

APPENDIX I

Noise Propagation & Modeling Assessment

**Castle Rock Solar Project
Pre-Construction Noise Study**



Prepared for:
Castle Rock Solar LLC
3316 Highland Avenue
Wayzata, MN 55391

Prepared by:
Stantec Consulting Services Inc.
733 Marquette Avenue, Suite 1000
Minneapolis, MN 55402

Project No: 193709215
September 5, 2024

**CASTLE ROCK SOLAR PROJECT
PRE-CONSTRUCTION NOISE STUDY**

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CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

Abbreviations

AC	Alternating current
dB	Decibel
dBA	Decibel (A-weighted)
DC	Direct current
GA	Ground absorption
Hz	Hertz
L_{eq}	Equivalent continuous sound level
L_{10}	Sound level exceeded for 10% of the time
L_{50}	Sound level exceeded for 50% of the time
L_{90}	Sound level exceeded for 90% of the time
L_{max}	Maximum sound level
L_{min}	Minimum sound level
MPCA	Minnesota Pollution Control Agency
MVA	Megavolt-ampere
MW	Megawatt
Project	Castle Rock Solar Project
PV	Photovoltaic
PWL	Sound power level
Castle Rock Solar	Castle Rock Solar Power, LLC
SLM	Sound level meter
SPL	Sound pressure level

CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

Executive Summary

Castle Rock Solar LLC (Castle Rock Solar), is proposing to construct and operate the Castle Rock Solar Project (Project). The Project is located within Castle Rock Township in Dakota County, Minnesota (Site) and will consist of an approximately 150-megawatt (MW) solar energy facility. Castle Rock Solar retained the services of Stantec Consulting Services Inc. (Stantec) to conduct a pre-construction noise study for the Project.

This noise assessment was completed to assess Project operational compliance with the Minnesota Pollution Control Agency (MPCA) noise regulations. Operational noise modeling was completed to estimate noise levels generated by the Project equipment. Modeled noise levels were predicted using CadnaA acoustical modelling software, configured to implement ISO 9613-2 environmental sound propagation algorithms. The modeling accounted for noise from the proposed solar array inverter stations and the Project substation transformer based on manufacturer-provided data.

Castle Rock Solar provided two potential layouts for the Project facility's equipment, referred to as "Preferred" and "Alternate", and Stantec completed a noise assessment for both layouts. The maximum Project-generated noise level at residences and other sensitive receptors was estimated to be an equivalent continuous sound level (Leq) of 57 A-weighted decibels (dBA) during daytime and 37 dBA during nighttime for the Preferred layout, and 57 dBA during daytime and 35 dBA during nighttime for the Alternate layout. The noise modeling results demonstrate that expected daytime and nighttime noise levels at the identified receptor locations are below MPCA limits and that the Project is expected to operate in compliance with the MPCA noise regulations.

CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

1.0 Project Description

Castle Rock Solar Project, LLC (Castle Rock Solar), is proposing to construct and operate the Castle Rock Solar Project (Project). The Project site is located on 1,355 acres of rural agricultural land in The Project is located within Castle Rock Township in Dakota County, Minnesota (Site). The Project includes the development of an approximately 150-MW alternating current (AC) utility scale solar energy generation facility. In addition to photovoltaic (PV) modules, the Project will also include single-axis solar trackers, inverter stations (also referred to as "power conversion stations"), an electrical collection system, access roads, a substation with a power transformer, a generation tie-in transmission line, and perimeter security fencing.

The solar arrays will be constructed on multiple agricultural parcels roughly bounded by 225th Street West to the north, Biscayne Avenue to the west, 240th Street West to the south, and Blaine Avenue to the east. The Project site is surrounded by agricultural, industrial, and undeveloped forested areas along, with dispersed single-family residences. Figures 1 and 2 display the Project components and surrounding area.

The operational noise sources from the Project include inverter stations and a substation transformer. The solar panels produce direct current (DC) voltage which will be converted to AC voltage through a series of inverters. This study assumes that forty (40) inverter stations will be installed within the Project area. Solar energy facilities operate by converting solar radiation into electricity, meaning the Project will only produce electricity between sunrise and sunset. After sunset, the site no longer receives solar radiation, and therefore the solar array inverters will operate in stand-by mode, emitting minimal noise. The Project will include one (1) step-up power transformer located within the substation footprint. The substation transformer is generally expected to operate at full capacity during daylight hours when the solar array will be generating power and operate less frequently during nighttime hours.

2.0 Terminology

Sound is caused by vibrations that generate waves of minute pressure fluctuations in the surrounding air. Sound levels are measured using a logarithmic decibel (dB) scale. Human hearing varies in sensitivity for different sound frequencies, and the frequency sensitivity changes based on the overall sound level. The ear is most sensitive to sound at frequencies between 800 and 8,000 hertz (Hz) and is least sensitive to sound at frequencies below 400 Hz or above 12,500 Hz. Consequently, several different frequency weighting schemes have been used to approximate the way the human ear responds to various frequencies at different sound levels. The A-weighted decibel, or dBA, scale is the most widely used for regulatory requirements, as it discriminates against low frequency noise similar to the response of the human ear at the low to moderate sound levels typical of environmental sources. Sound levels without a frequency weighting applied, referred to as unweighted or linear, are generally reported as dB or dBZ. Noise is defined as unwanted sound.

The sound power level (PWL) of a noise source is the strength or intensity of noise that the source emits regardless of the environment in which it is placed. Sound power is a property of the source, and therefore is independent of distance. The radiating sound power then produces a sound pressure level (SPL) at a distance where human beings can perceive it as audible sound. The sound pressure level is

CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

dependent on the acoustical environment (e.g., indoor, outdoor, absorption, reflections) and the distance from the noise source. Unless otherwise stated, sound levels in this report are sound pressure levels.

Broadband (overall) sound levels which are expressed as a single number in decibels, account for acoustical energy across the frequency spectrum, including energy at low, middle, and high frequencies. To assess how much acoustical energy is present in different ranges of the frequency spectrum, noise can be separated into spectral (frequency) components using octave band filters. For environmental noise assessments, octave band noise levels are often expressed in unweighted decibels (dB) at octave band center frequencies from 31.5 to 8,000 Hz.

A change in sound levels of 3 decibels is generally considered to be the threshold of perception, whereas a change of 5 decibels is clearly perceptible, and a change of 10 decibels is perceived as a doubling or halving of loudness.

3.0 Regulatory Environment

The Minnesota Pollution Control Agency (MPCA) enforces the State of Minnesota noise rules under Minnesota Administrative Rules Chapter 7030¹. Section 7030.0040 establishes noise standards (State noise limits) that define the noise levels that may be generated by developments, including solar energy facilities. The State noise limits are expressed in dBA using both L₁₀ and L₅₀ noise metrics and are evaluated over a one-hour period. The limits depend on the noise area classification (NAC) of the location where a person hears the noise and whether the noise occurs during daytime (7:00 a.m. – 10:00 p.m.) or nighttime (10:00 p.m. – 7:00 a.m.) periods, as shown in Table 3.1.

¹ A review of local noise ordinances was also conducted, and Section 7.19.D of the Castle Rock Township Zoning Ordinance states the following, “No noise shall be permitted or caused to be permitted that exceed the standards and rules adopted by the Minnesota Pollution Control Agency.”

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PRE-CONSTRUCTION NOISE STUDY**

Table 3.1. State of Minnesota Noise Limits

Noise Area Classification (NAC)	Daytime (7 a.m. – 10 p.m.)		Nighttime (10 p.m. – 7 a.m.)	
	dBA L ₁₀	dBA L ₅₀	dBA L ₁₀	dBA L ₅₀
NAC 1 Residences, religious uses, camping and picnicking, health services, hotels, educational services.	65	60	55	50
NAC 2 Retail, business and government services, recreational activities, transit terminals	70	65	70	65
NAC 3 Manufacturing, fairgrounds and amusement parks, agricultural and forestry activities	80	75	80	75

When inverters and substation transformers are in operation, the noise generated by the equipment is generally continuous and the noise level does not fluctuate significantly over time. Thus, the noise levels generated by the equipment are expected to be similar when measured using the Leq, L₁₀, or L₅₀ metrics. For this analysis, the estimated Project Leq noise level has been compared to the most stringent noise limits of 60 dBA L₅₀ during daytime and 50 dBA L₅₀ during nighttime to evaluate compliance at NAC 1 residential receptors.

4.0 Sensitive Receptor Locations

Publicly available aerial imagery and on-site field verification of residence occupancy were utilized to identify noise-sensitive receptors (also referred to as sensitive receptors), based on the land uses listed in Table 3.1, in the vicinity of the solar facility. A total of 154 residential receptors (NAC 1) were identified within one-half mile of the Project limits. Locations of sensitive receptors are shown on Figures 1-6. A tabulated summary of sensitive receptors is provided in Appendix C.

5.0 Noise Modeling Methodology

The Project, as currently proposed, includes forty (40) inverter stations within the solar generation arrays and one (1) substation transformer, as shown on Figures 1-6. These are the primary operational noise sources associated with the Project.

TMEIC PVU-0840GR solar array inverter stations are expected to be used for the Project. Each inverter station will include five inverter modules and a medium voltage transformer. This analysis assumed a sound power level of 113 dBA for each inverter station based on manufacturer sound testing data for the specified unit. The inverter octave band noise spectrum from the manufacturer noise testing report was utilized.

CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

The Project substation is expected to include one 158 megavolt-ampere (MVA) step-up power transformer. The NEMA TR-1 standard² was used to estimate a transformer NEMA noise rating of 81.4 dBA for the forced air cooling (ONAF2) condition with fans operating. Methods from the Electric Power Plant Environmental Noise Guide³ were then used to estimate the overall sound power level of 101.3 dBA and the octave band spectra.

The equipment sound power levels used for the noise assessment are presented in Table 5.1.

Table 5.1. Equipment Sound Power Levels

Equipment	Octave Band Sound Power Level (dB)									Broadband Sound Power Level, dBA
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Inverter Station	111	111	113	112	111	107	104	103	97	113
Substation transformer	98	104	106	101	101	95	90	85	78	101

Sound attenuates between a source and receptor location due to a variety of factors, including but not limited to, distance between source and receptor, atmospheric absorption, ground type, topography, shielding from solid structures, vegetation, and meteorological conditions. Operational noise levels from the proposed Project equipment were estimated using the CadnaA model by Datakustik, which utilizes the ISO 9613-2 standard⁴ algorithms for outdoor sound propagation.

A CadnaA Project base model was first developed by importing topographic data from the U.S. Geological Survey National Elevation Dataset and aerial imagery. The inverter and substation transformer noise sources were then modeled as point sources within CadnaA based on the current Project layout. Receptor points were added for the identified sensitive receptor locations at five feet above ground. Additional assumptions that were used to estimate worst-case operational noise levels included the following:

- A ground absorption value of 0.5 (on a scale of 0.0 representing hard ground or water bodies to 1.0 representing porous ground) was used.
- No sound attenuation from vegetation (foliage) to simulate a worst-case condition when leaves have fallen off trees.
- Meteorological conditions are conducive to sound propagation with all receptors located downwind of all noise sources.

6.0 Predicted Operational Noise Results

An operational noise analysis was completed for the Project inverter stations and substation transformer for both daytime and nighttime conditions. The modeled daytime operational condition includes noise from

² National Electrical Manufacturers Association (NEMA) Standards Publication TR 1-2013 (R2019). Transformers, Step Voltage Regulators and Reactors.

³ Edison Electric Institute. Electric Power Plant Environmental Noise Guide. Volume 1 2nd Edition.

⁴ ISO 9613-2: 1996. Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation.

CASTLE ROCK SOLAR PROJECT PRE-CONSTRUCTION NOISE STUDY

solar array inverter stations and the substation transformer. The modeled nighttime operational condition includes noise from the substation transformer.

Estimated noise levels at each sensitive receptor location are provided in tabular format in Appendix C for the daytime and nighttime conditions. Noise contours, which illustrate areas of equal sound level, are displayed on Figures 2 and 3. The figures present the expected broadband A-weighted noise levels due to the operation of the Project noise sources. The noise contours do not include the contribution of ambient sound levels.

6.1 PREFERRED

For the Preferred layout, the results show that Leq noise levels generated by the Project are not expected to exceed 57 dBA during daytime and 37 dBA during nighttime at residences and other noise-sensitive uses, which are below the most stringent MPCA noise limits of 60 dBA L₅₀ during daytime and 50 dBA L₅₀ during nighttime. The highest estimated daytime noise level was at receptor R-016, and the highest estimated nighttime noise level was at receptor R-025.

The Appendix C results table and noise contour lines shown in Figures 3 and 5 further demonstrate that the expected daytime and nighttime noise levels at the identified receptor locations comply with the MPCA noise limits. Therefore, the results of this pre-construction noise study demonstrate that the Project is expected to operate in compliance with the MPCA noise regulations with the Preferred layout.

6.2 ALTERNATE OPTION

For the Alternate layout, the results show that Leq noise levels generated by the Project are not expected to exceed 57 dBA during daytime and 35 dBA during nighttime at residences and other noise-sensitive uses, which are below the most stringent MPCA noise limits of 60 dBA L₅₀ during daytime and 50 dBA L₅₀ during nighttime. The highest estimated daytime noise level was at receptor R-016, and the highest estimated nighttime noise level was at receptor R-018.

The Appendix C results table and noise contour lines shown in Figures 4 and 6 further demonstrate that the expected daytime and nighttime noise levels at the identified receptor locations comply with the MPCA noise limits. Therefore, the results of this pre-construction noise study demonstrate that the Project is expected to operate in compliance with the MPCA noise regulations with the Alternate layout.

7.0 Conclusion

This noise assessment was completed to evaluate operational compliance of the Castle Rock Solar project with the Minnesota Pollution Control Agency noise regulations. An operational noise model was developed and utilized to estimate the noise levels generated by Project equipment, including noise from the proposed solar array inverter stations and the Project substation transformer, for both the “Preferred” and “Alternate” layouts. The maximum Project-generated noise level at residences and other sensitive receptors was estimated to be an equivalent continuous sound level (Leq) of 57 A-weighted decibels (dBA) during daytime and 37 dBA during nighttime for the Preferred layout, and 57 dBA during daytime and 35 dBA during nighttime for the Alternate layout. The noise modeling results demonstrate that expected daytime and nighttime noise levels at the identified receptor locations are below MPCA limits and that the Project is expected to operate in compliance with the MPCA noise regulations.

CASTLE ROCK SOLAR PROJECT
PRE-CONSTRUCTION NOISE STUDY

Figures

CASTLE ROCK SOLAR PROJECT
PRE-CONSTRUCTION NOISE STUDY

Figure 1

Project Site Layout – Preferred

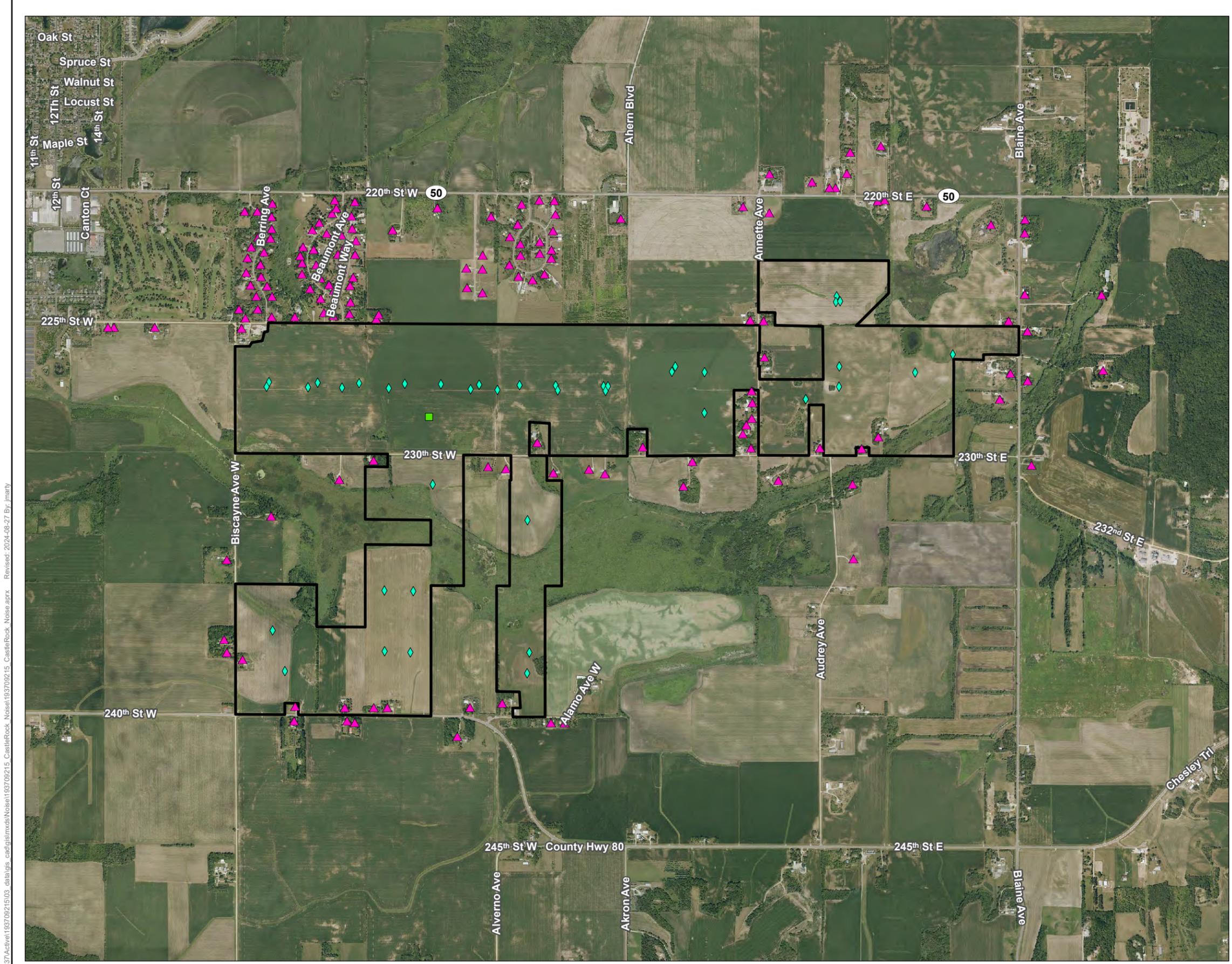


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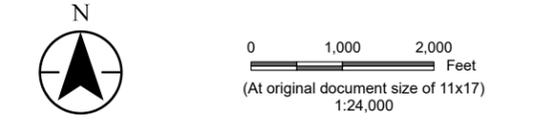
Title
Project Site Layout (Preferred)

Client/Project
Matrix Renewables USA LLC
Castle Rock

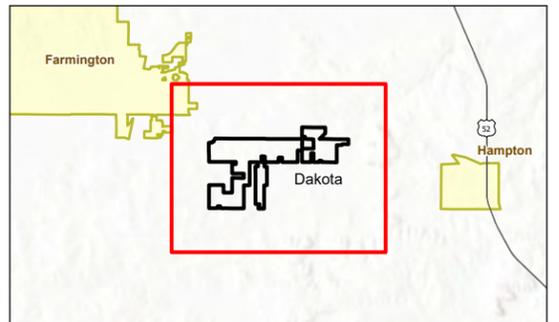
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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Figure 2
Project Site Layout – Alternate Option

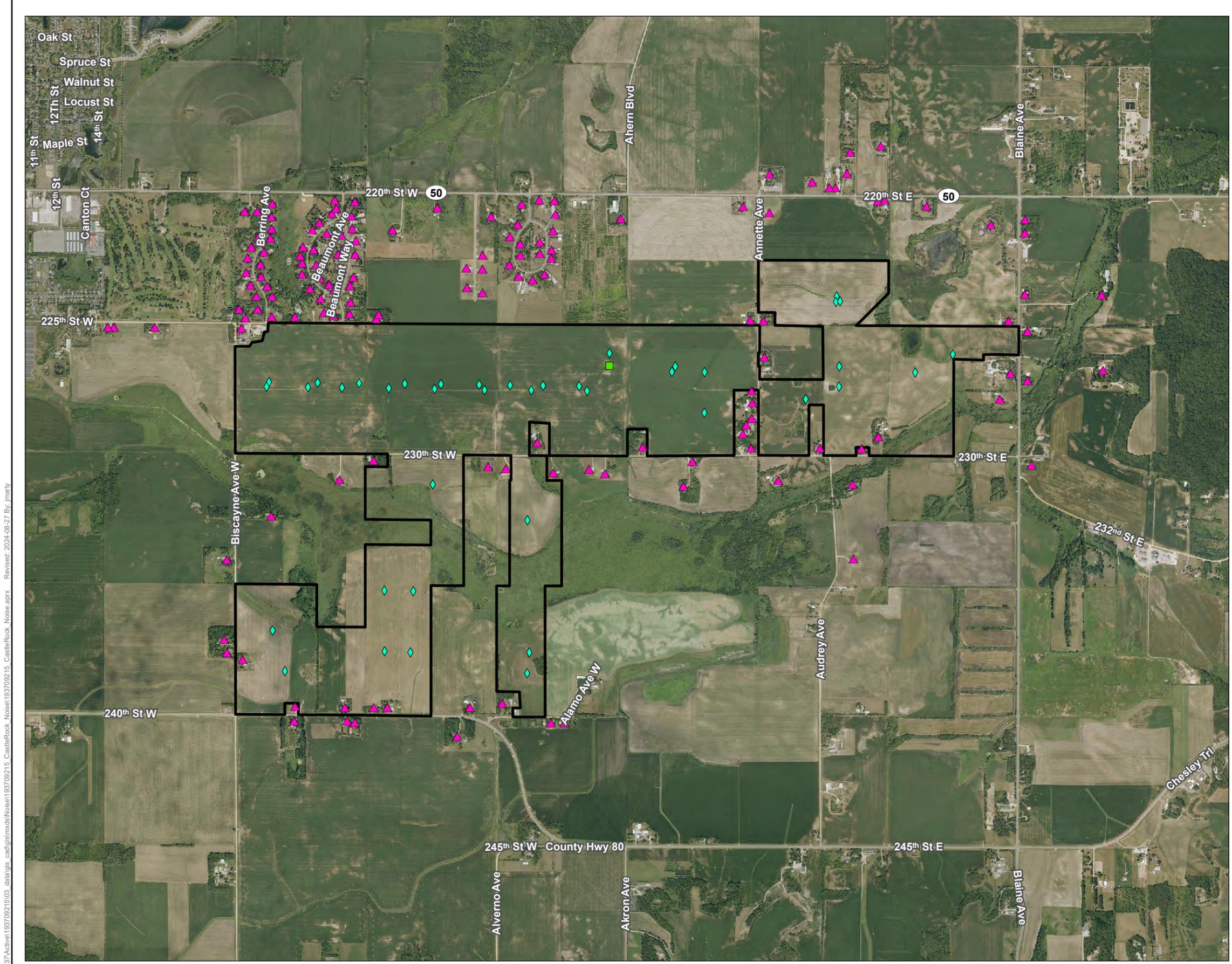
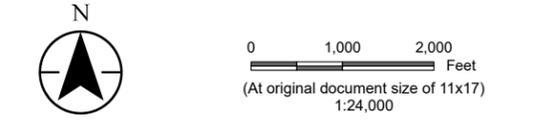
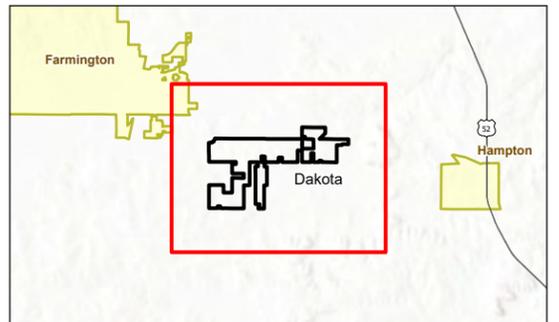


