BURNS McDONNELL

SUMMARY OF SOUND STUDY

Heritage Prairie Wind Project

June 18, 2024

Agenda

01	Introduction
02	Acoustics Overview
03	Sound Level Criteria
04	Modeling Overview
05	Model Parameters / Inputs
06	Modeling Results

Introduction

STUDY LEAD

Ryan Gurreri

- BS in Mechanical Engineering, concentration in Acoustical Engineering
- 7+ years sound and vibration experience
- Acoustical studies for many industries all over the world. Power generation, aviation, transportation, oil and gas, government installations, etc.
- Over 15 wind turbine noise studies across multiple states

- 14,000+ Professionals
- Founded in 1898
- 75+ Offices Worldwide
- **#1:** Power
  #1: Transmission and Distribution
  #2: Wind
  Engineering News-Record
- 100% Employee-Owned

Acoustics Overview

Sound Power Level vs Sound Pressure Level
- Sound Power = Energy
- Sound Pressure = Air Pressure Fluctuations

Decibel (dB) A-weighted decibels (dBA)

Frequency (Hz)

Equivalent Sound Level (L_{eq})

3-dB, 5-dB, and 10-dB difference

Sound Level Criteria

Federal

Noise Control Act of 1972 – EPA mandated a national policy, but later delegated all authority to local entities (i.e., no applicable Federal limits).

State

The Illinois Pollution Control Board (IPCB) regulates noise under Illinois Administrative Code **Title 35, Subtitle H, Chapter I, Part 901 Sound Emissions Standards for Property-Line Noise-Sources**

Local

Livingston County Code of Ordinances,

Section 56-620:

Wind Energy Systems, states that noise shall be regulated per the IPCB…"except that sound pressure levels for purposes of establishing a violation of this section may be measured at any point on the property not more than 150 feet from any portion of the edge of the primary structure."

Sound Level Criteria

IPCB Regulation

Limits noise based on land classification (Class A, B, or C) of source and receiver

- Residences are Class A and wind turbines are Class C

The IPCB Regulation has daytime and nighttime limits for each octave band

- For this analysis, the nighttime limits (most stringent) were used for noise from land Class C (wind turbines) to Class A (residences)

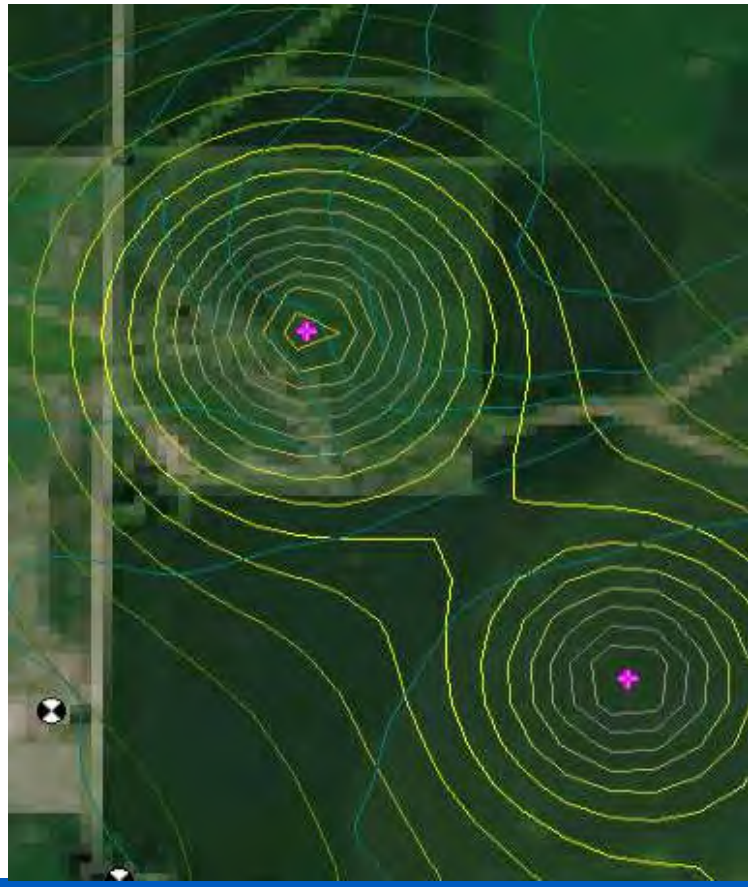
Permissible Source Sound Levels, from Class C to Class A

