold recommended for policy-makers considering wind tower setbacks.

It is up to the Planning Board to determine what an acceptable level of risk is in the context of this application. Is one in one million too high a bar? Does it vary? For example, is the acceptable level of risk higher for a skier on the ski trail than for the ski lift infrastructure? Or for a rider on the lift?

- I recommend that the Board require the applicant to provide documentation regarding the safety of constructing lifts and trails closer than the 1,300-foot setback recommended in the operators manual, a figure accepted by the SEC. This information should include the level of risk from rotor fragments at various locations based on either a peer-reviewed published model or a model published by a government agency.
- The concept of acceptable risk should also be applied to the issue of ice throw. The AWS Truepower estimate submitted by the applicant, based on a review of available research, was that an ice fragment would only reach 836 feet about once every 1,000 years. That paper then recommends an exclusion zone of that size during icing (B. Bailey and M. Markus). The DNV-GL paper, also submitted by the applicant, recommends that further steps be taken to reduce the risk to 1 hit in 500,000 years (D. Faghani). One specific question for the applicant’s team is whether the recommendations made by Faghani to reduce the risk have been achieved with the proposed operating plan applied to the proposed layout.







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