Figure No. **2**
 Title **Project Site Layout (Alternate)**
 Client/Project **Matrix Renewables USA LLC** 193709215
Castle Rock
 Project Location **T. of Castle Rock, Dakota Co., MN** Prepared by JM on 2024-08-26
 TR by ML on 2024-08-27
 IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - Sensitive Receptor
 - Inverter
 - Substation



Notes
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 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure 3

Daytime Operational Noise Results – Preferred

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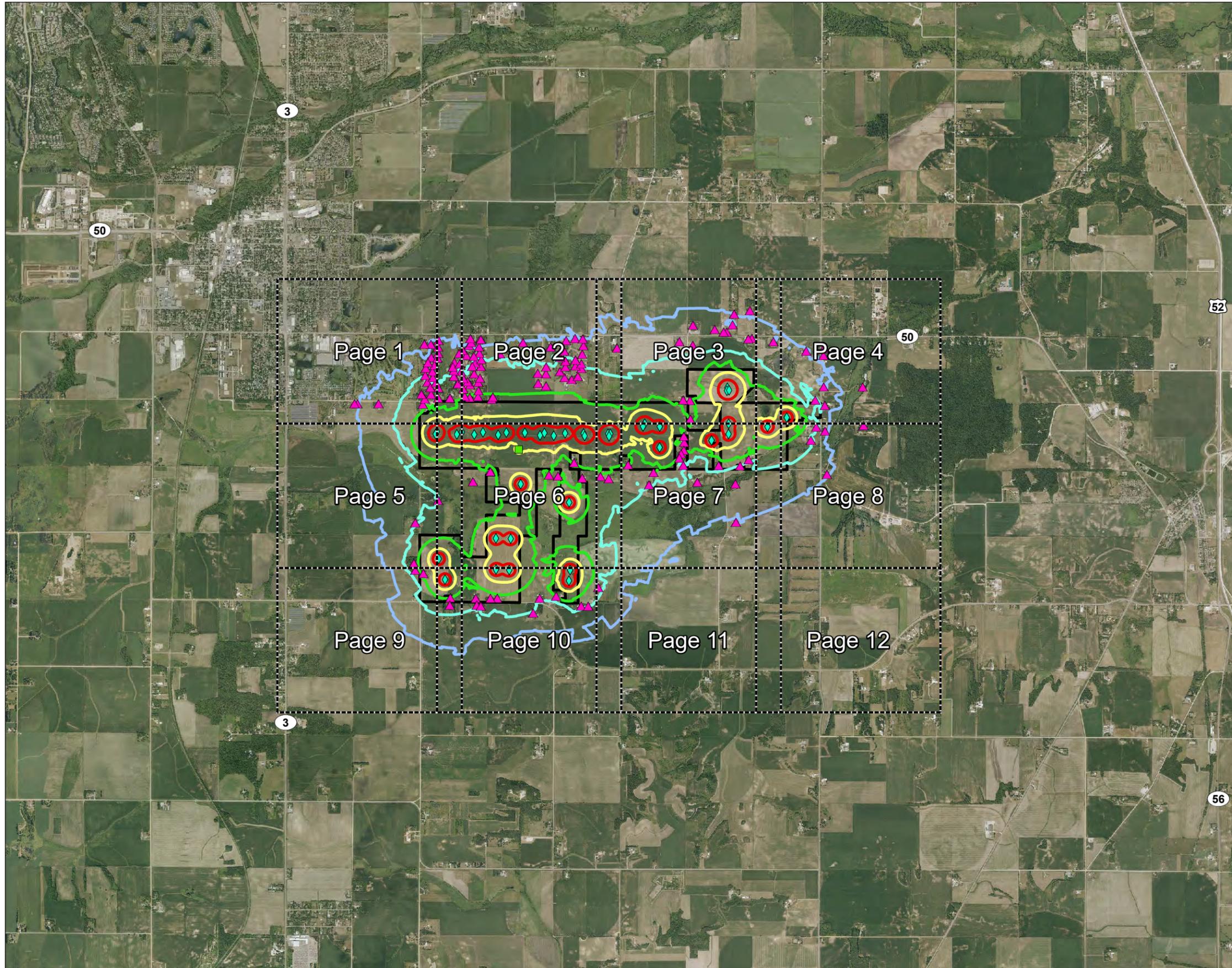


Figure No.

3

Title

**Operational Noise Results
(Preferred - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
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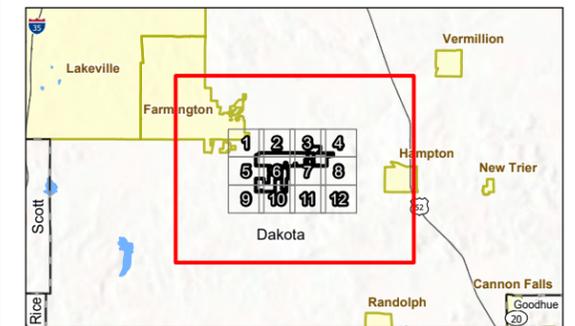
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
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Index Map

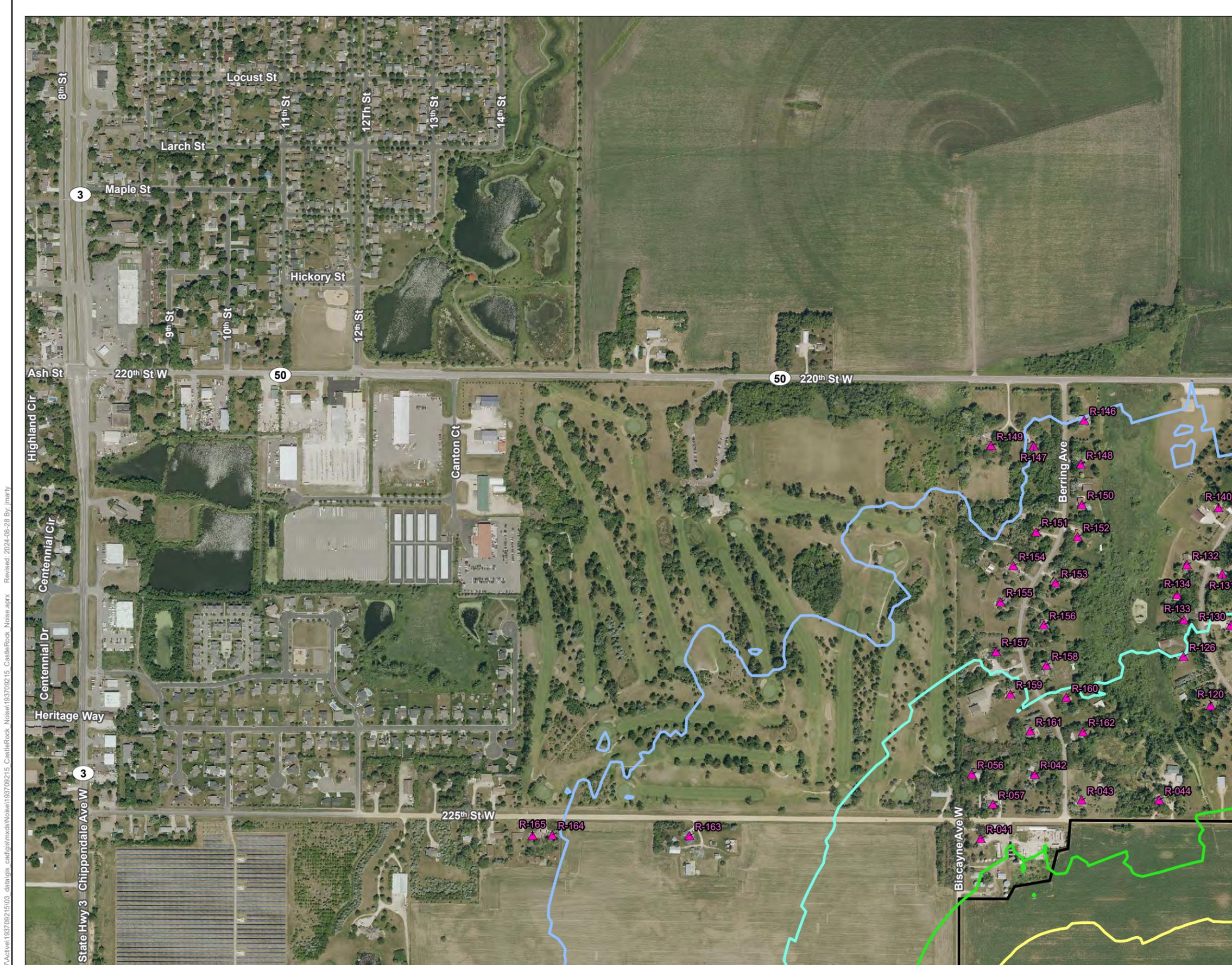


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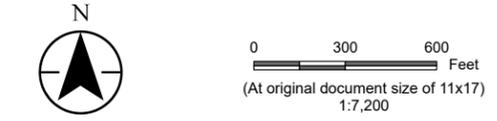
Title
**Operational Noise Results
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Client/Project
Matrix Renewables USA LLC
Castle Rock

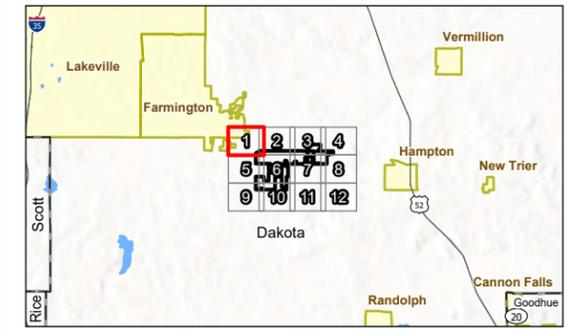
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Project Location
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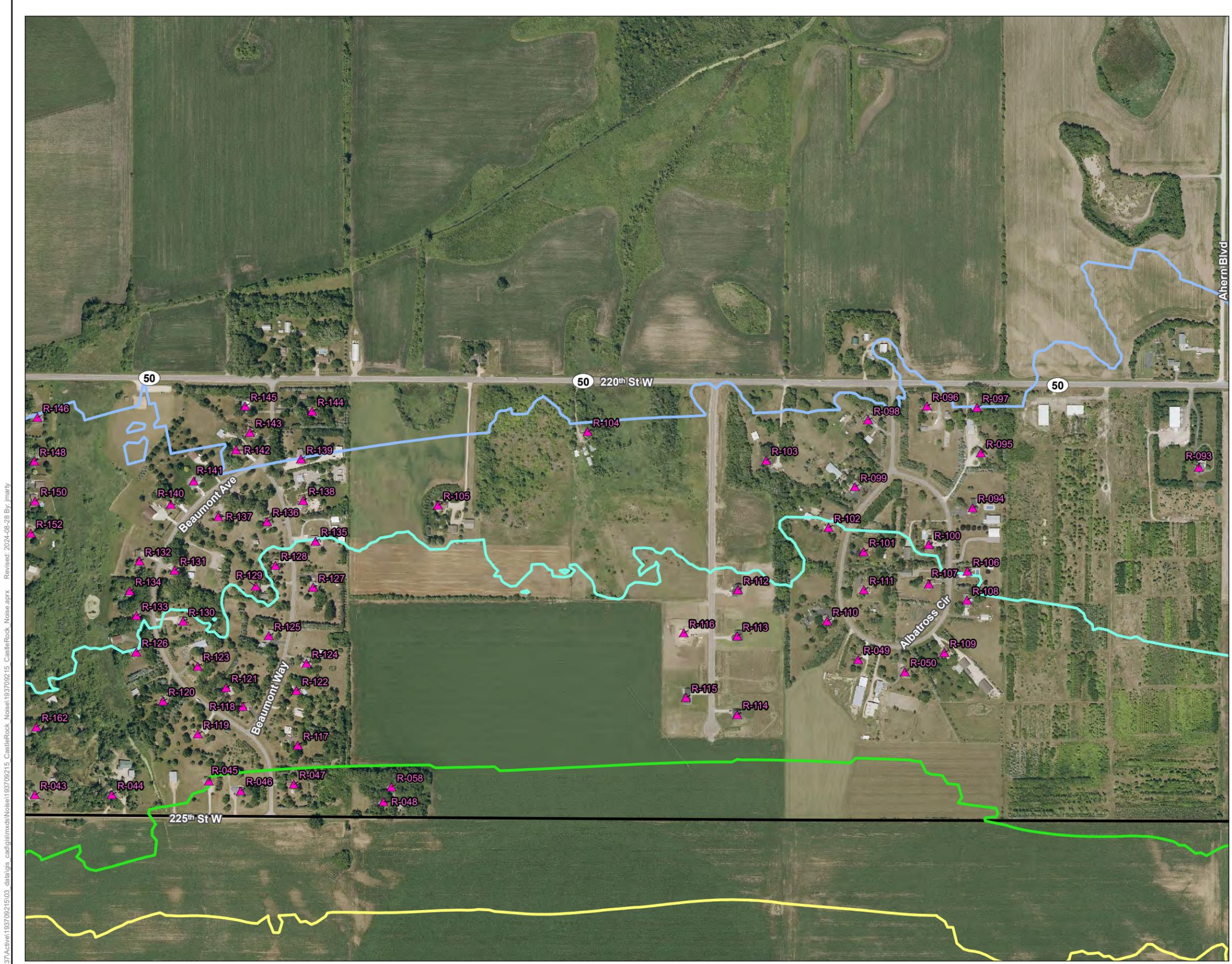


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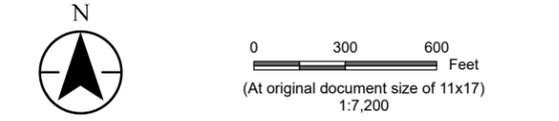
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**Operational Noise Results
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Client/Project
Matrix Renewables USA LLC
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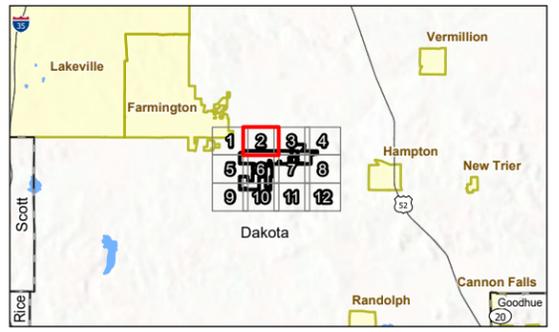
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Prepared by JM on 2024-08-26
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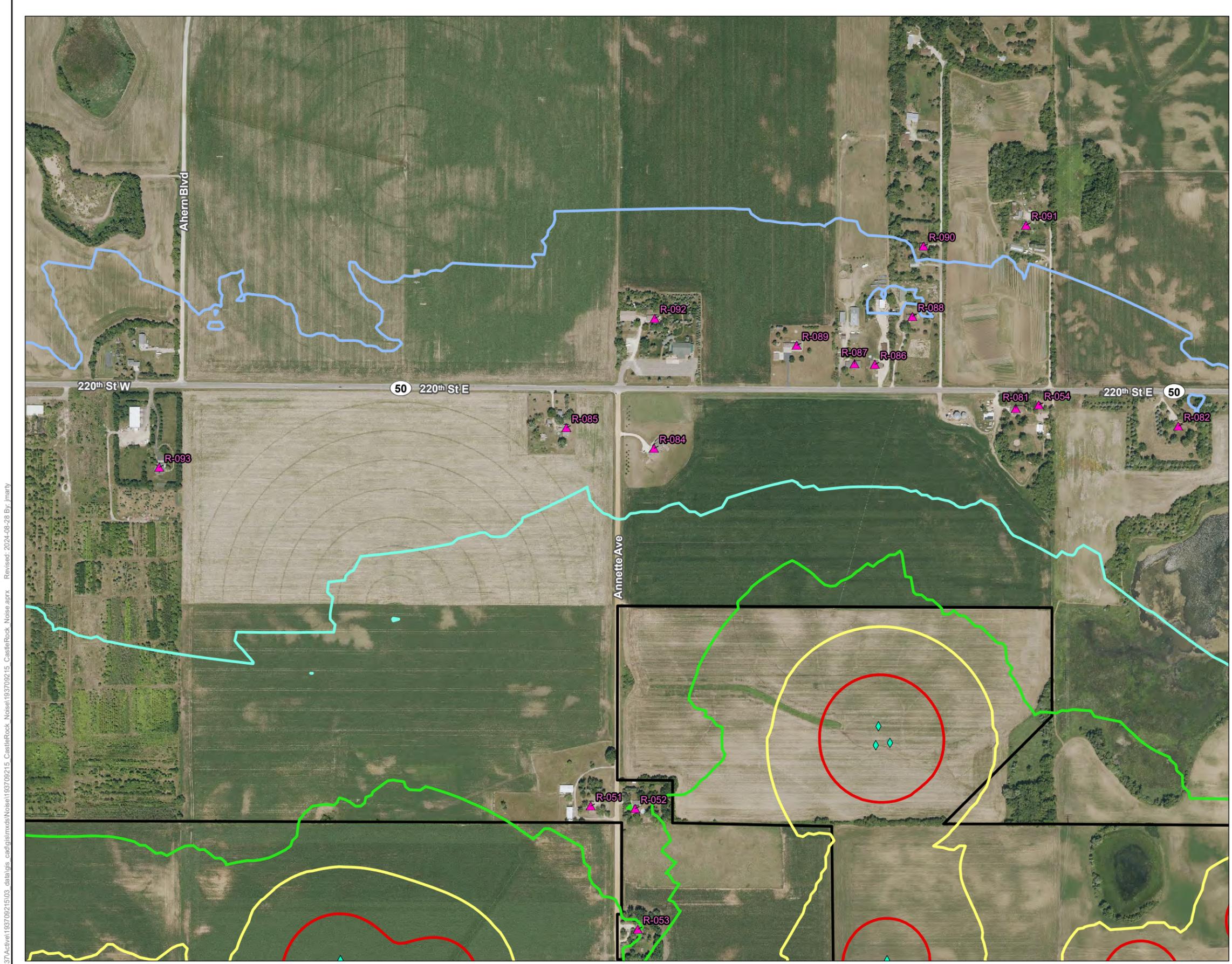


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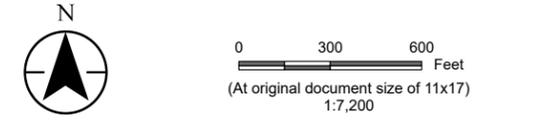
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Matrix Renewables USA LLC
Castle Rock

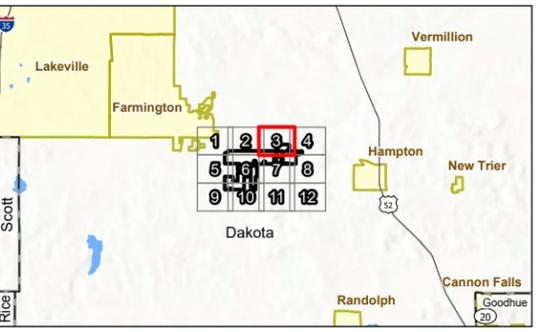
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Figure No.