Freq (Hz)	31.5	63	125	250	500	1k	2k	4k	8k
Nighttime Limit (dB)	69	67	62	54	47	41	36	32	32

Modeling Overview

CadnaA Noise Modeling Software

- Scaled, three-dimensional program
- Calculates sound propagation based on ISO 9613-2:1996, General Method of Calculation
- Assesses sound pressure levels based on the octave-band center-frequency range from 31.5 to 8,000 Hertz
- Looked out to 12,000 feet (~2.3 miles)



Modeling Parameters/Inputs

Turbine Coordinates

71 locations modeled, in Livingston County

Receptor Coordinates

298 modeled residences

Terrain

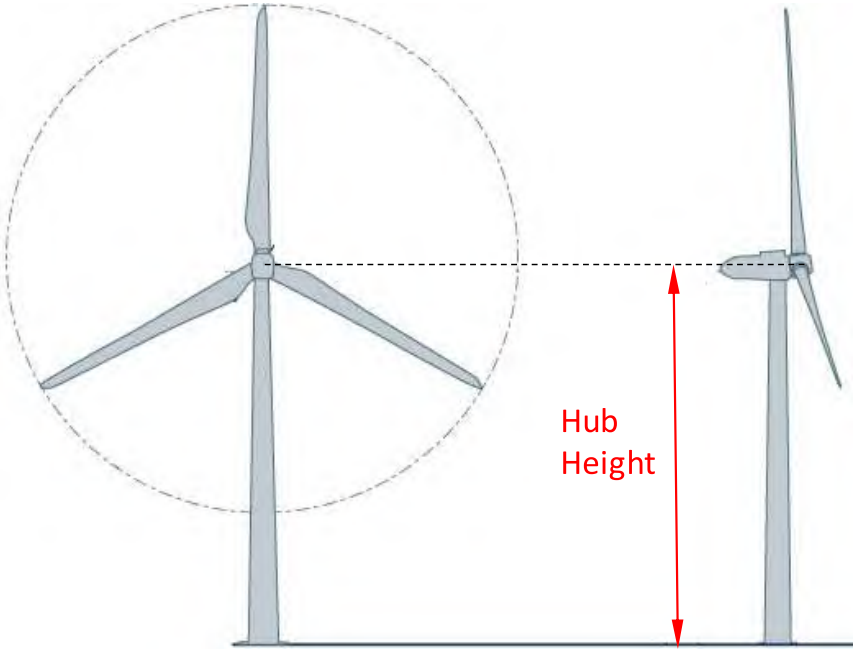
10-foot contours
Source: USGS Digital Elevation Model

Ground Attenuation

It is assumed to be semi-reflective even though the agricultural land is soft ground that provides attenuation

Modeling Parameters/Inputs

Turbine Model	Hub Ht. [m]	Sound Power Level (dBA)
GE 3.4-154	98	103-109
Vestas V163-4.5	113	106.5-108.5



Sound Level Data

- Provided by wind turbine manufacturers
- Used loudest sound level for each octave band
- Uncertainty added to all turbines (0.8 dB added to each turbine)
- All turbines operating simultaneously at max level

Modeling Parameters / Inputs

Conservative Assumptions that were made:

- The model assumes atmospheric conditions favorable for sound propagation (travels farther)
- Vegetation excluded for conservativeness (no obstructions)
- Assumed to be semi-reflective even though the agricultural land is soft ground that would provide attenuation
- Maximum sound propagation and worst-case directivity factors
- Ground-based moderate temperature inversion (less sound escapes to the atmosphere)
- The model assumes every direction is “downwind” (not possible)
- Used loudest sound level for each octave band
- Uncertainty added to all turbines (0.8 dB added to each turbine)
- All turbines operating simultaneously at max level

Modeling Results

Impacts modeled at all identified receivers

The model assumes all directions are downwind of WTGs

Logarithmic addition of all WTGs at each receiver: 35 dBA + 35 dBA + … ≈ 38 dBA

Impact at 1,000 Hz generally determines compliance: 1,000-Hz limit ≤ 41 dB

Predicted sound levels can comply with nighttime IPCB limits.