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Castle Rock

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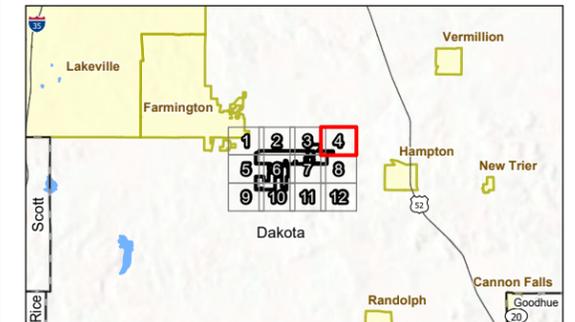
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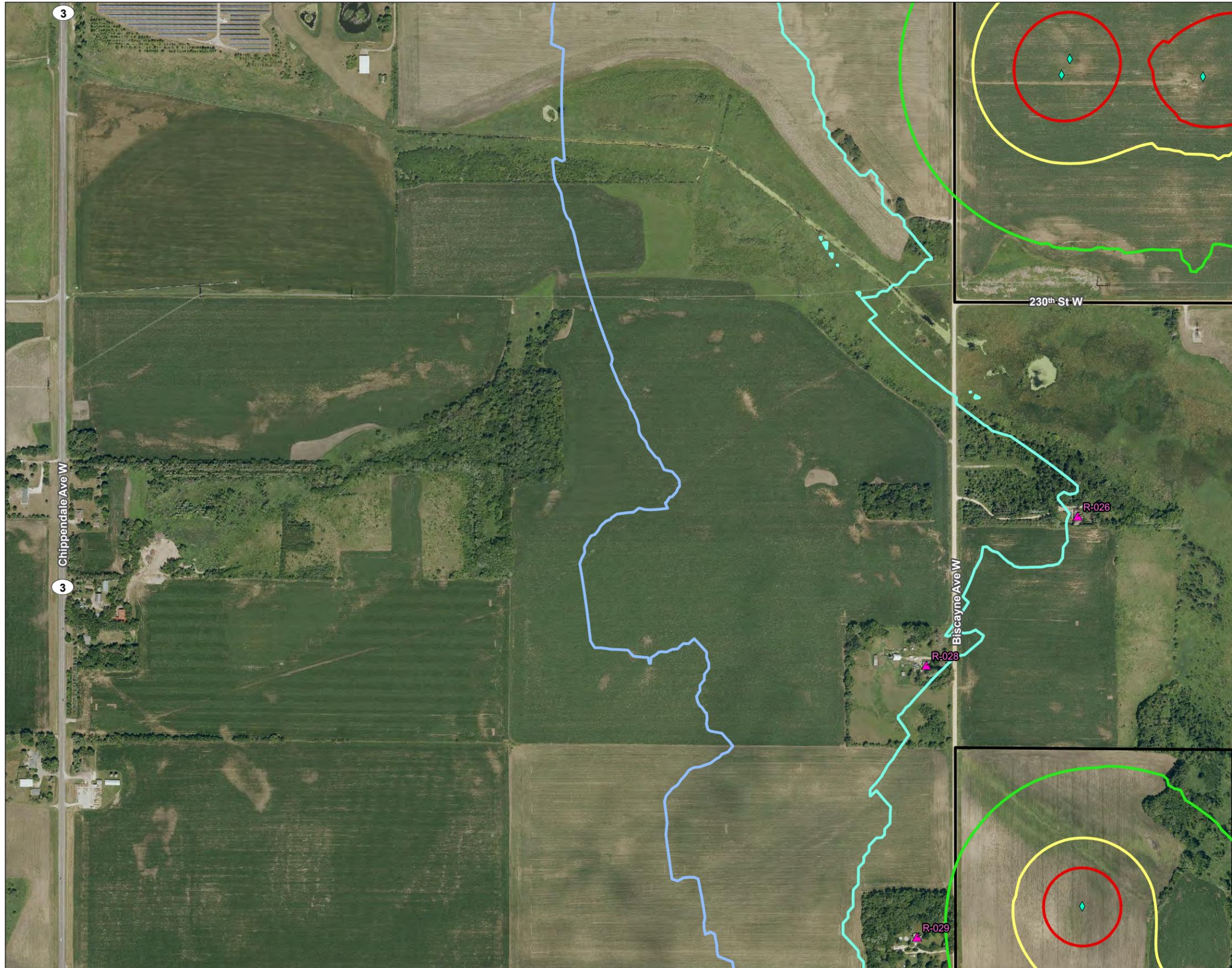


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Client/Project
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Castle Rock

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Project Location
T. of Castle Rock
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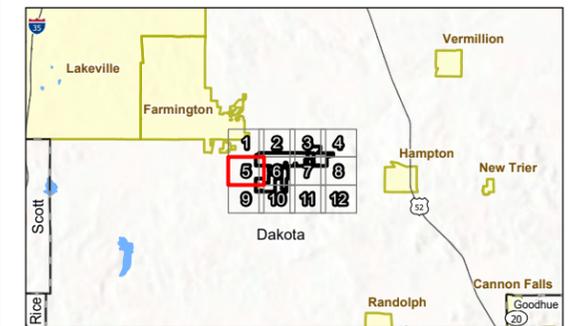
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- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



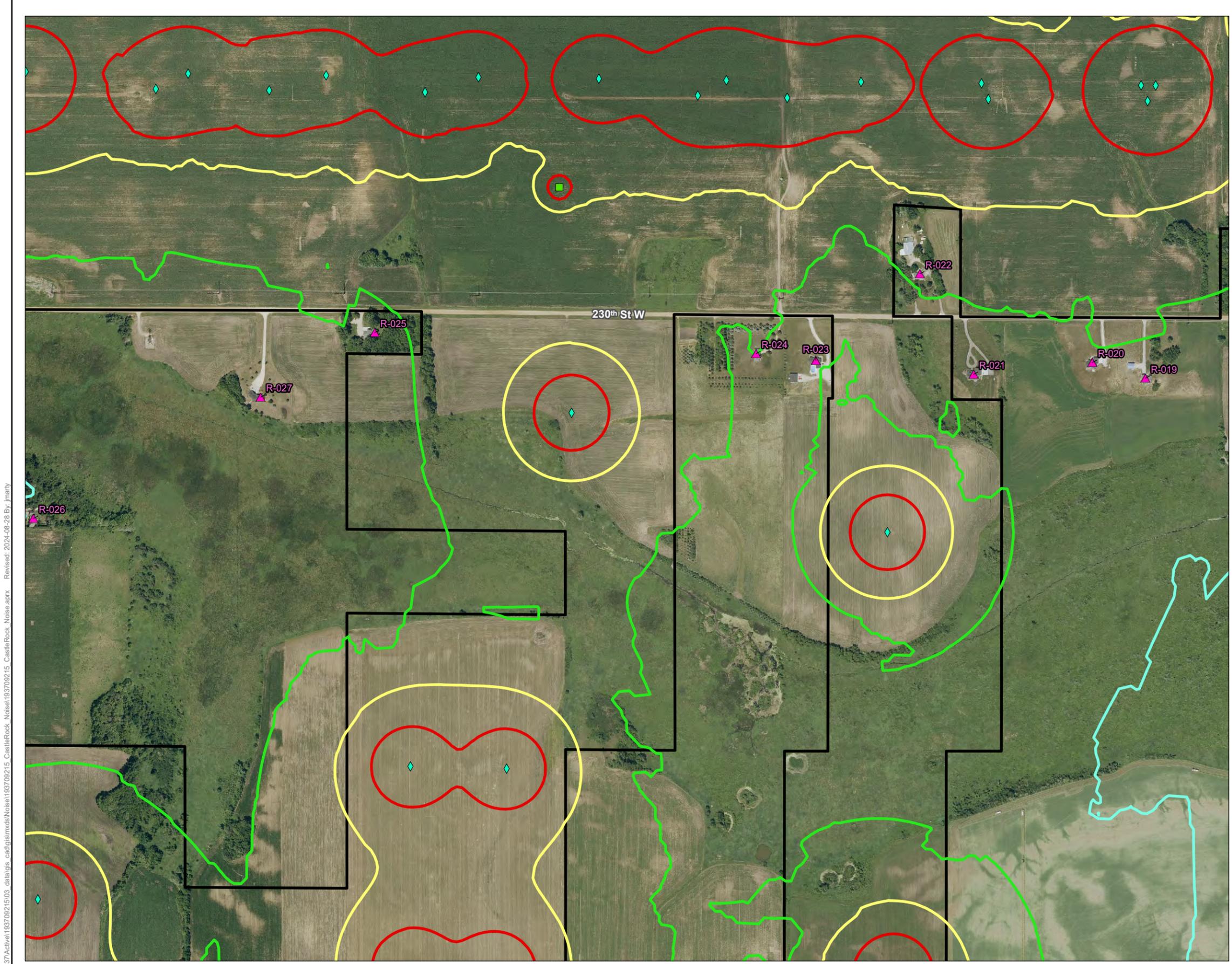


Figure No.
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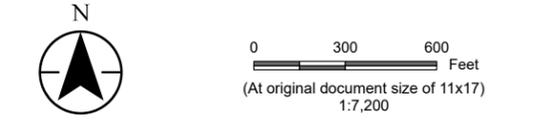
Title
**Operational Noise Results
(Preferred - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

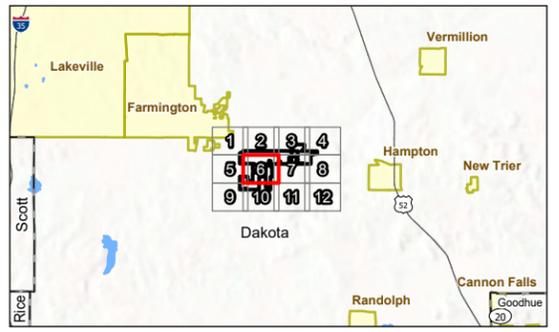
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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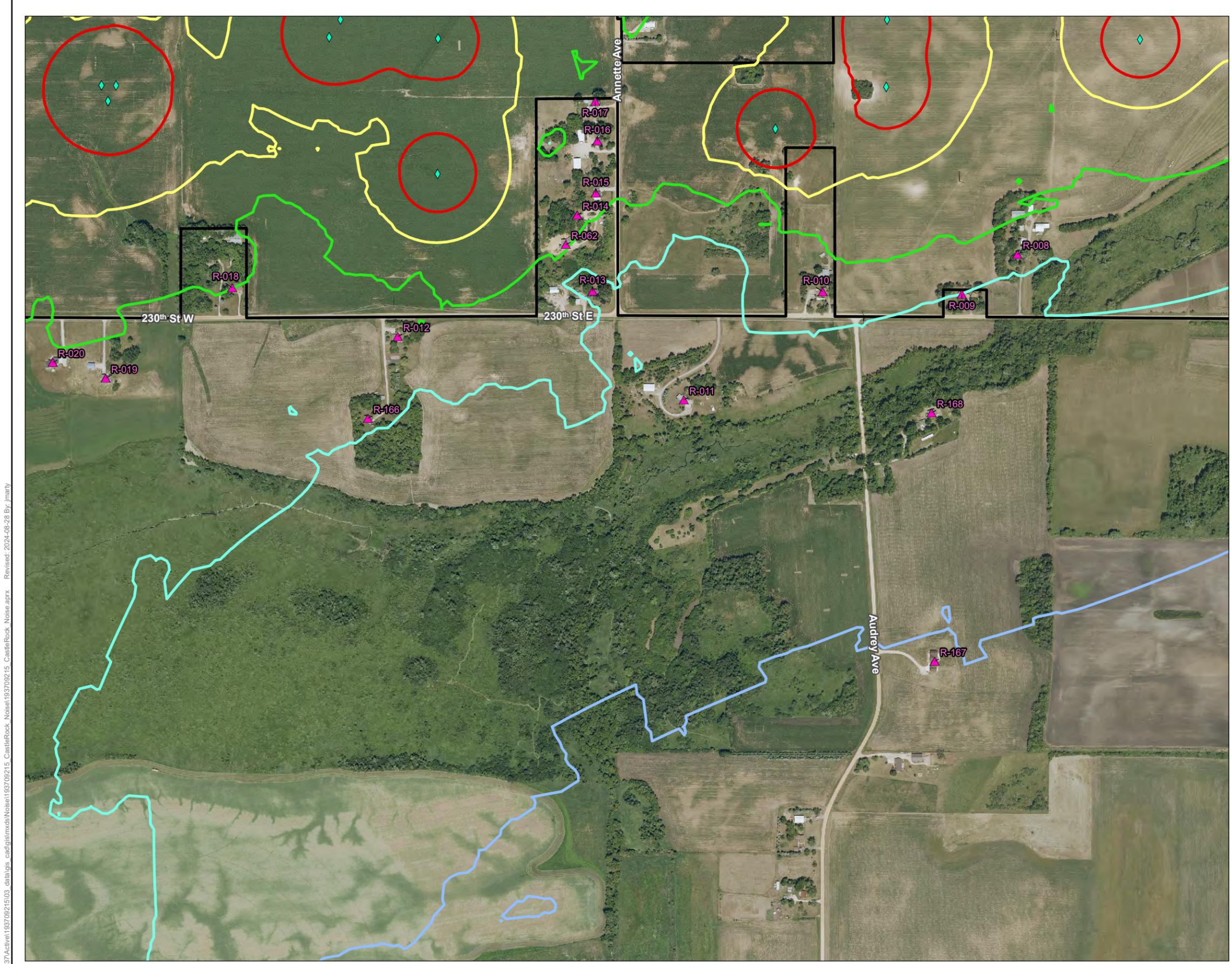
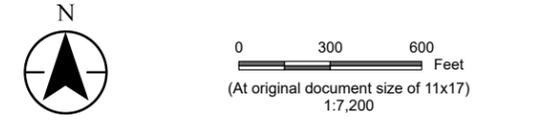
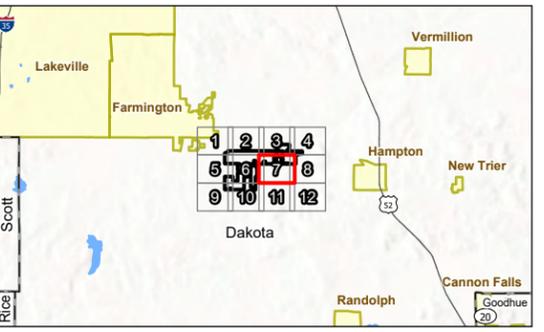


Figure No. **3**
 Title **Operational Noise Results (Preferred - Daytime)**
 Client/Project **Matrix Renewables USA LLC** 193709215
Castle Rock
 Project Location **T. of Castle Rock, Dakota Co., MN** Prepared by JM on 2024-08-26
 TR by ML on 2024-08-27
 IR by XX on 2024-XX-XX



- Legend**
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)**
- ⤵ 45
 - ⤵ 50
 - ⤵ 55
 - ⤵ 60
 - ⤵ 65



Notes
 1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure No.

3

Title

Operational Noise Results (Preferred - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



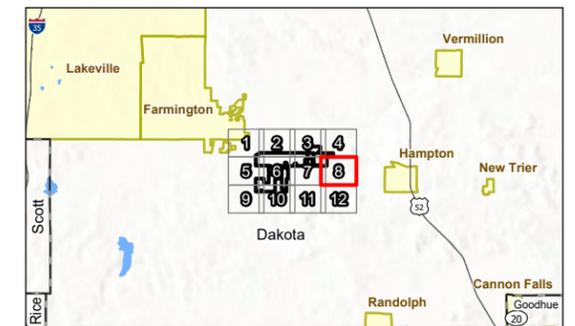
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023





Figure No.
3

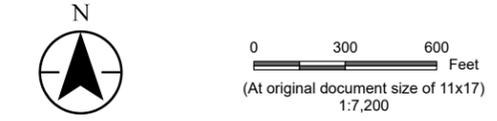
Title
**Operational Noise Results
(Preferred - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

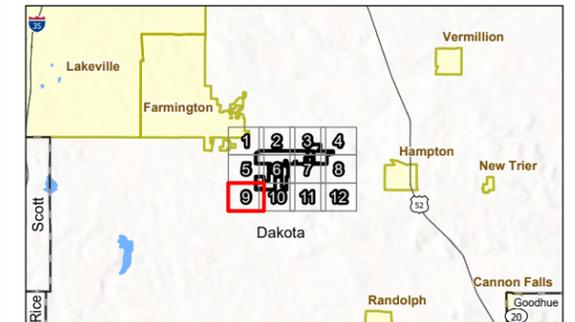
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- ⤵ 45
 - ⤵ 50
 - ⤵ 55
 - ⤵ 60
 - ⤵ 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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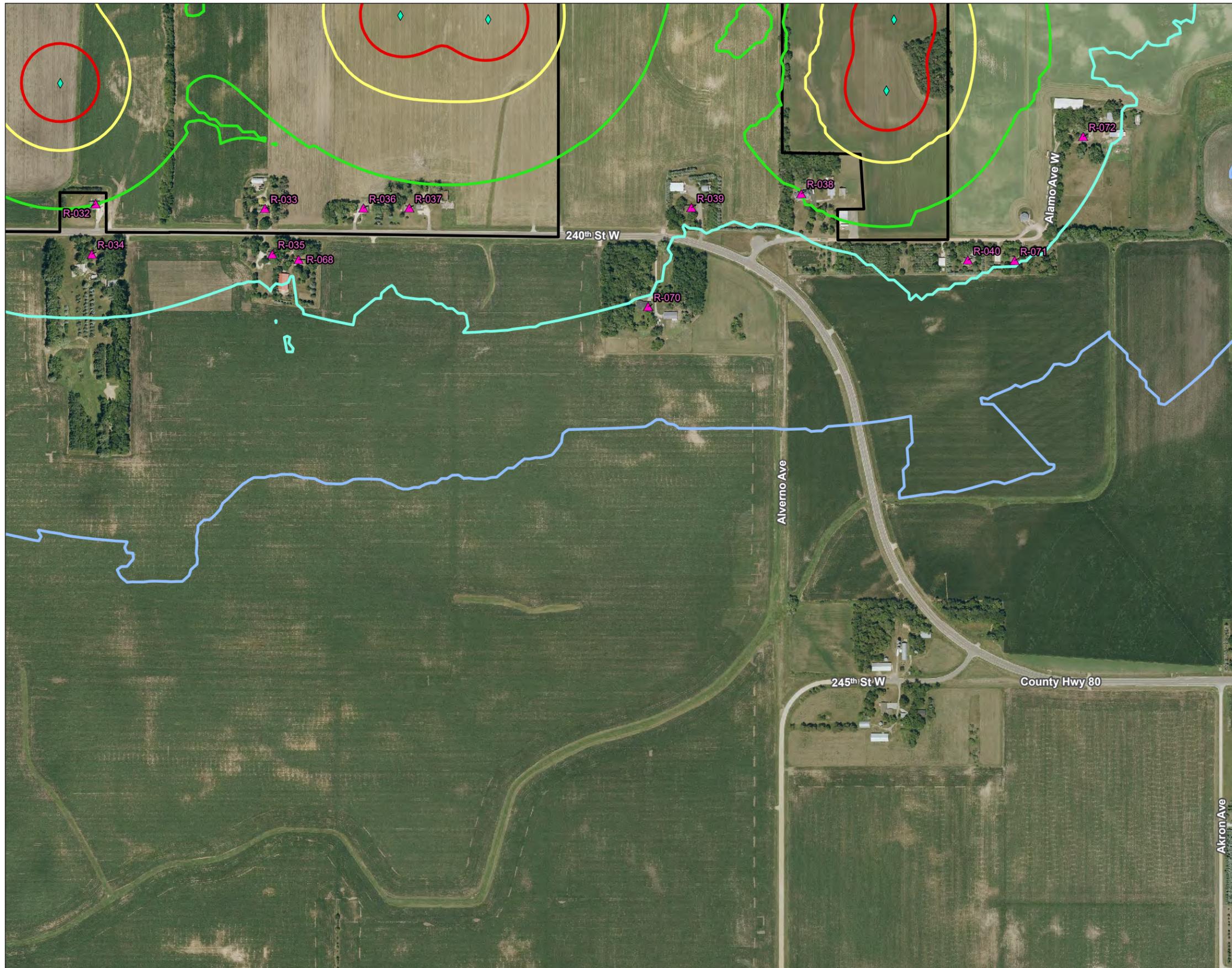


Figure No.

3

Title

Operational Noise Results (Preferred - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

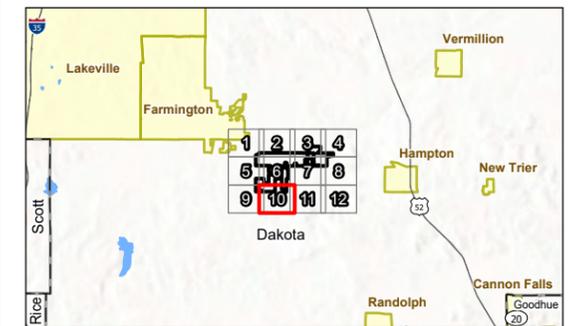
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TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



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Legend

- Project Boundary
 - Sensitive Receptor
 - Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
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- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure No.

3

Title

Operational Noise Results (Preferred - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
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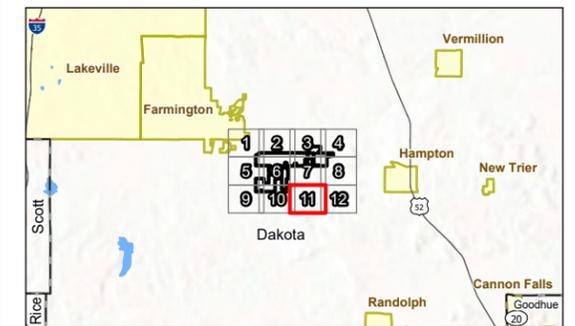
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(At original document size of 11x17)
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
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 3. Background: NAIP 2023





Figure No.

3

Title

**Operational Noise Results
(Preferred - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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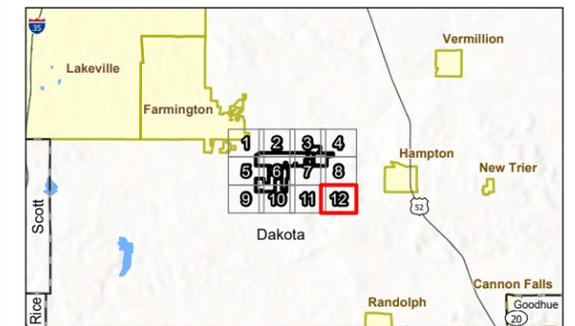
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

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- 50
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- Notes
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 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



Figure 4

Nighttime Operational Noise Results – Preferred

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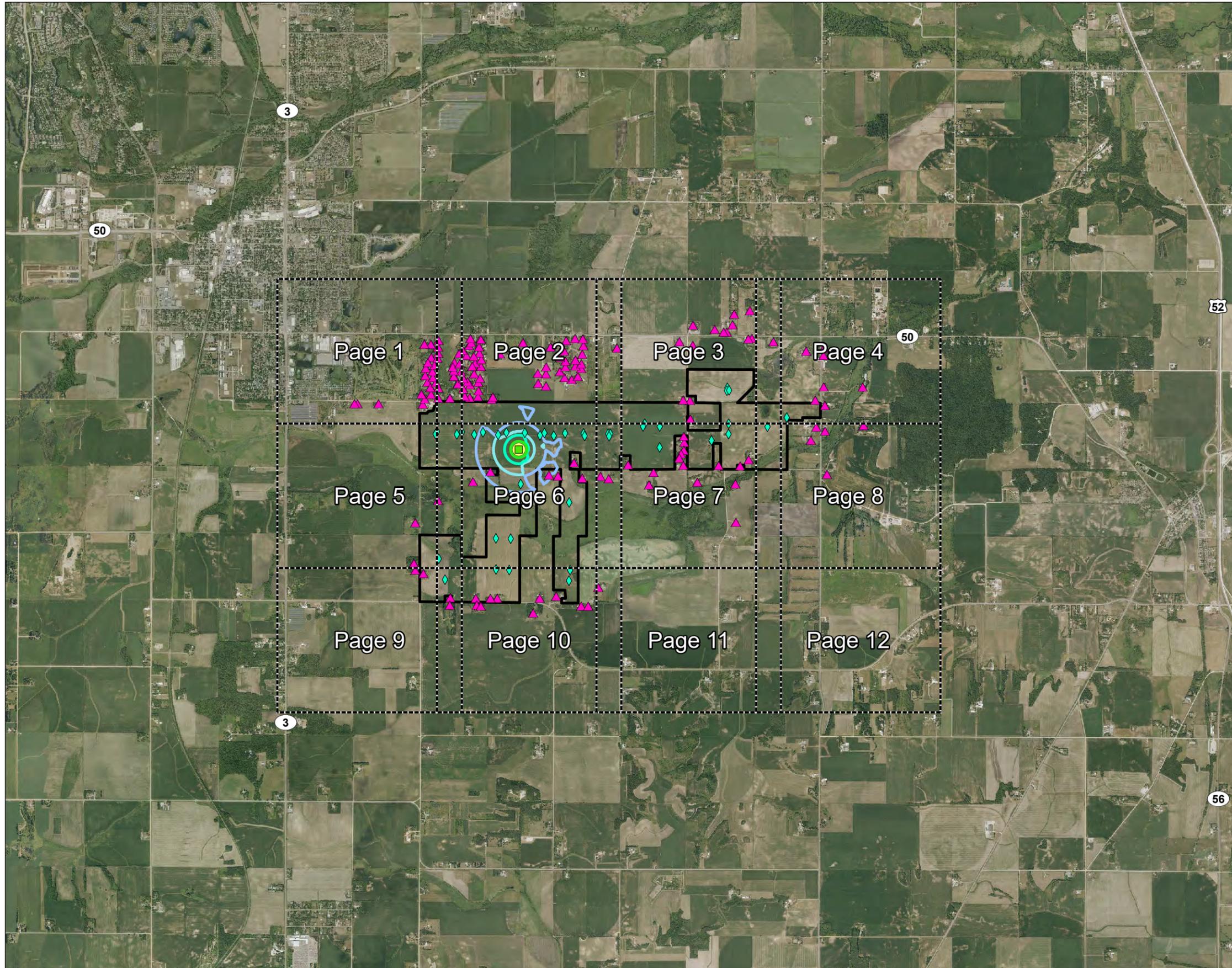


Figure No.

4

Title

Operational Noise Results (Preferred- Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



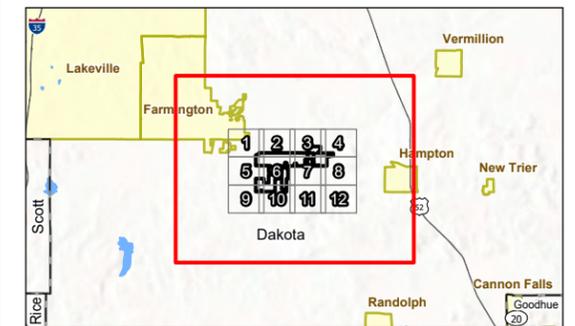
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
- 50
- 55
- 60
- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



Index Map



Figure No.

4

Title

**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



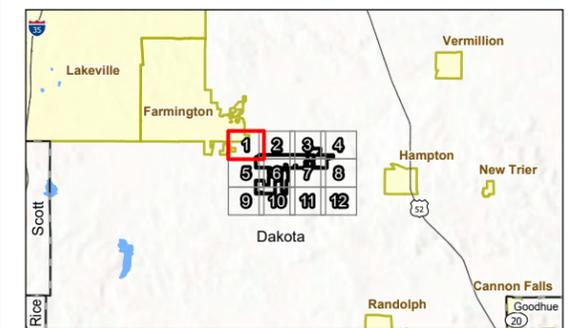
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
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- 60
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Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023





Figure No.

4

Title

**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
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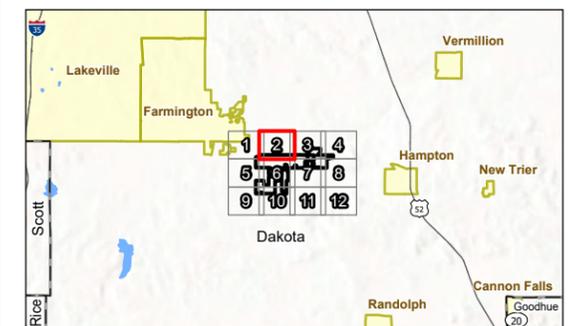
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
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- 60
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- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



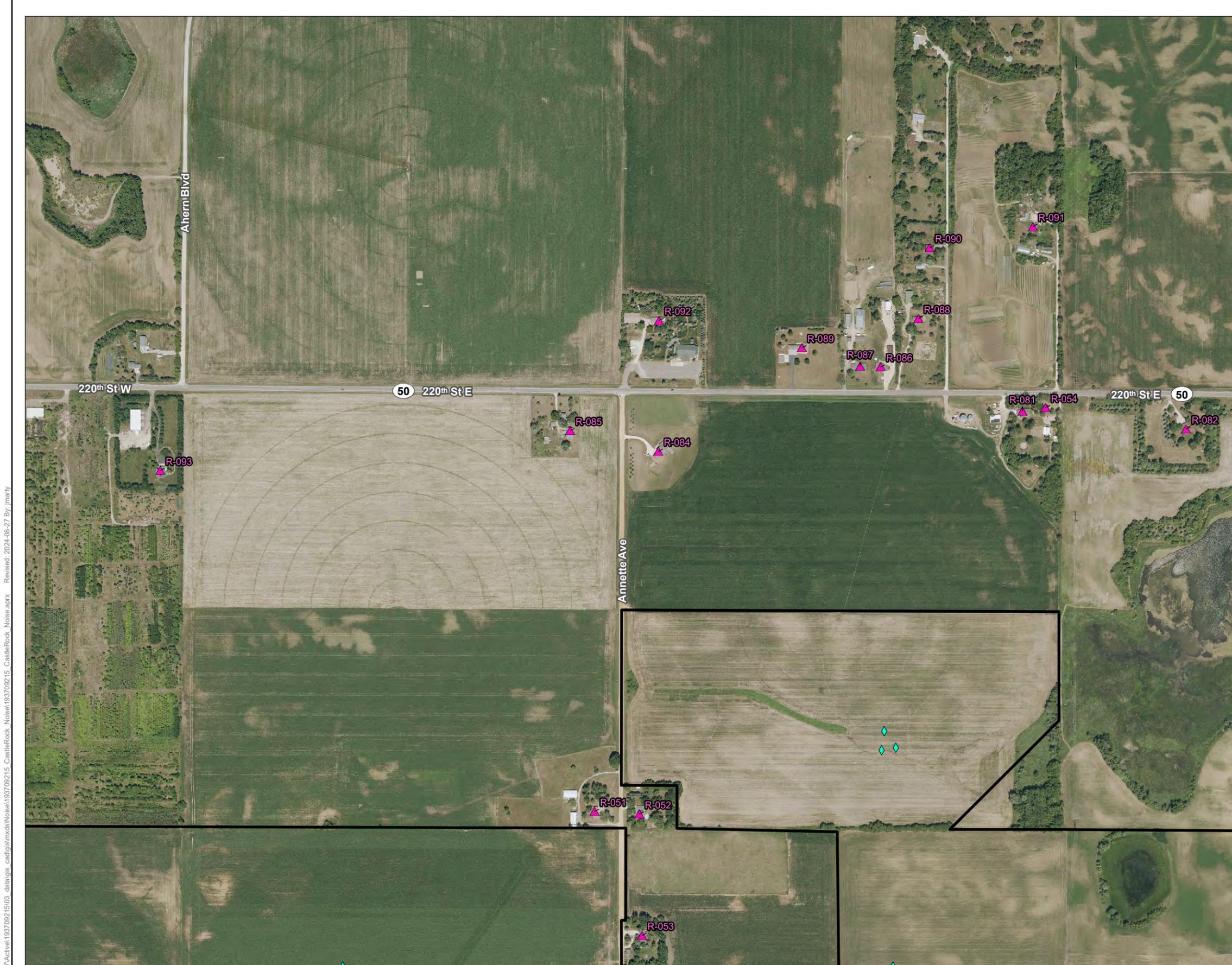


Figure No.

4

Title

**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



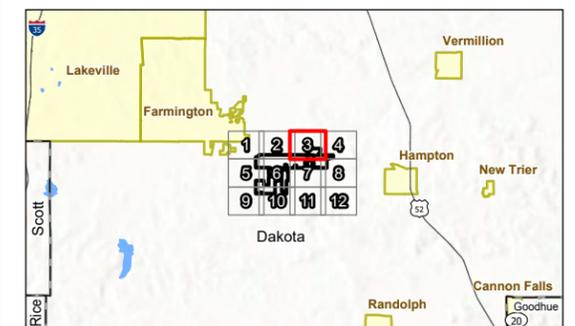
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
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- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



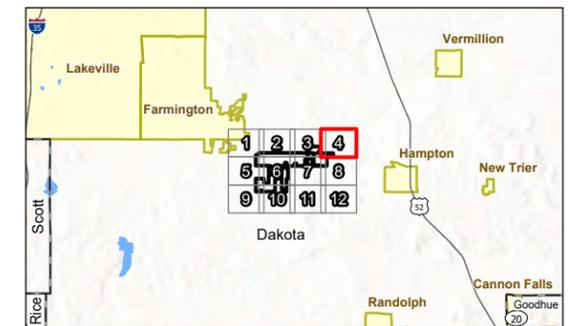
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(At original document size of 11x17)
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
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Notes
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Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



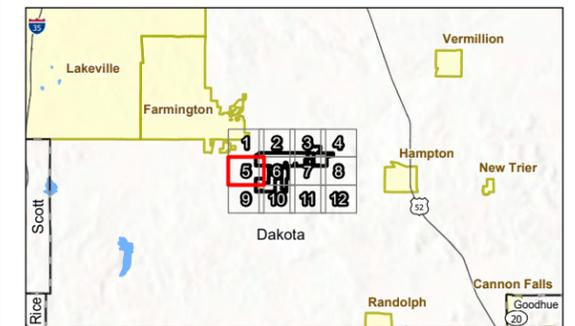
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(At original document size of 11x17)
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Legend

- Project Boundary
- Sensitive Receptor
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Noise Contour (dBA)

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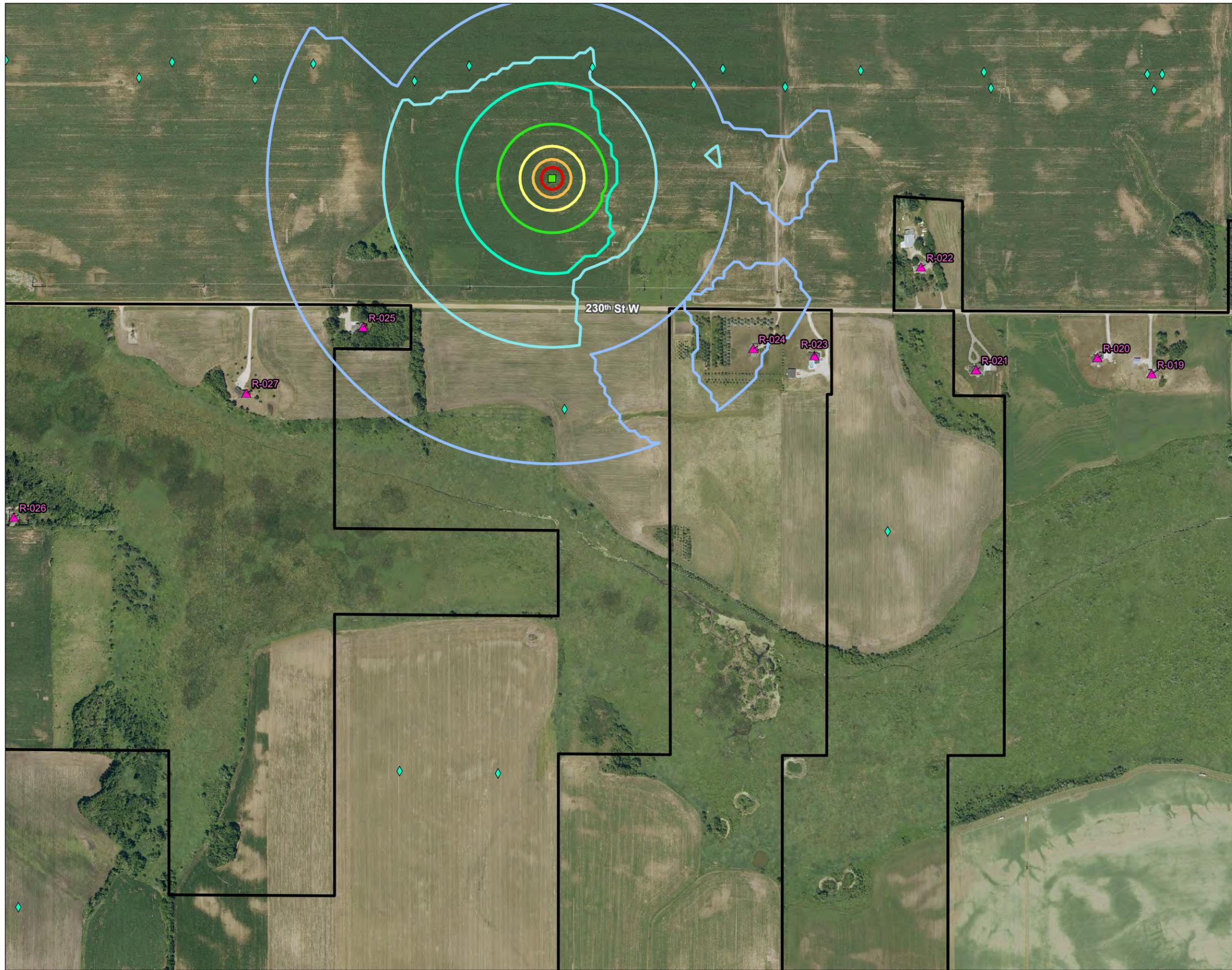


Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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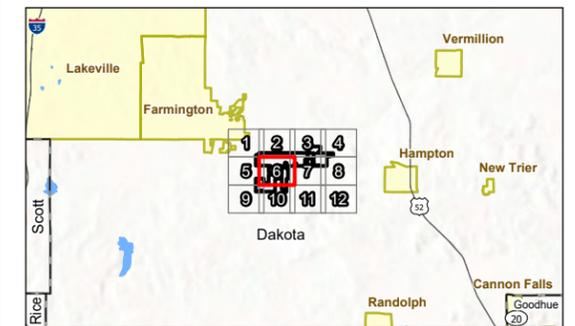
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Legend

- Project Boundary
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- Inverter
- Substation

Noise Contour (dBA)

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Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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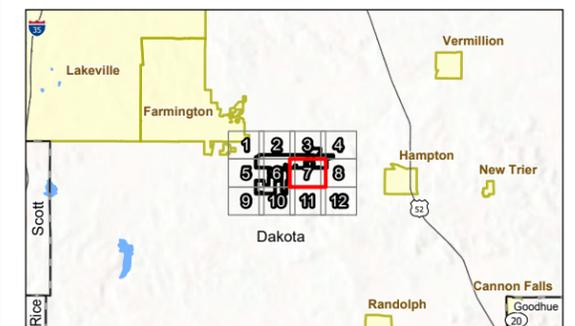
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
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Noise Contour (dBA)

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- Notes
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Figure No.

4

Title

**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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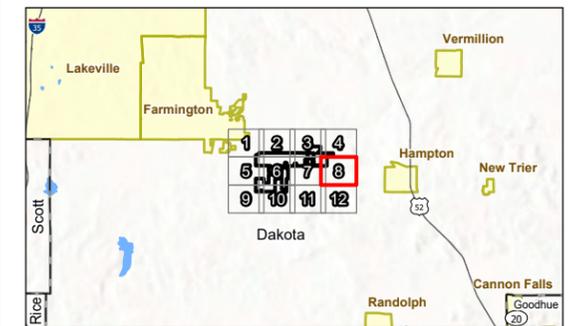
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Legend

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- Sensitive Receptor
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Noise Contour (dBA)

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Figure No.
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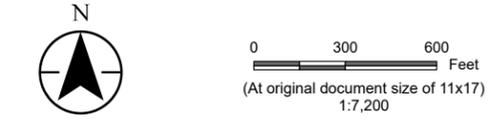
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**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

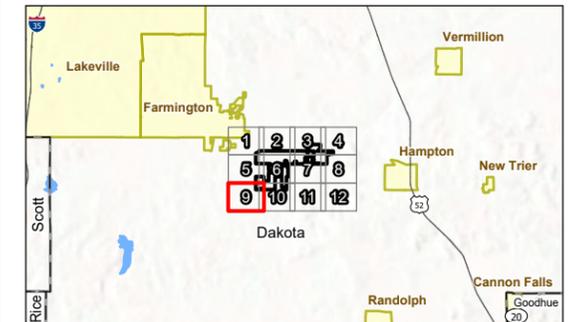
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Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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- Legend
- Project Boundary
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- ⤿ 35
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Notes

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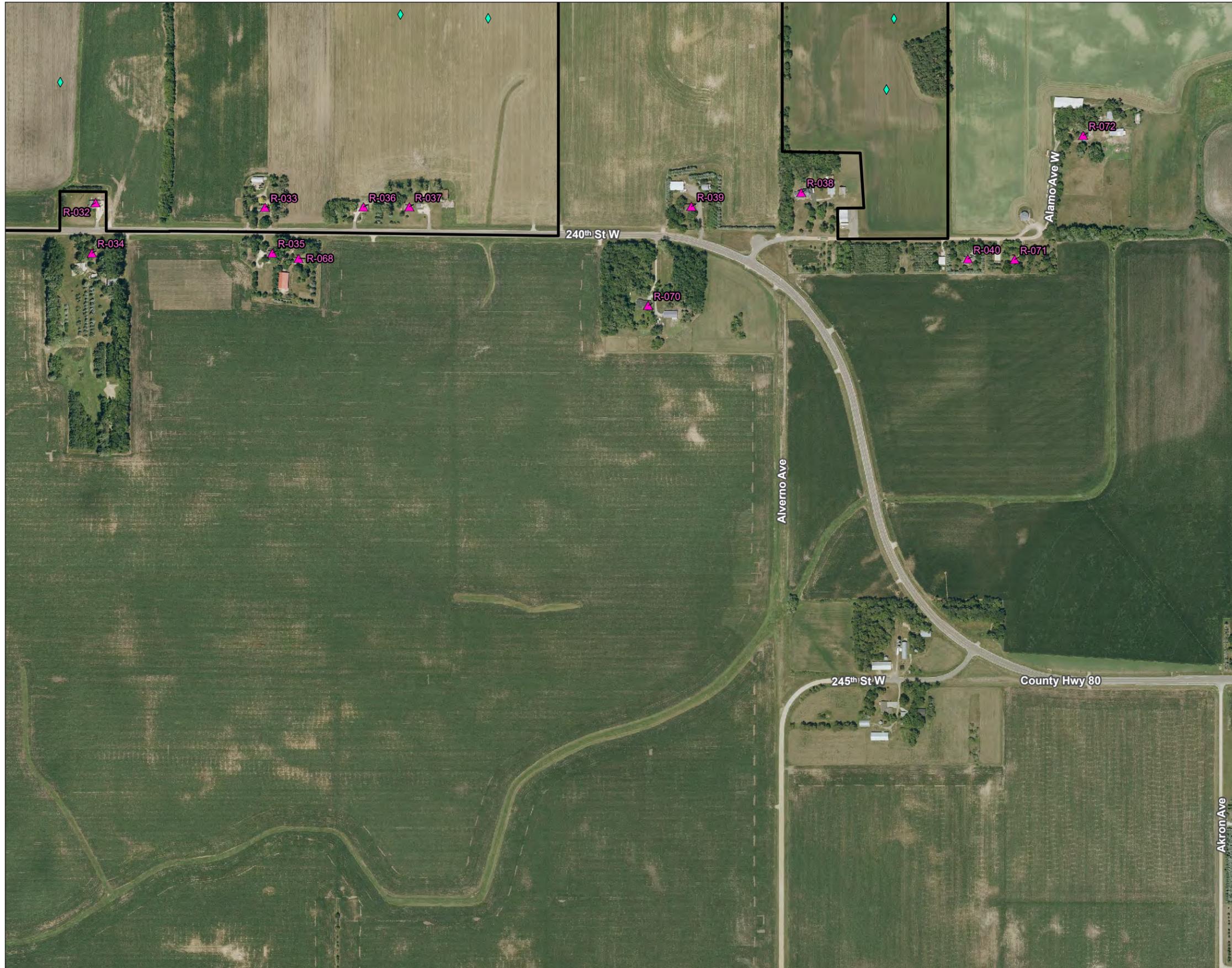


Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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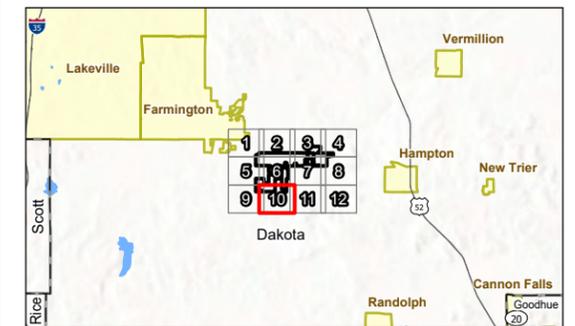
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

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3. Background: NAIP 2023



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Figure No.

4

Title

Operational Noise Results (Preferred - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
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Dakota Co., MN

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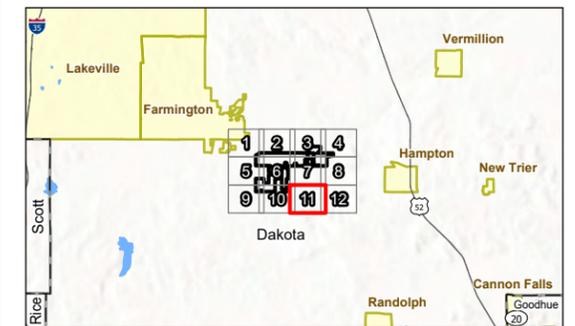
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Legend

- Project Boundary
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Noise Contour (dBA)

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- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023





Figure No.

4

Title

**Operational Noise Results
(Preferred - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



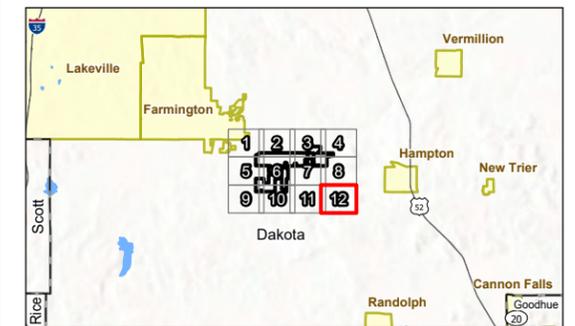
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(At original document size of 11x17)
1:7,200

Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



Figure 5

Daytime Operational Noise Results – Alternate Option

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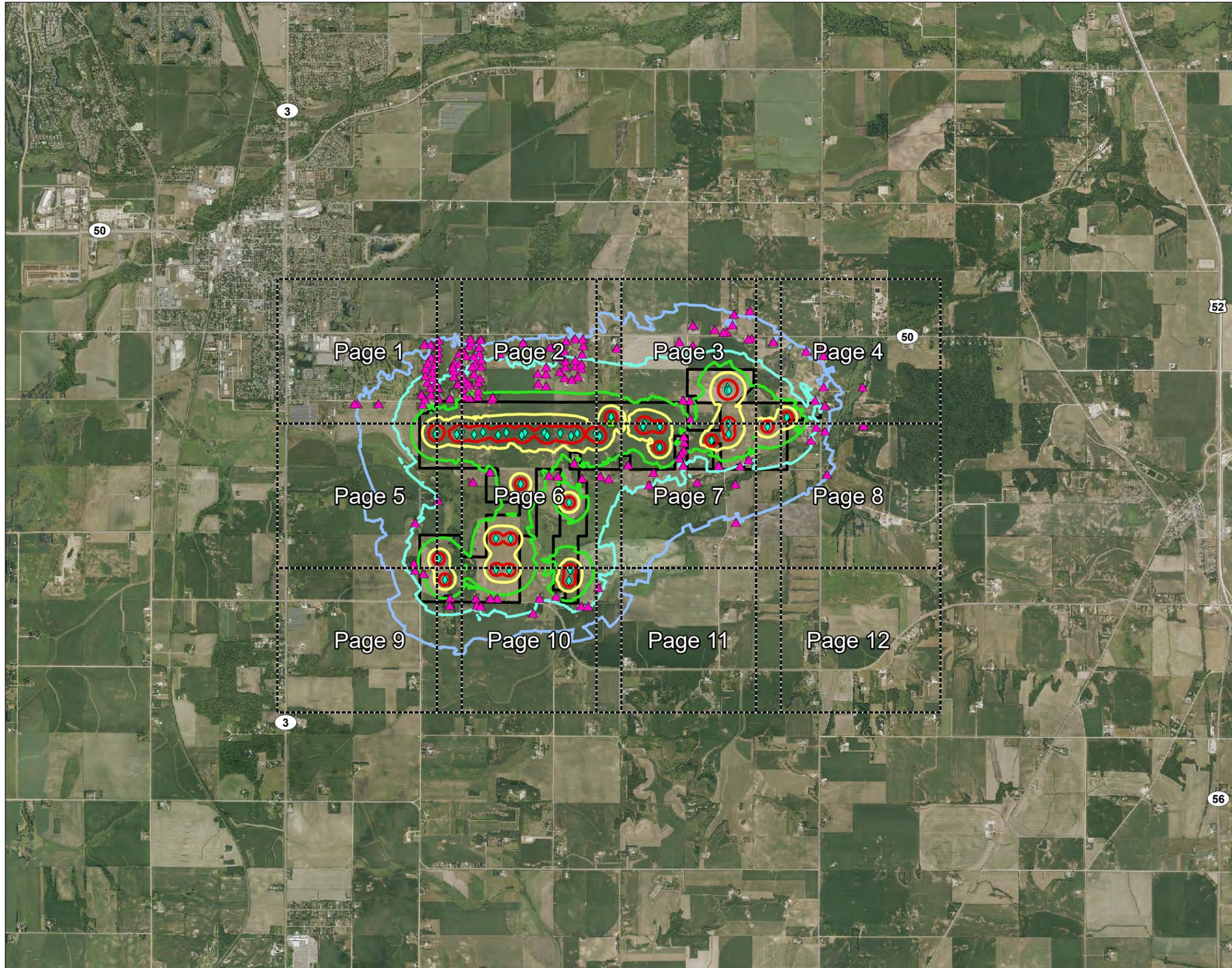


Figure No.