- Noise waiver agreements being executed with specific residences or Project participants
- NRO is applied when appropriate

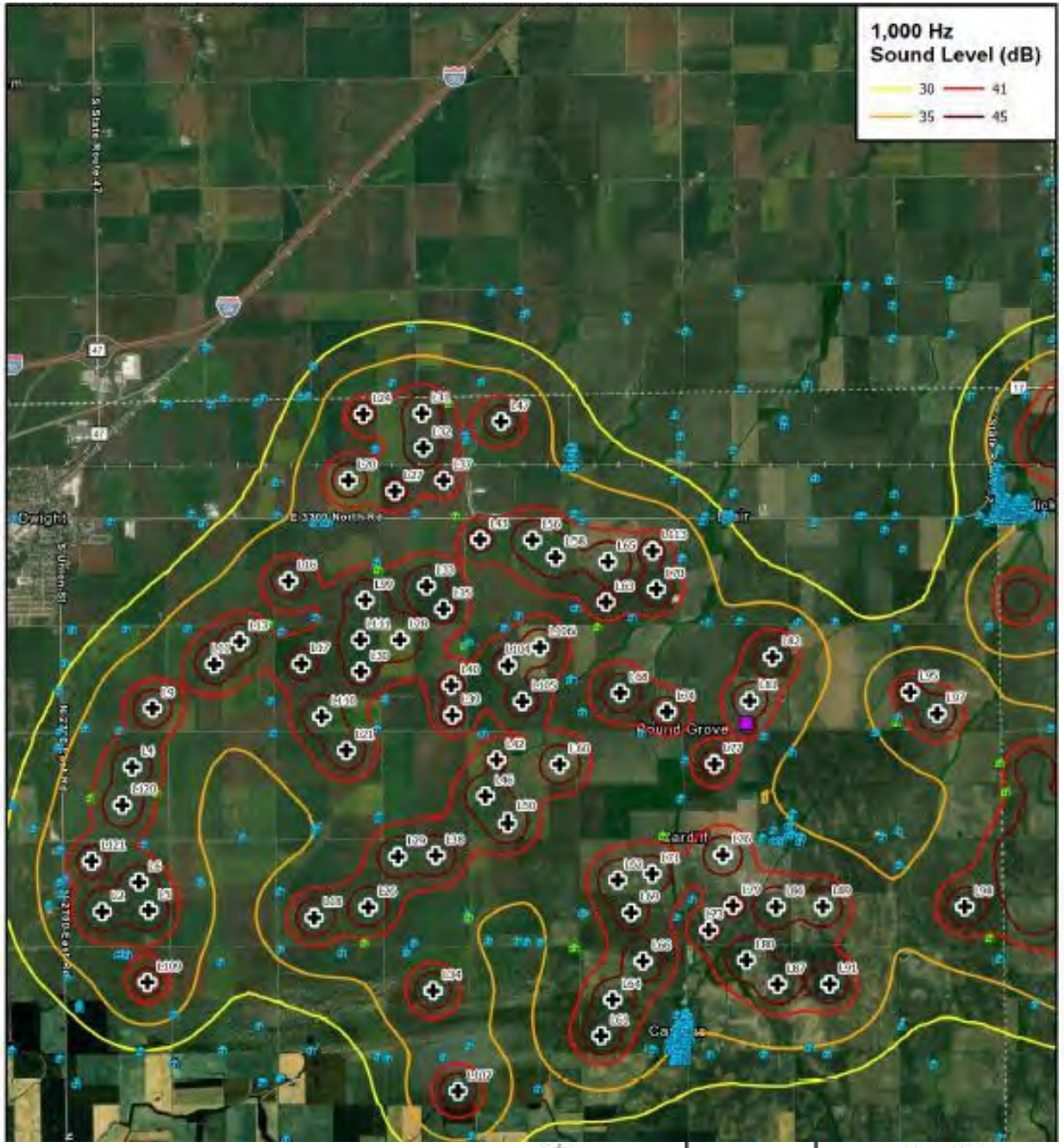


Figure B-1
Heritage Prairie Wind
Livingston L12R Layout
GE 3.8-154 Turbine
L(GE) / K(GE)