5

Title

**Operational Noise Results
(Alternate - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



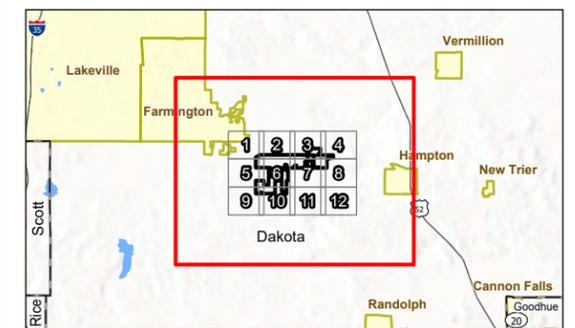
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Feet
(At original document size of 11x17)
1:48,000

Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



Index Map

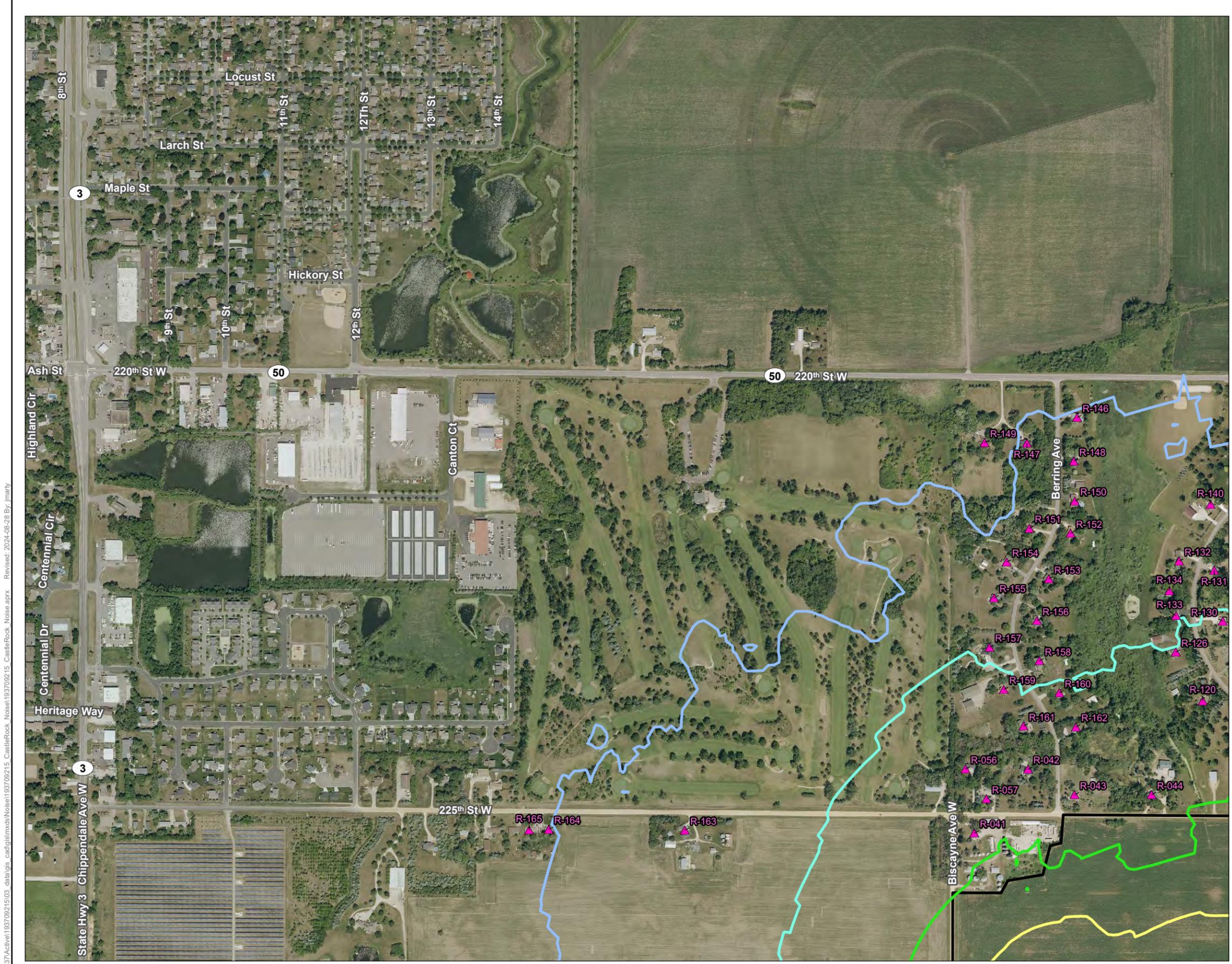
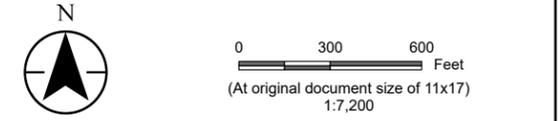
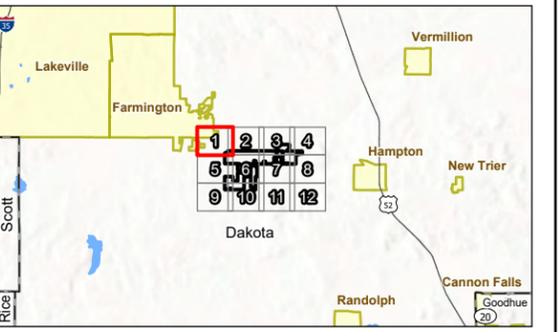


Figure No. **5**
 Title **Operational Noise Results (Alternate - Daytime)**
 Client/Project **Matrix Renewables USA LLC** 193709215
 Castle Rock
 Project Location **T. of Castle Rock, Dakota Co., MN** Prepared by JM on 2024-08-26
 TR by ML on 2024-08-27
 IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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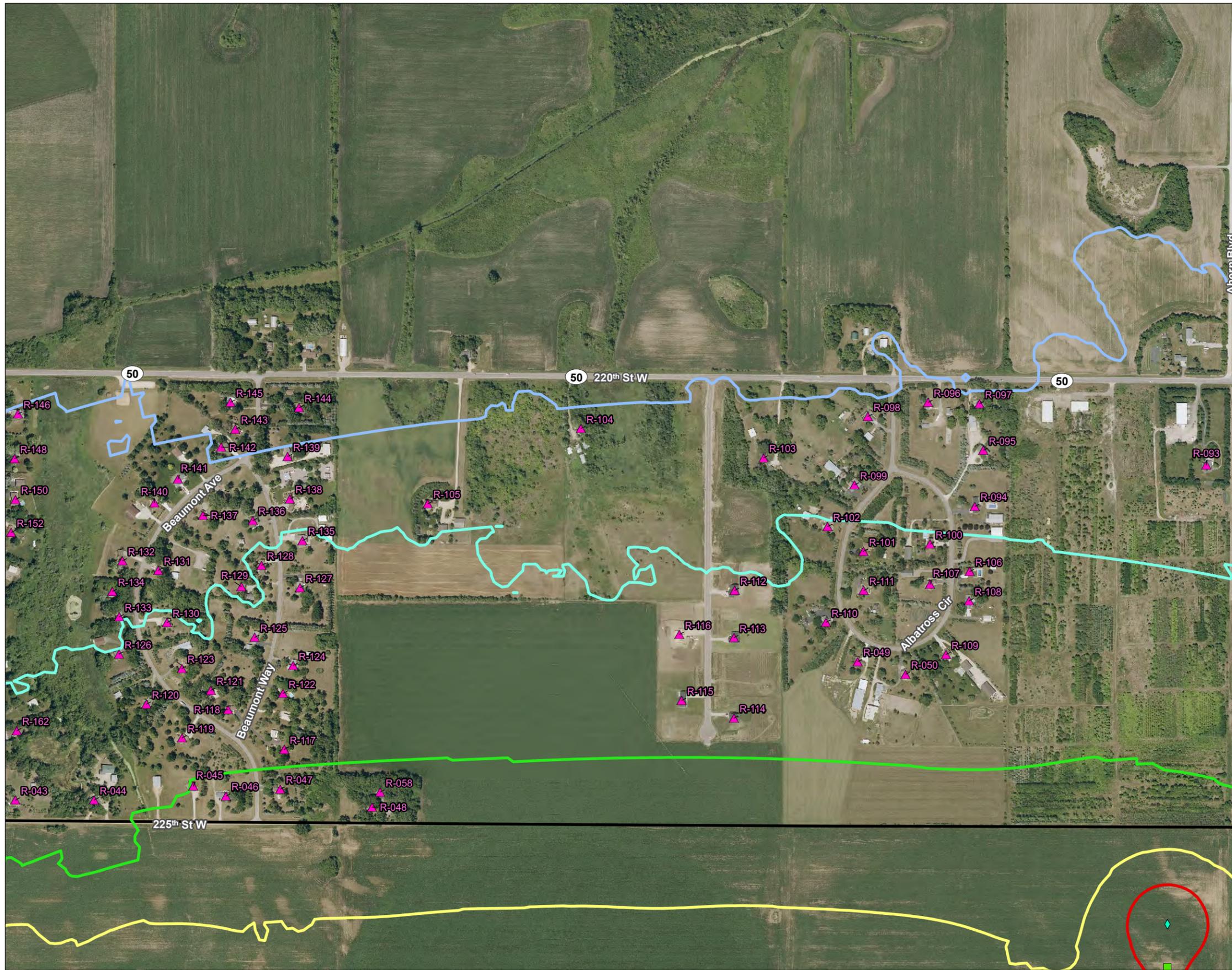


Figure No.

5

Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



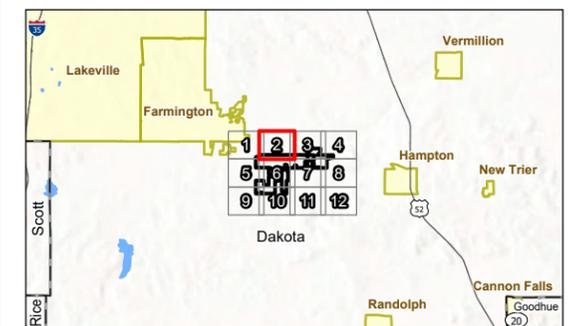
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



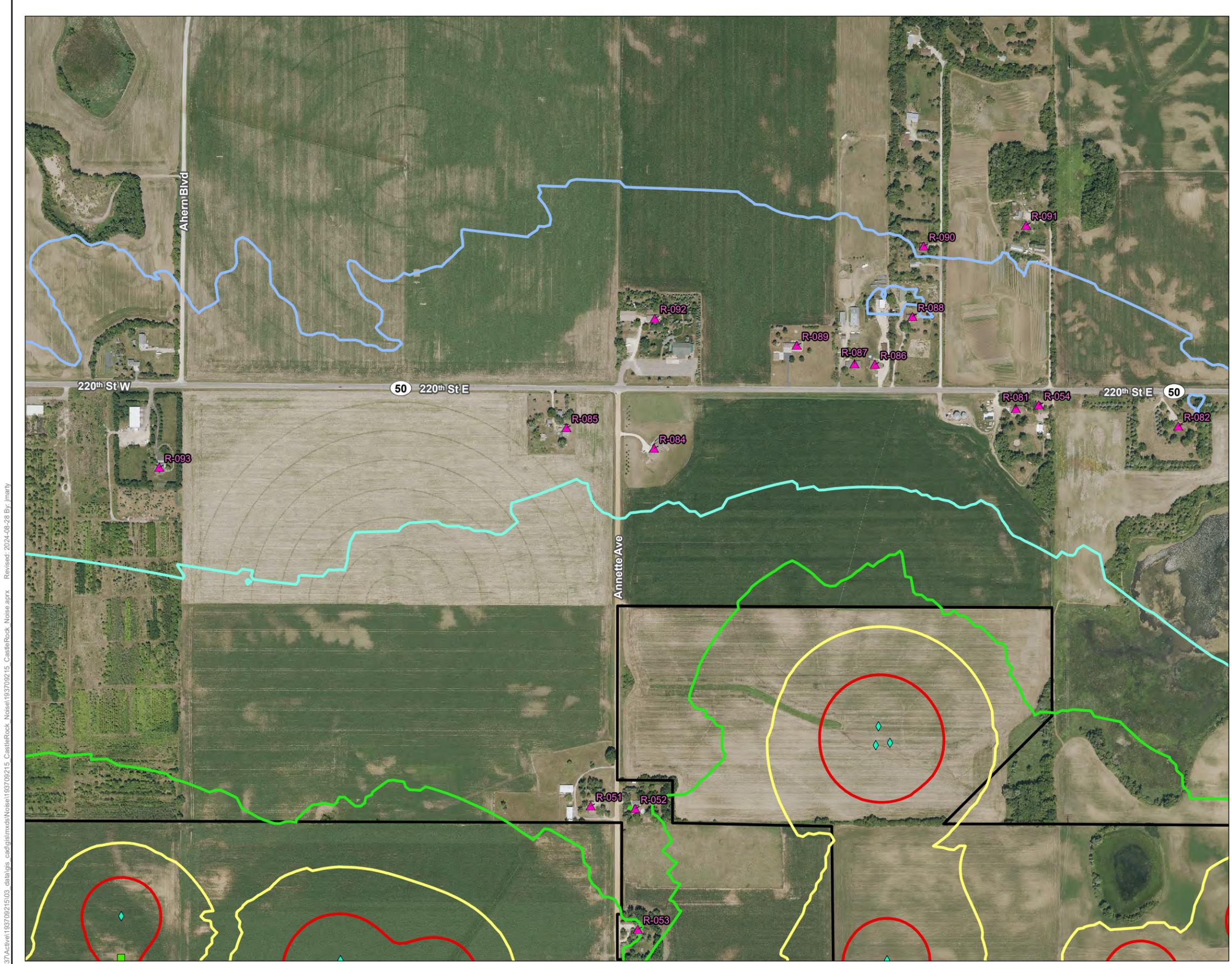


Figure No.
5

Title
**Operational Noise Results
(Alternate - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

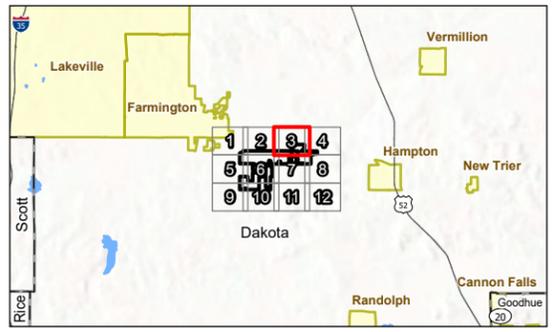
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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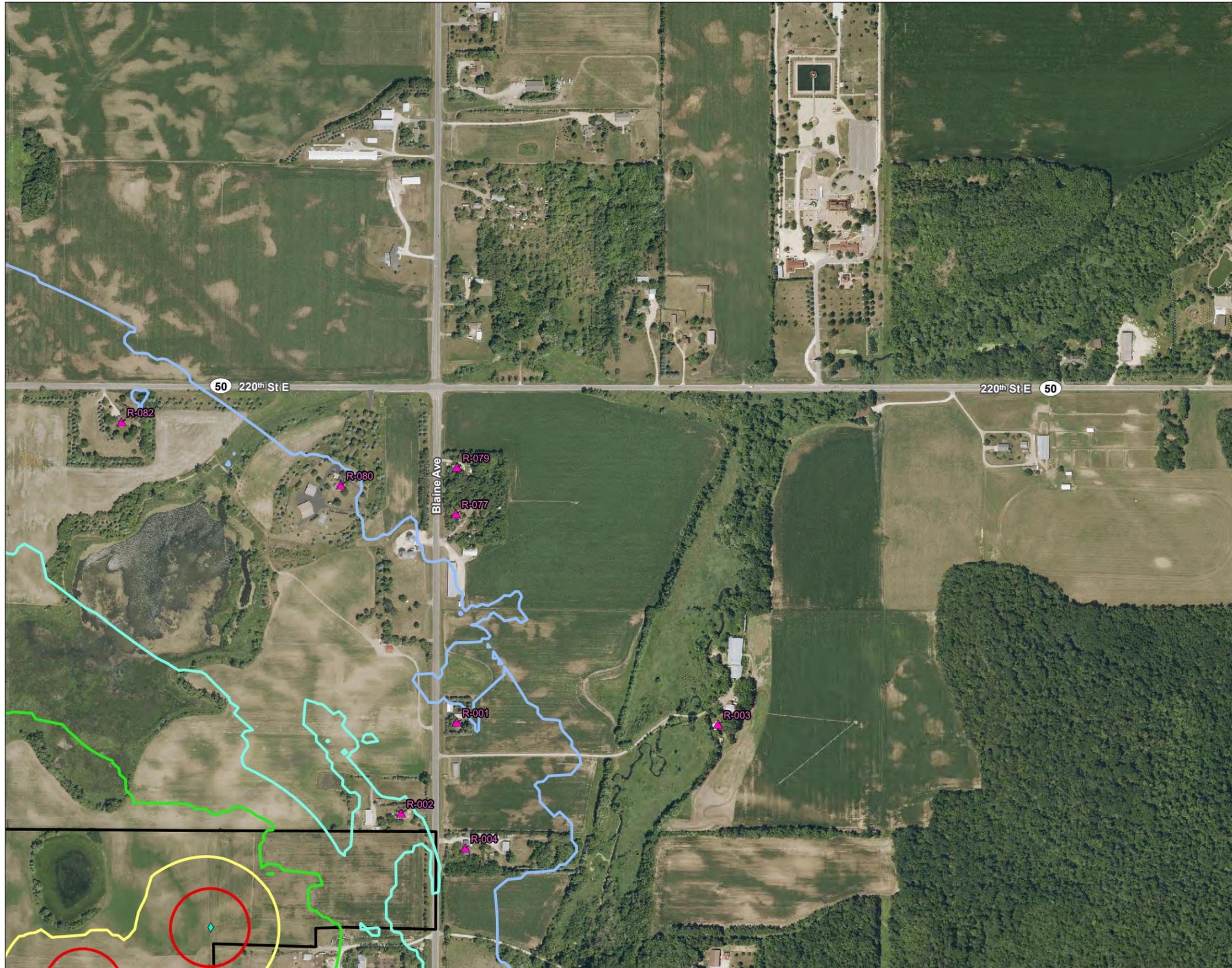


Figure No.

5

Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



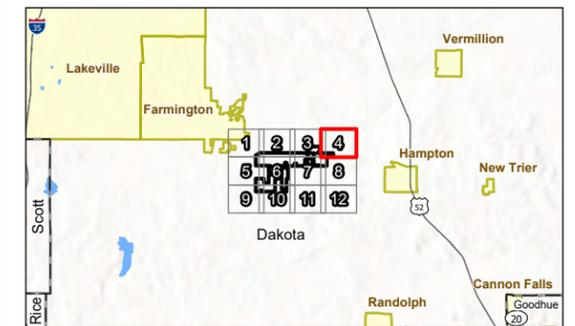
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(At original document size of 11x17)
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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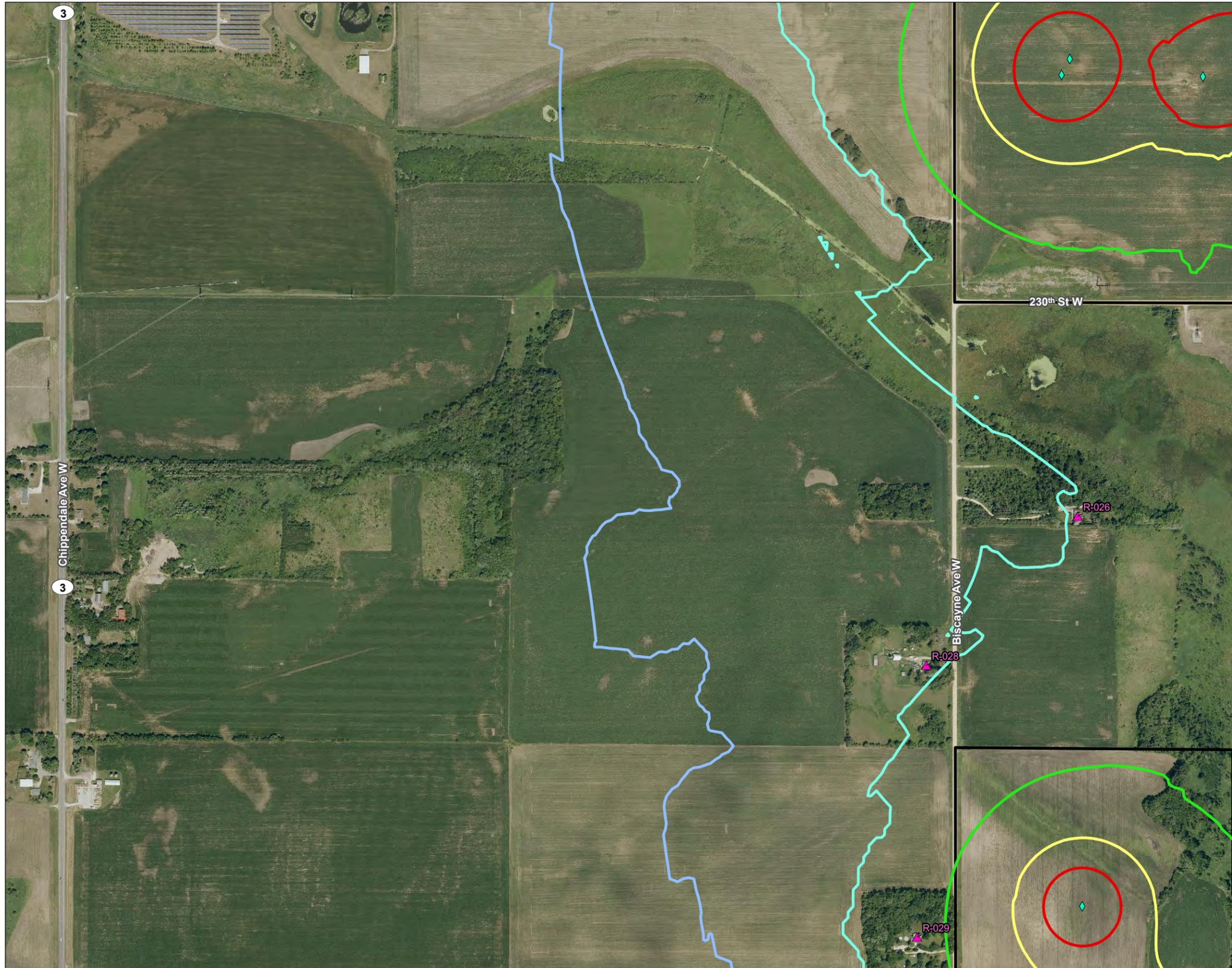


Figure No.

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Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

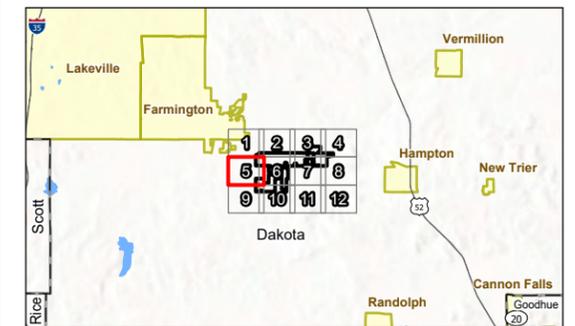
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TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



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Legend

- Project Boundary
 - Sensitive Receptor
 - Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes
 1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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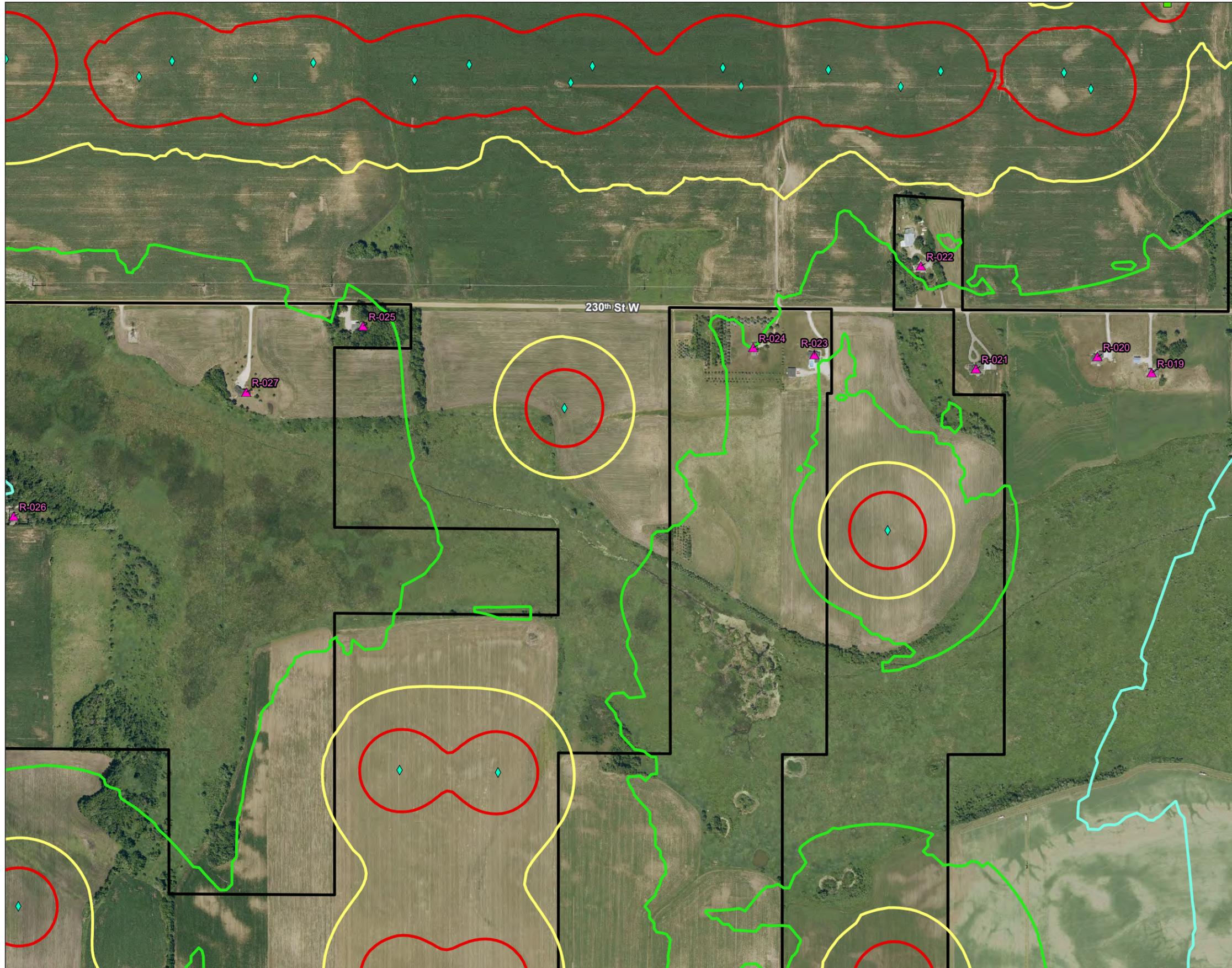


Figure No.

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Title

**Operational Noise Results
(Alternate - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



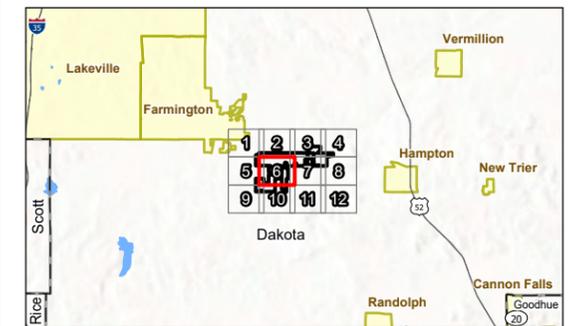
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(At original document size of 11x17)
1:7,200

Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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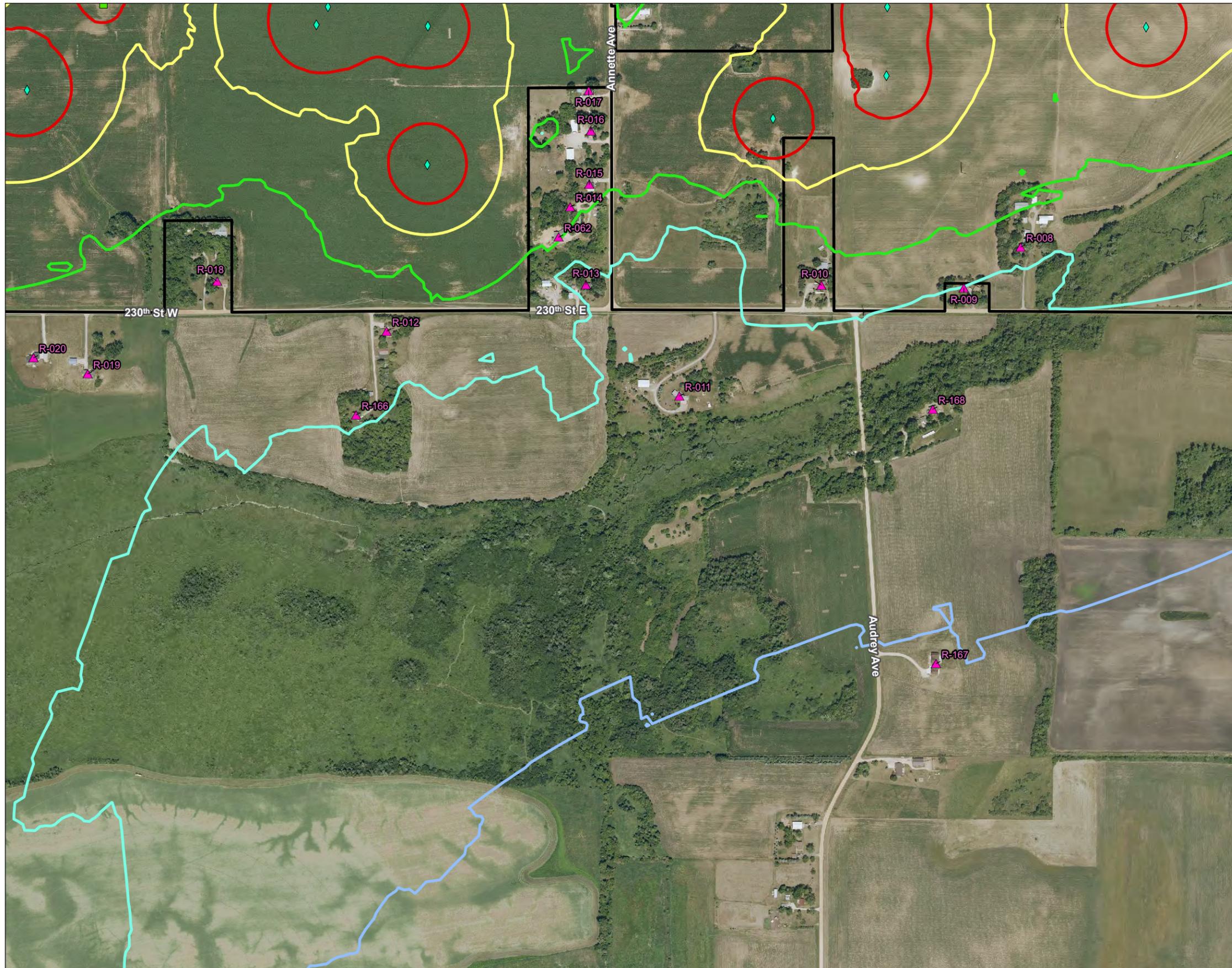
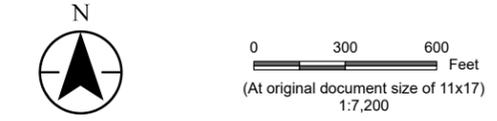
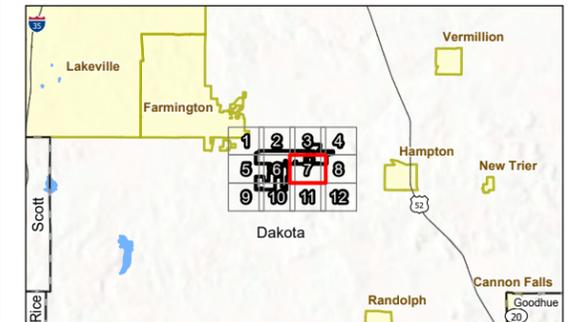


Figure No. **5**
 Title **Operational Noise Results (Alternate - Daytime)**
 Client/Project **Matrix Renewables USA LLC** 193709215
Castle Rock
 Project Location **T. of Castle Rock, Dakota Co., MN** Prepared by JM on 2024-08-26
 TR by ML on 2024-08-27
 IR by XX on 2024-XX-XX



- Legend**
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)**
- 45
 - 50
 - 55
 - 60
 - 65



Notes
 1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure No.

5

Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



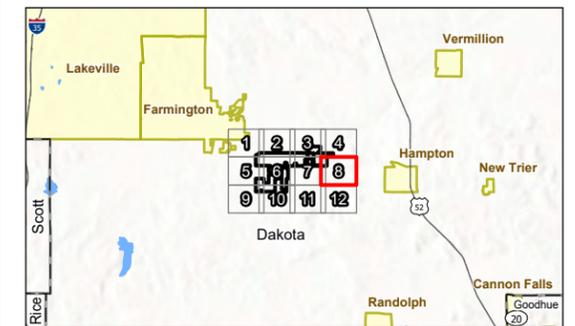
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes**
- Coordinate System: NAD 1983 UTM Zone 15N
 - Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 - Background: NAIP 2023



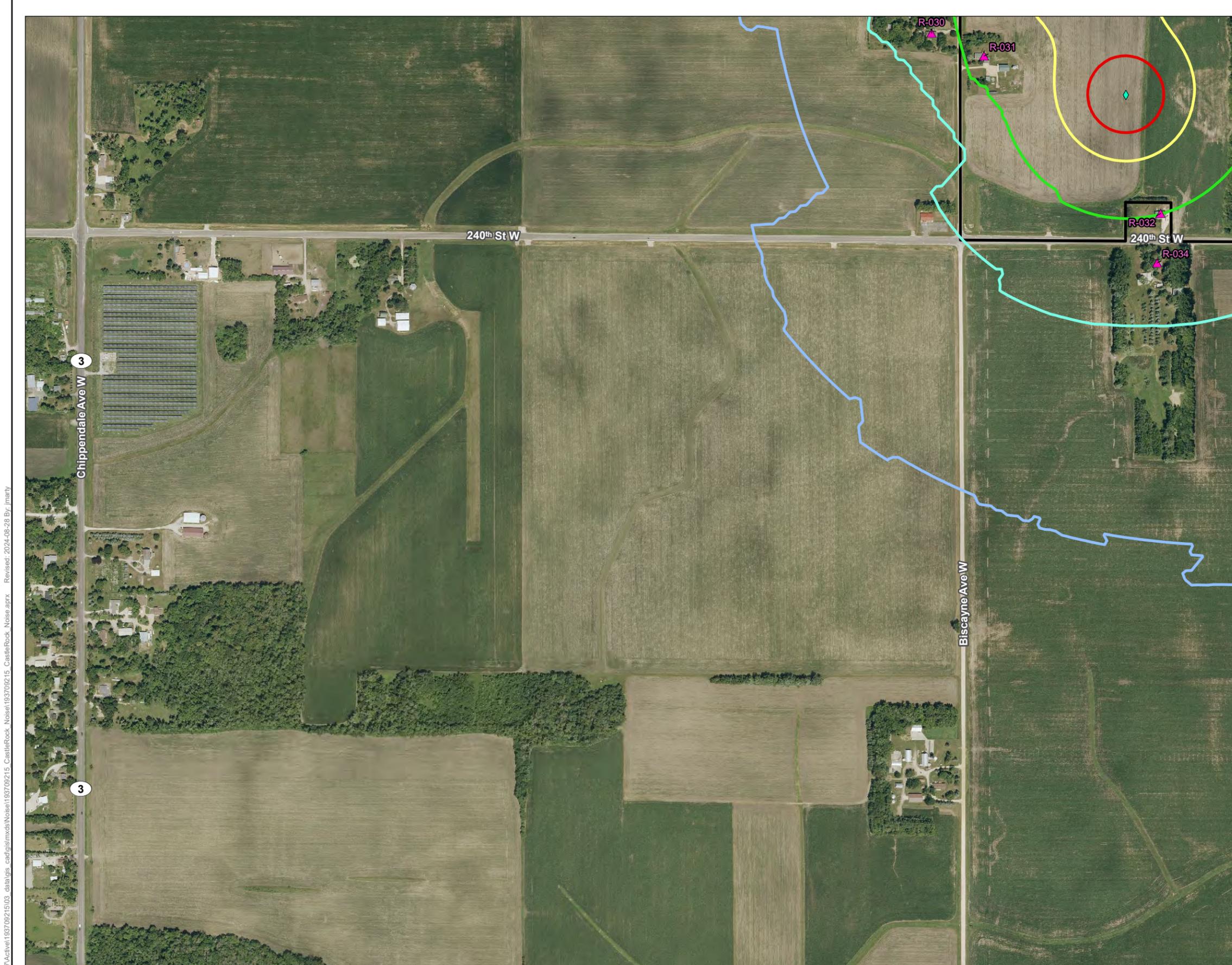


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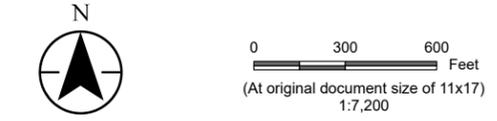
Title
**Operational Noise Results
(Alternate - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

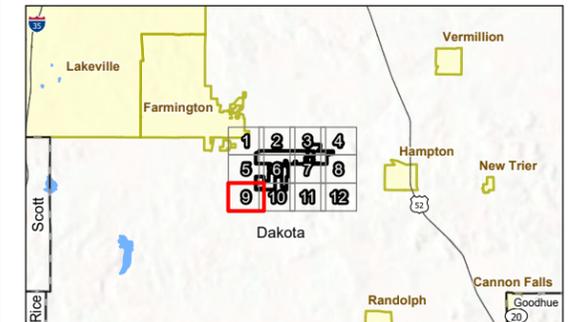
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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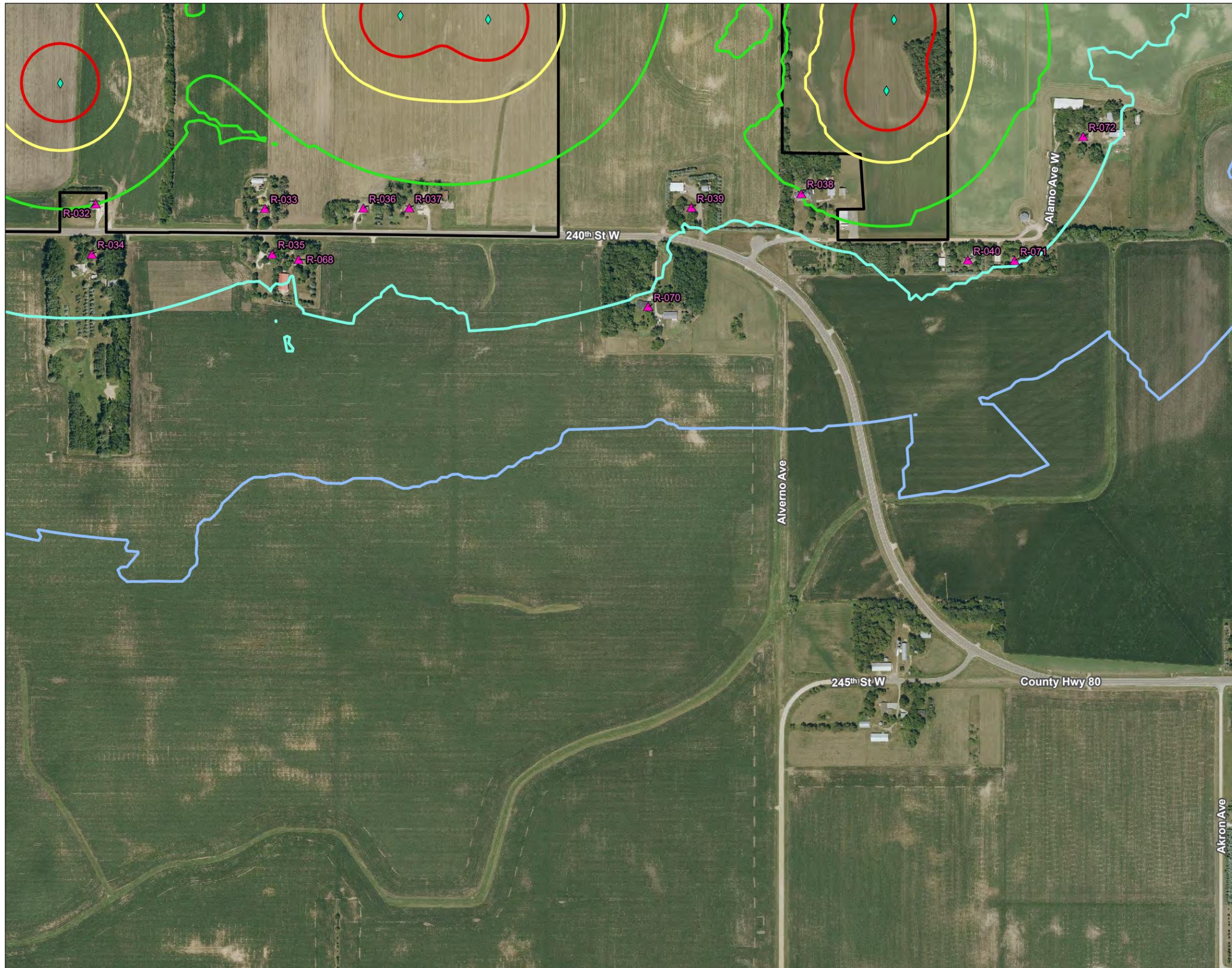


Figure No.

5

Title

**Operational Noise Results
(Alternate - Daytime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

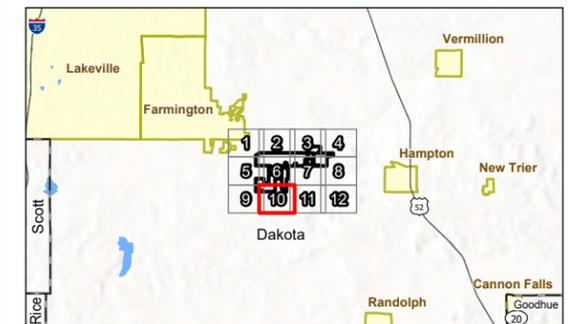
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TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



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Legend

- Project Boundary
 - Sensitive Receptor
 - Inverter
 - Substation
- Noise Contour (dBA)
- 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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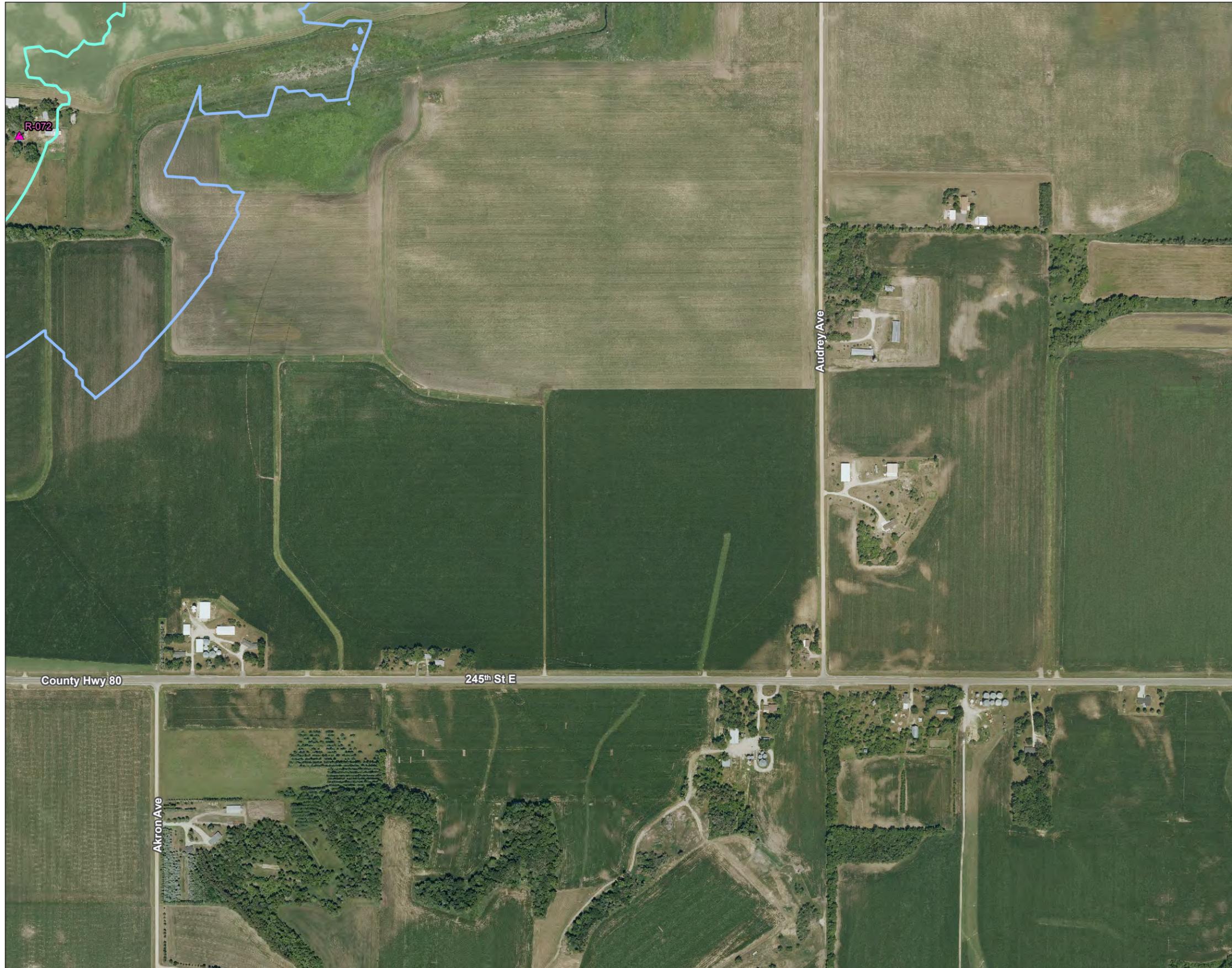


Figure No.