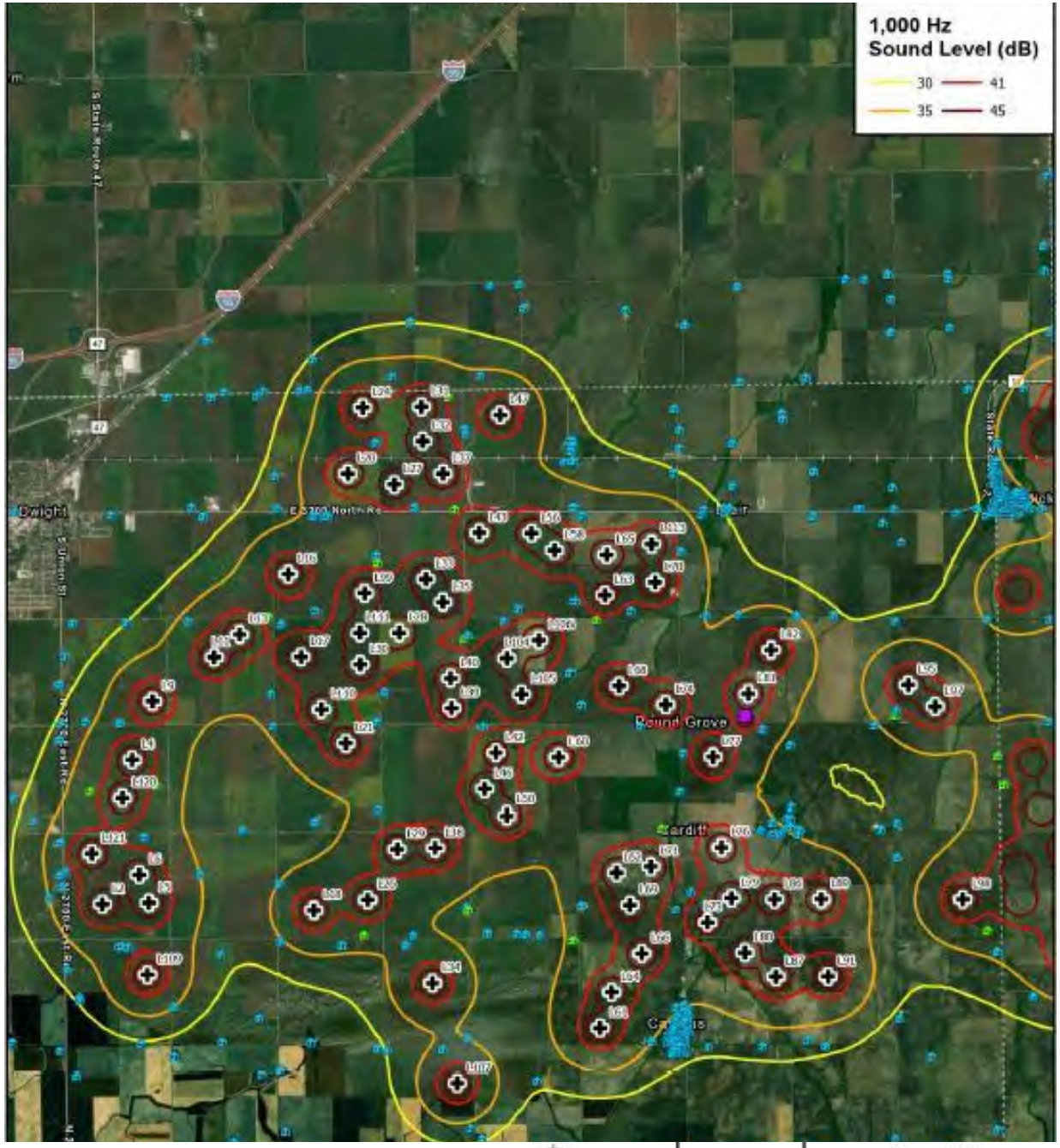


Figure B-2
Heritage Prairie Wind
Livingston L12R Layout
Vestas 163-4.5 Turbine
L(V) / K(V)

Questions?