5

Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



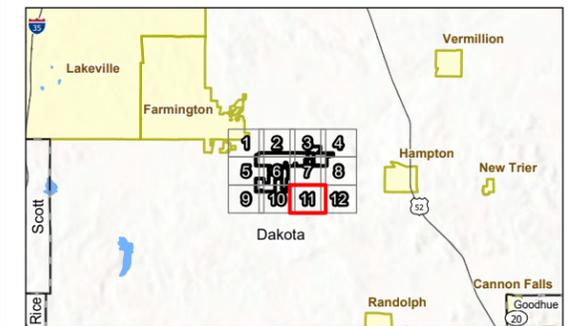
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Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure No.

5

Title

Operational Noise Results (Alternate - Daytime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



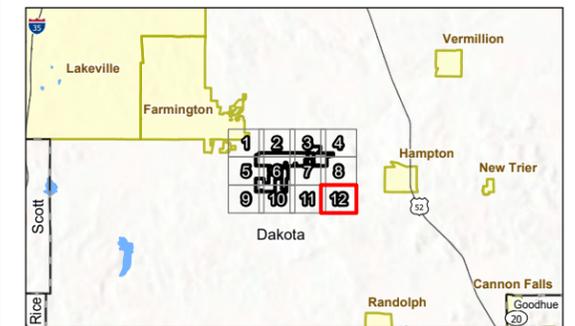
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(At original document size of 11x17)
1:7,200

Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 45
- 50
- 55
- 60
- 65



- Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



Figure 6

Nighttime Operational Noise Results – Alternate Option

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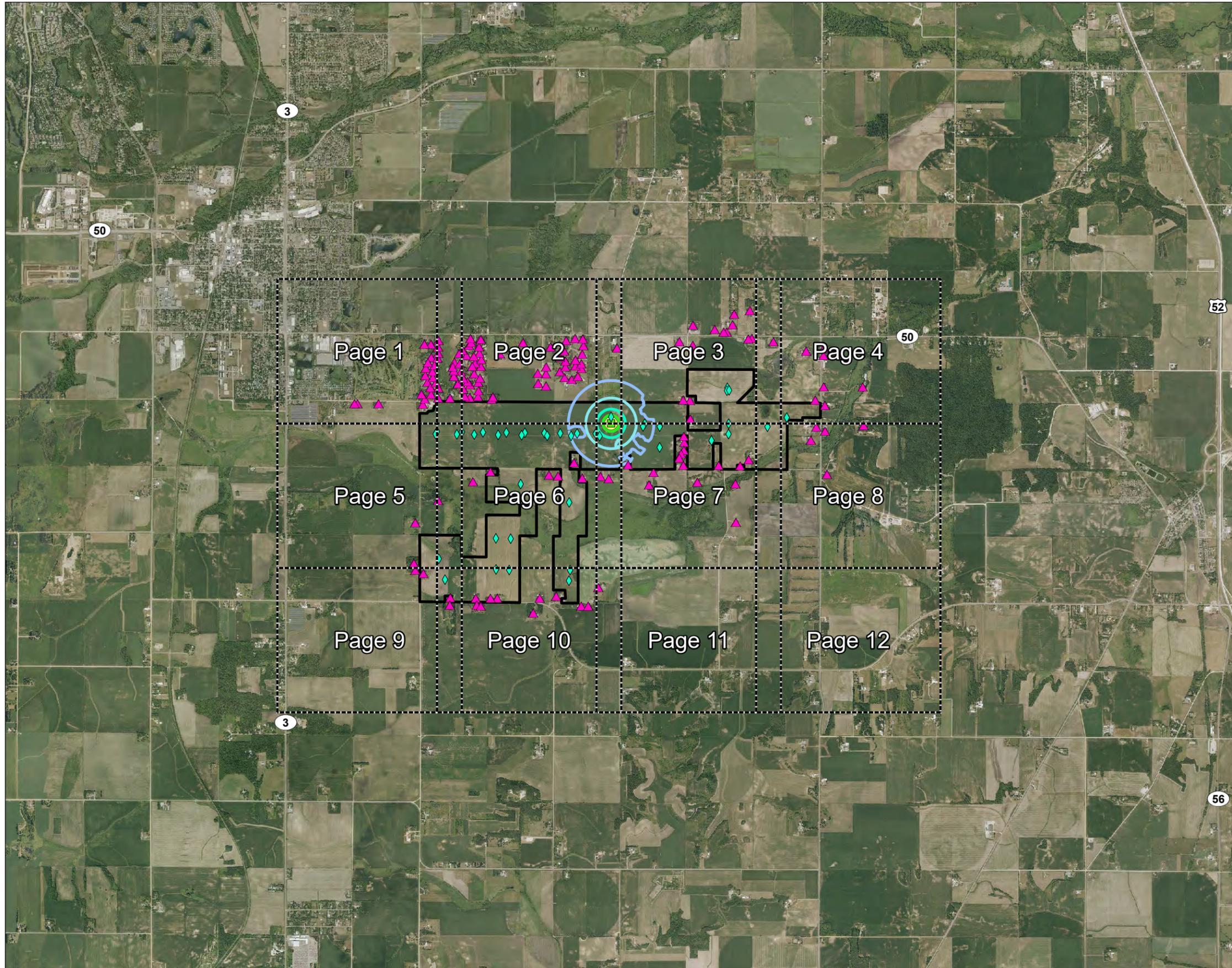


Figure No.

6

Title

Operational Noise Results (Alternate - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



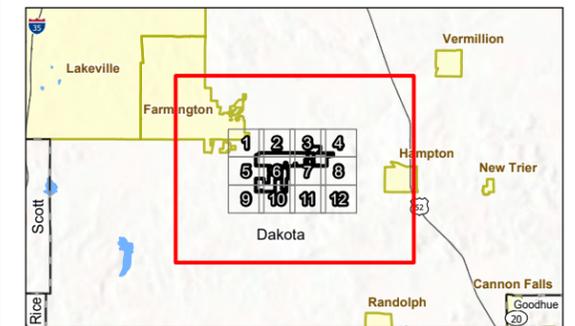
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(At original document size of 11x17)
1:48,000

Legend

- Project Boundary
- Sensitive Receptor
- Inverter
- Substation

Noise Contour (dBA)

- 35
- 40
- 45
- 50
- 55
- 60
- 65



Notes

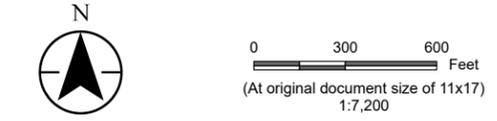
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2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



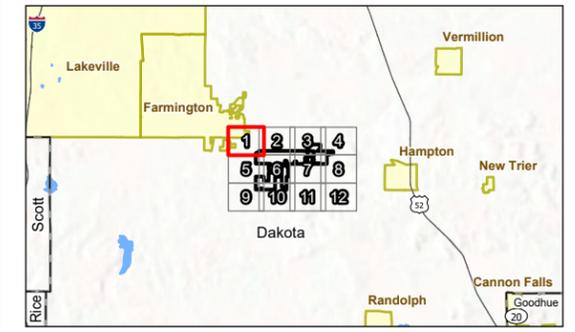
Index Map



Figure No. **6**
 Title **Operational Noise Results (Alternate - Nighttime)**
 Client/Project Matrix Renewables USA LLC 193709215
 Castle Rock
 Project Location T. of Castle Rock, Dakota Co., MN
 Prepared by JM on 2024-08-26
 TR by ML on 2024-08-27
 IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - Sensitive Receptor
 - Inverter
 - Substation
- Noise Contour (dBA)
- 35
 - 40
 - 45
 - 50
 - 55
 - 60
 - 65



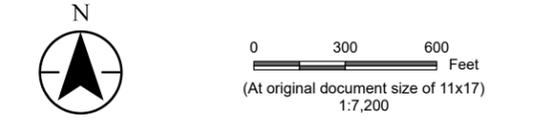
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 1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



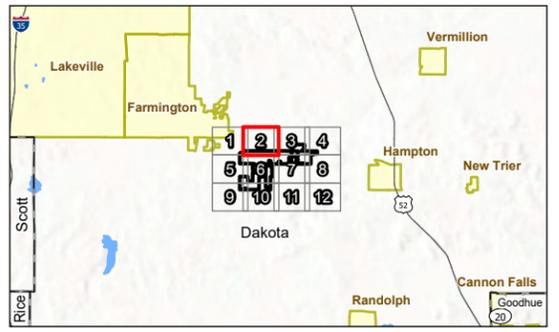
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Figure No. **6**
 Title **Operational Noise Results (Alternate - Nighttime)**
 Client/Project Matrix Renewables USA LLC 193709215
 Castle Rock
 Project Location T. of Castle Rock, Dakota Co., MN Prepared by JM on 2024-08-26, TR by ML on 2024-08-27, IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 35
 - 40
 - 45
 - 50
 - 55
 - 60
 - 65



Notes
 1. Coordinate System: NAD 1983 UTM Zone 15N
 2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
 3. Background: NAIP 2023



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Figure No.
6

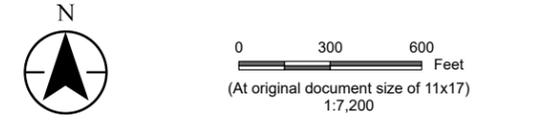
Title
**Operational Noise Results
(Alternate - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

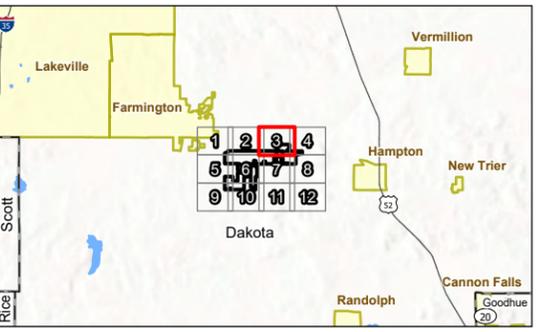
193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
TR by ML on 2024-08-27
IR by XX on 2024-XX-XX



- Legend
- Project Boundary
 - ▲ Sensitive Receptor
 - ◆ Inverter
 - Substation
- Noise Contour (dBA)
- 35
 - 40
 - 45
 - 50
 - 55
 - 60
 - 65



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Stantec, Matrix Renewables USA, NADS, Dakota Co., USGS
3. Background: NAIP 2023



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Figure No.

6

Title

**Operational Noise Results
(Alternate - Nighttime)**

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
T. of Castle Rock
Dakota Co., MN

Prepared by JM on 2024-08-26
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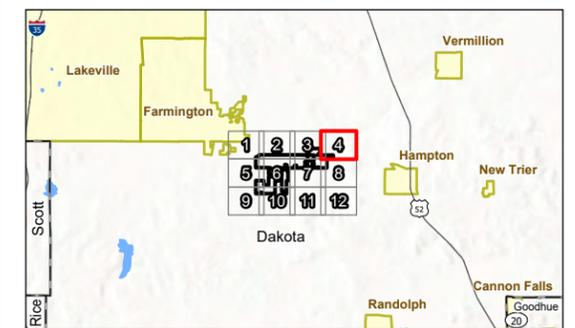
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Legend

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- Inverter
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Noise Contour (dBA)

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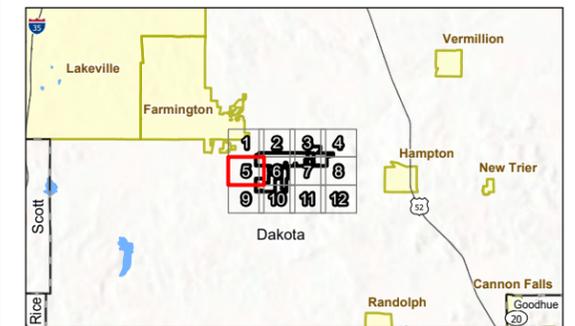
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Noise Contour (dBA)

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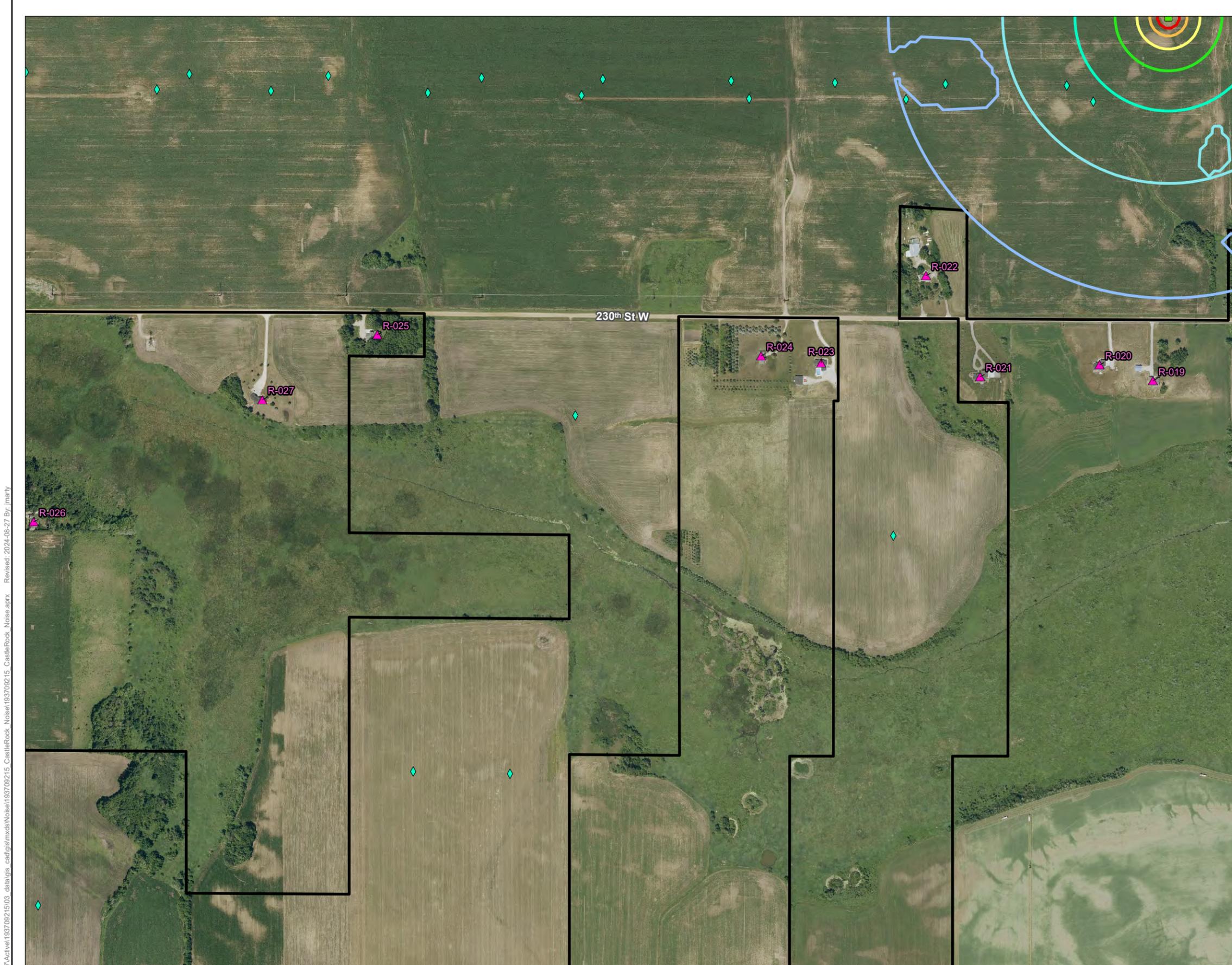


Figure No.

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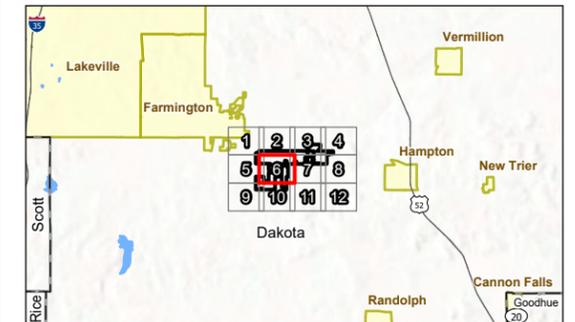
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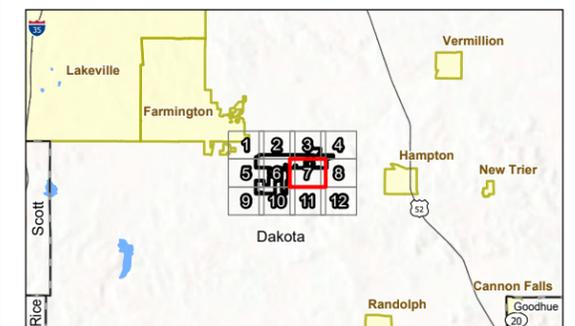
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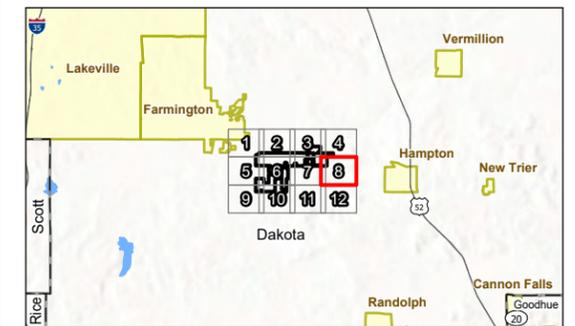
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Figure No.

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Title

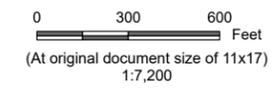
Operational Noise Results (Alternate - Nighttime)

Client/Project
Matrix Renewables USA LLC
Castle Rock

193709215

Project Location
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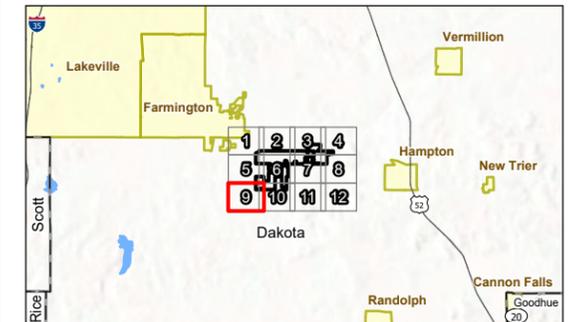


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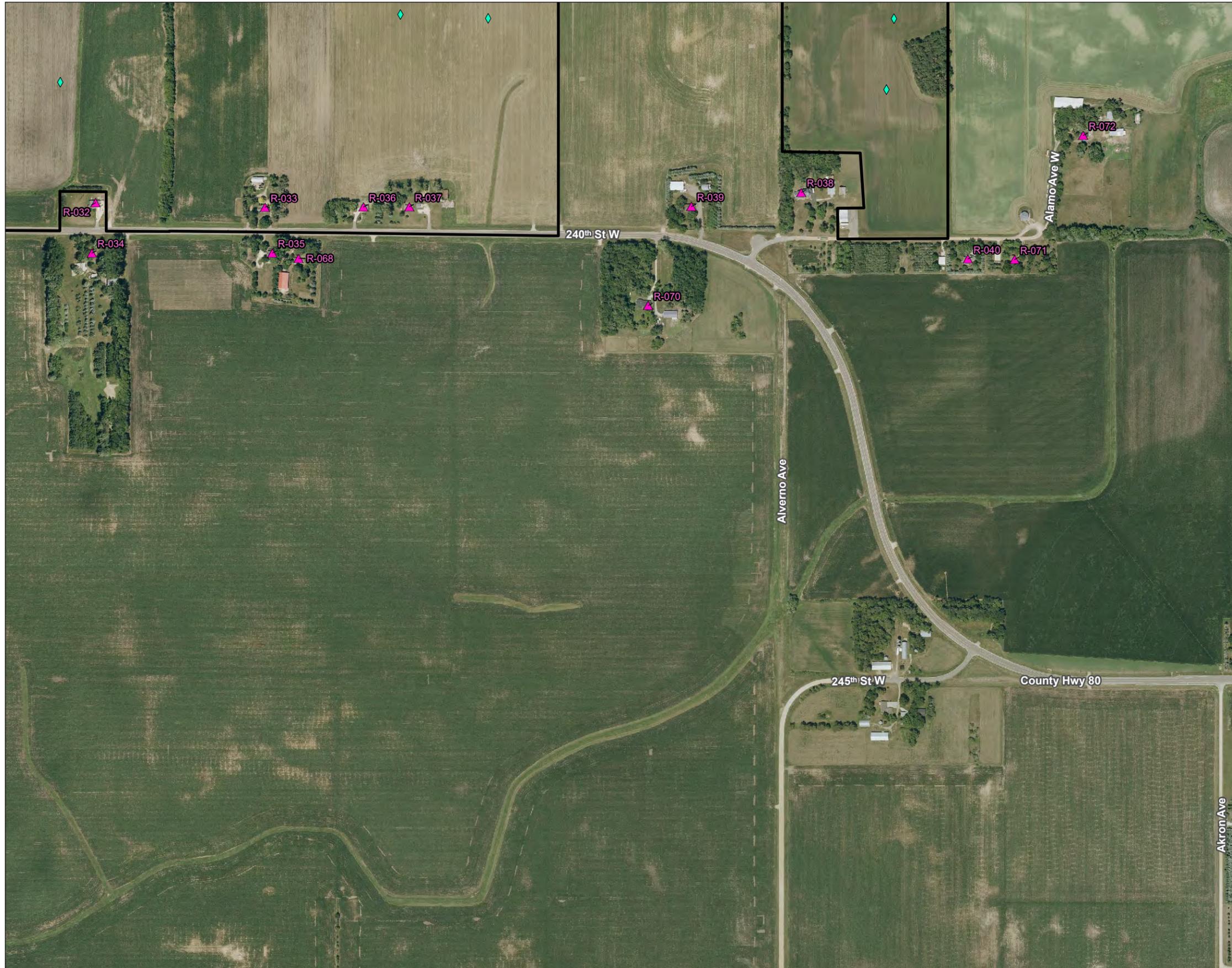


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Client/Project
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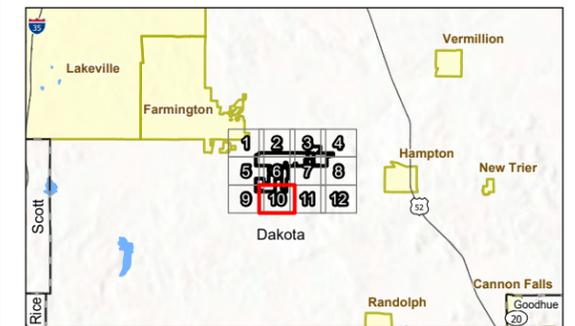
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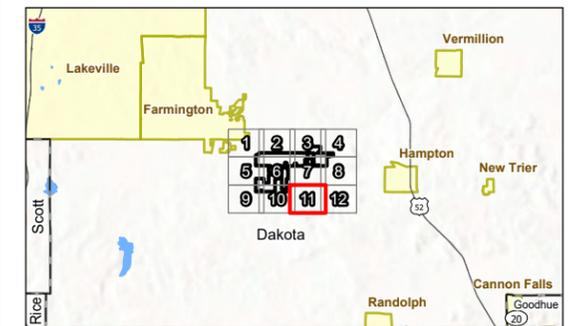
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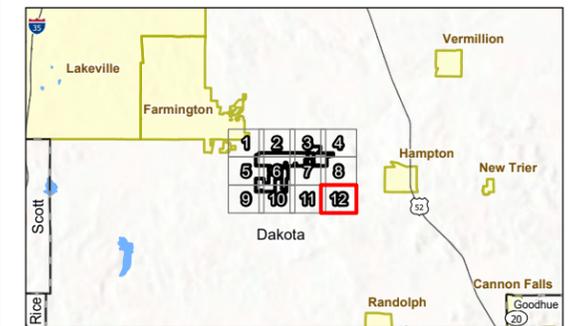
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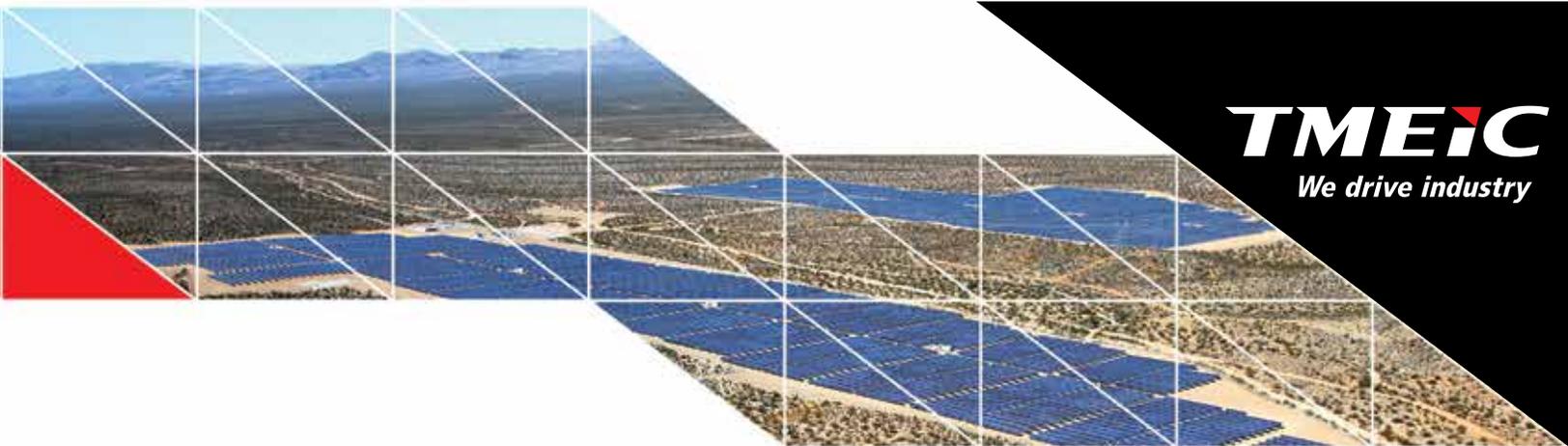


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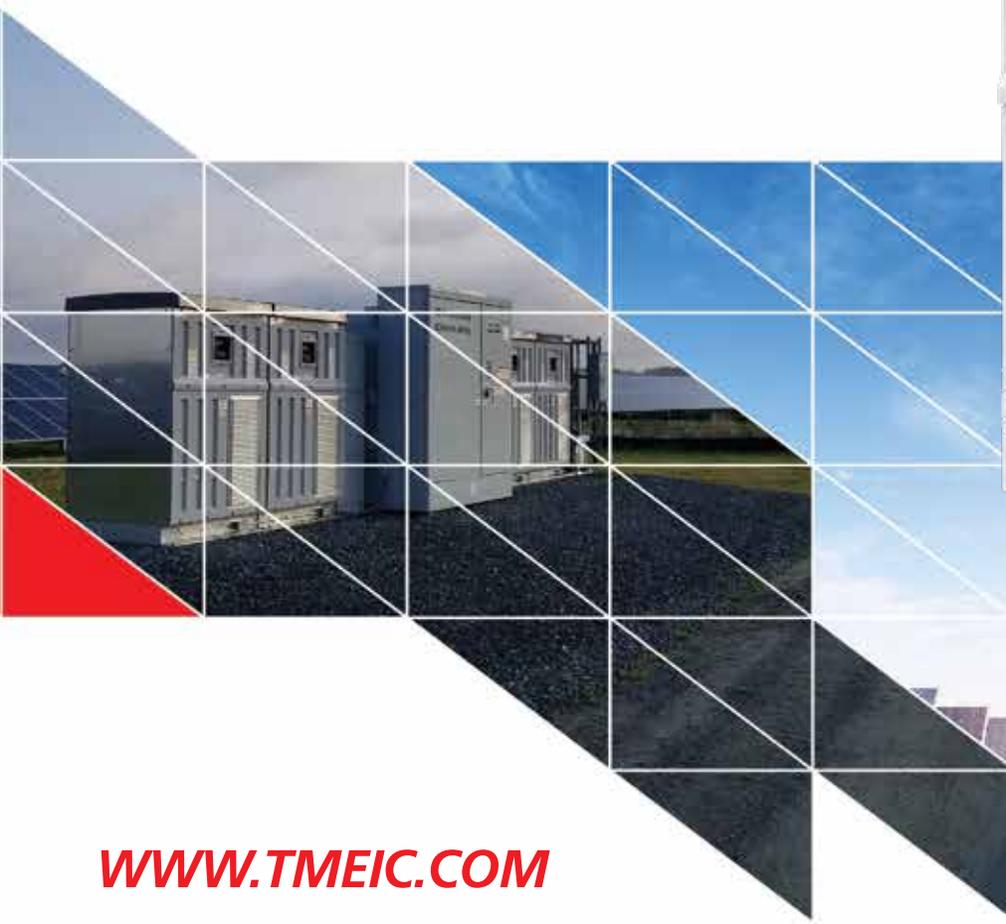
Appendix A
Equipment Specifications



TMEiC
We drive industry

Solar Ware Ninja™

PV and Energy Storage Solutions



WWW.TMEIC.COM

JAPAN | NORTH AMERICA | SOUTH AMERICA | EUROPE | SOUTHEAST ASIA | INDIA | CHINA | MIDDLE EAST | AUSTRALIA





Multiple Configurations for Maximum Flexibility

TMEIC's Solar Ware Ninja is the latest evolution of the highly successful Solar Ware family of inverters, joining over 43GW of TMEIC's globally installed photovoltaic inverters. Continuing the legacy of high efficiency, cutting-edge features, and unmatched reliability, the new Ninja modular inverter system is the culmination of input from utilities, developers, and technicians.

The Ninja is a global product, performing the duties of both generation and energy storage. The modular system introduces multiple layers of flexibility to allow designers an almost unlimited number of options for every project. The advanced controls system is packed with features to meet not only today's smart inverter requirements, but also new requirements as they are introduced. Like the award-winning Samurai series of inverters, the Ninja utilizes the same highly reliable IGBT based power conversion system.



Solar Ware Ninja™

		PV-PCS		
Type		PVU-L0800GR-2	PVU-L0840GR-2	PVU-L0880GR-2
Output side (AC)	Rated Power@25°C	800kW	840kW	880kW
	Rated Power@50°C	730kW	765kW	800kW
	Rated Voltage	600V +10%, -12%	630V +10%, -12%	660V +10%, -12%
	Rated Frequency	50Hz / 60Hz (+0.5Hz, -0.7Hz)		
	Rated Power Factor	>0.99		
	Reactive Capability	±421 kVAR	±442 kVAR	±464 kVAR
	Rated Current	702 Arms @50 °C		
	Maxium Current	770 Arms @25 °C		
	Maximum Efficiency	98.72%*		
	CEC Efficiency	98%*		
Input side (DC)	Maximum Voltage	1500 Vdc		
	MPPT Operation Range	875-1300VDC	915-1300VDC	960-1300VDC
Environ. Conditions	Ingress Protection Ratings	NEMA3R		
	Installation	Outdoor		
	Ambient Temperature Range	-25° to 50°C		
	Altitude	Full power up to 2000 meters. Consult TMEIC for altitude above 2000 meters		
Protective Functions	Input (DC) Side	DC Protection: Input Fuses (see below for available sizes), Ground Fault Detection, DC Reverse Current, Over Voltage, Over Current		
	Input Fuses	160 - 500A		
	Grid (AC) Side	AC protection and isolation: Fuse and Contactor, Anti-islanding, Over/Under Voltage, Over/Under Frequency, Over Current		
	Grid Assistance	Reactive/Active Power Control, Power Factor Control, Fault Ride Through (optional)		
Harmonic Distortion of AC Current		≤ 3% THD (at rated power)		
Communication		Modbus/TCP		
Fault Analysis		Fault Event Log, Waveform Acquisition via memory card		
Compliance		UL1741, UL1741SA / IEEE1547 / NEC2020 / IEC62109-1,2 / IEC61000-6-2,4 / IEC61727, IEC62116 / IEC61400, BDEW / IEC61683 / IEC60068		
Cooling Method		Heat Pipes and Forced Air Cooling		
Number of Inputs		Up to 6 inputs per inverter		
Standard Control Power Supply		Control Power Supply from Inverter output and Capacitor backup circuit (3 sec. compensation)		
Short Circuit Withstand Current		AC side : 65kA; DC side : 30kA		
Weight		<1000kgs		
Dimensions (H x W x D)		1991 X 1100 X 1100 mm (H x W x D)		
Floor Space		1875.5 sq. in. (1.21 m ²)		
Color		Cabinet: Munsell N7.0, Roof: Munsell N4.5		

Note: Standard configuration not limited configuration. Contact TMEIC for detailed information.

*CEC efficiency based on testing done on 840kW inverter

		ESS-PCS		
Type		BSU-L0640GR	BSU-L0800GR	BSU-L0840GR
Output side (AC)	Rated Power@25°C	640kW	800kW	840kW
	Rated Power@50°C	550kW	730kW	765kW
	Rated Voltage	480V +10%, -12%	600V +10%, -12%	630V +10%, -12%
	Rated Frequency	50Hz / 60Hz (+0.5Hz, -0.7Hz)		
	Rated Power Factor	>0.99		
	Reactive Capability	±448 kVAR	±560 kVAR	±588 kVAR
	Rated Current	702 Arms @50 °C		
	Maxium Current	770 Arms @25 °C		
	Maximum Efficiency	98.72% *		
	CEC Efficiency	98% *		
Input side (DC)	Maximum Voltage	1500 Vdc		
Environ. Conditions	Ingress Protection Ratings	NEMA3R		
	Installation	Outdoor		
	Ambient Temperature Range	-25° to 50°C		
	Altitude	Full power up to 2000 meters. Consult TMEIC for altitude above 2000 meters		
Protective Functions	Input (DC) Side	DC Protection: Input Fuses, Ground Fault Detection, DC Reverse Current, Over Voltage, Over Current		
	Input Fuses	Up to 1100A		
	Grid (AC) Side	AC protection and isolation: Fuse and Contactor, Anti-islanding, Over/Under Voltage, Over/Under Frequency, Over Current		
	Grid Assistance	Reactive/Active Power Control, Power Factor Control, Fault Ride Through (optional)		
Harmonic Distortion of AC Current		≤ 5% THD (at rated power)		
Communication		Modbus/TCP		
Fault Analysis		Fault Event Log, Waveform Acquisition via memory card		
Compliance		UL1741, UL1741SA / IEEE1547 / NEC2020 / IEC62109-1,2 / IEC61000-6-2,4 / IEC61727, IEC62116 / IEC61400, BDEW / IEC61683 / IEC60068		
Cooling Method		Heat Pipes and Forced Air Cooling		
Number of Inputs		1 per Inverter		
Standard Control Power Supply		Control Power Supply from Inverter output and Capacitor backup circuit (3 sec. compensation)		
Short Circuit Withstand Current		AC side : 65kA; DC side : 100kA		
Weight		<1000kgs		
Dimensions (H x W x D)		1991 X 1100 X 1100 mm (H x W x D)		
Floor Space		1875.5 sq. in. (1.21 m ²)		
Color		Cabinet: Munsell N7.0, Roof: Munsell N4.5		

Note: Standard configuration not limited configuration. Contact TMEIC for detailed information.

*CEC efficiency based on testing done on 840kW inverter



Customizable Block

Up to 6 Ninja units on the same skid. Able to combine PV and ESS inverters in the same lineup. A skid controller will manage output of the Ninja power station.

- Fully Modular design means:
 - Completely independent inverters for increased availability
 - Individual MPPT for greater energy yield
 - Latest generation of Smart Inverter controls platform
 - 640kW-5280kW integrated skid sizes
- DC Zone monitoring is standard
- UL or IEC certified global design
- PV or Energy Storage (bi-directional)
- Outdoor rated enclosure



TMEIC is Bankable

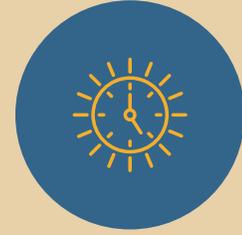
- Stable, with multi-billion \$USD revenue
- Diversified, with decades of power electronics experience in a variety of heavy industries, including metals, oil & gas, mining, and container cranes industries
- Manufacturing in the US and several other locations

TMEIC is Reliable

- Over 43GW of PV and ESS inverters globally
- Own exclusive use of Mitsubishi Electric's 3 level NPS technology
- Industry-leading fleet availability

TMEIC is Support

- Interconnect Application and Modeling Support
- 24/7 US-based hot line
- Over 30 years PV inverter manufacturing and R&D experience
- Comprehensive customer training programs
- Authorized Service Provider program available



Round The Clock

**For Service Call
877-280-1835**

**International
+1 540-283-2010**

www.tmeic.com/customer-support





▼ TMEIC Corporation Americas

Headquarters

1325 Electric Road, Suite 200
Roanoke, VA, 24018, U.S.A.

Mailing

2060 Cook Drive
Salem, VA, 24153, U.S.A.

Houston

15810 Park Ten Place, Suite 370,
Houston, TX, 77084, U.S.A.

Manufacturing

25390 Clay Road
Katy, TX, 77439, U.S.A.

▼ Customer Support and Service

+1 877-280-1835

Intl: +1 540-283-2010

www.tmeic.com/customer-support

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Appendix B
Project Equipment Locations

Castle Rock Solar Project - Noise Study
Appendix B.1 - Project Equipment Locations (Preferred)

Source ID	Coordinates (UTM 15N)			Height above ground
	X	Y	Z (ground)	
	m	m	m	m
SS-01	491,960	4,940,528	288	3.0
I-01	490,970	4,940,742	286	2.0
I-02	491,272	4,940,739	282	2.0
I-03	491,528	4,940,736	286	2.0
I-04	491,810	4,940,732	287	2.0
I-05	492,033	4,940,729	286	2.0
I-06	492,270	4,940,726	287	2.0
I-07	492,520	4,940,723	288	2.0
I-08	492,743	4,940,721	287	2.0
I-09	493,039	4,940,717	288	2.0
I-10	493,066	4,940,717	288	2.0
I-11	493,051	4,940,688	287	2.0
I-12	492,756	4,940,692	287	2.0
I-13	492,383	4,940,694	288	2.0
I-14	492,217	4,940,698	287	2.0
I-15	491,711	4,940,704	285	2.0
I-16	491,422	4,940,708	288	2.0
I-17	491,212	4,940,710	286	2.0
I-18	490,956	4,940,714	285	2.0
I-19	491,983	4,940,111	276	2.0
I-20	492,569	4,939,890	279	2.0
I-21	491,684	4,939,457	280	2.0
I-22	491,862	4,939,452	278	2.0
I-23	491,685	4,939,082	281	2.0
I-24	491,844	4,939,075	280	2.0
I-25	492,580	4,939,074	280	2.0
I-26	492,566	4,938,946	282	2.0
I-27	490,993	4,939,210	281	2.0
I-28	491,069	4,938,960	281	2.0
I-29	493,482	4,940,839	290	2.0
I-30	493,461	4,940,806	290	2.0
I-31	493,663	4,940,804	290	2.0
I-32	493,662	4,940,553	283	2.0
I-33	494,965	4,940,802	275	2.0
I-34	495,198	4,940,913	275	2.0
I-35	494,480	4,941,272	273	2.0
I-36	494,475	4,941,237	272	2.0
I-37	494,501	4,941,241	272	2.0
I-38	494,496	4,940,839	276	2.0
I-39	494,289	4,940,637	283	2.0
I-40	494,494	4,940,714	278	2.0

Notes: SS = Substation Transformer
I = Inverter

Castle Rock Solar Project - Noise Study
Appendix B.2 - Project Equipment Locations (Alternate)

Source ID	Coordinates (UTM 15N)			Height above ground
	X	Y	Z (ground)	
	m	m	m	m
SS-01 B	493,075	4,940,843	292	3.0
I-01	490,970	4,940,742	286	2.0
I-02	491,272	4,940,739	282	2.0
I-03	491,528	4,940,736	286	2.0
I-04	491,810	4,940,732	287	2.0
I-05	492,033	4,940,729	286	2.0
I-06	492,270	4,940,726	287	2.0
I-07 B	493,076	4,940,920	286	2.0
I-08 B	492,937	4,940,688	286	2.0
I-09 B	492,888	4,940,718	288	2.0
I-10 B	492,665	4,940,720	286	2.0
I-11 B	492,592	4,940,692	286	2.0
I-12 B	492,461	4,940,723	288	2.0
I-13 B	492,303	4,940,694	288	2.0
I-14 B	491,994	4,940,700	287	2.0
I-15	491,711	4,940,704	285	2.0
I-16	491,422	4,940,708	288	2.0
I-17	491,212	4,940,710	286	2.0
I-18	490,956	4,940,714	285	2.0
I-19	491,983	4,940,111	276	2.0
I-20	492,569	4,939,890	279	2.0
I-21	491,684	4,939,457	280	2.0
I-22	491,862	4,939,452	278	2.0
I-23	491,685	4,939,082	281	2.0
I-24	491,844	4,939,075	280	2.0
I-25	492,580	4,939,074	280	2.0
I-26	492,566	4,938,946	282	2.0
I-27	490,993	4,939,210	281	2.0
I-28	491,069	4,938,960	281	2.0
I-29	493,482	4,940,839	290	2.0
I-30	493,461	4,940,806	290	2.0
I-31	493,663	4,940,804	290	2.0
I-32	493,662	4,940,553	283	2.0
I-33	494,965	4,940,802	275	2.0
I-34	495,198	4,940,913	275	2.0
I-35	494,480	4,941,272	273	2.0
I-36	494,475	4,941,237	272	2.0
I-37	494,501	4,941,241	272	2.0
I-38	494,496	4,940,839	276	2.0
I-39	494,289	4,940,637	283	2.0
I-40	494,494	4,940,714	278	2.0

Notes: SS = Substation Transformer
I = Inverter

Appendix C

Receptor Locations and Operational Noise Results

Castle Rock Solar Project - Noise Study
Appendix C - Project Operational Noise Modeling Results

Receptor ID	Coordinates (UTM 15N)			Height above ground	Estimated Project Operational Noise Level Preferred		Estimated Project Operational Noise Level Alternate		Project Operational Noise Limit	
	X	Y	Z (ground)		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
	m	m	m		m	dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA
R-001	495,644	4,941,284	272	1.5	47	8	47	17	60	50
R-002	495,543	4,941,120	274	1.5	51	8	51	17	60	50
R-003	496,117	4,941,281	270	1.5	40	6	40	10	60	50
R-004	495,659	4,941,057	274	1.5	49	8	49	17	60	50
R-005	496,127	4,940,815	276	1.5	44	6	44	14	60	50
R-007	495,489	4,940,638	275	1.5	51	8	51	13	60	50
R-008	494,738	4,940,405	278	1.5	54	12	54	18	60	50
R-009	494,635	4,940,331	274	1.5	50	12	50	18	60	50
R-010	494,377	4,940,335	278	1.5	51	13	51	20	60	50
R-011	494,119	4,940,135	275	1.5	49	15	49	21	60	50
R-012	493,589	4,940,252	286	1.5	54	18	53	31	60	50
R-013	493,950	4,940,336	279	1.5	49	16	49	24	60	50
R-014	493,921	4,940,477	288	1.5	56	16	56	29	60	50
R-015	493,956	4,940,518	288	1.5	56	16	56	29	60	50
R-016	493,959	4,940,614	286	1.5	57	16	57	25	60	50
R-017	493,955	4,940,688	285	1.5	56	16	56	25	60	50
R-018	493,281	4,940,343	282	1.5	55	21	53	35	60	50
R-019	493,047	4,940,175	282	1.5	54	22	53	32	60	50
R-020	492,949	4,940,204	282	1.5	54	23	53	33	60	50
R-021	492,728	4,940,182	280	1.5	55	26	54	31	60	50
R-022	492,629	4,940,368	288	1.5	57	28	56	33	60	50
R-023	492,436	4,940,208	288	1.5	55	34	55	29	60	50
R-024	492,325	4,940,221	287	1.5	55	36	55	28	60	50
R-025	491,618	4,940,260	280	1.5	55	37	55	19	60	50
R-026	490,985	4,939,916	280	1.5	50	27	50	14	60	50
R-027	491,406	4,940,140	280	1.5	54	32	54	17	60	50
R-028	490,711	4,939,646	284	1.5	50	23	50	12	60	50
R-029	490,694	4,939,155	290	1.5	54	21	54	15	60	50
R-030	490,711	4,939,073	290	1.5	54	21	54	15	60	50
R-031	490,808	4,939,031	288	1.5	56	21	56	15	60	50
R-032	491,133	4,938,742	284	1.5	55	16	55	11	60	50
R-033	491,440	4,938,733	290	1.5	53	21	53	16	60	50
R-034	491,127	4,938,651	286	1.5	52	15	53	15	60	50
R-035	491,454	4,938,651	290	1.5	52	20	52	16	60	50
R-036	491,619	4,938,734	287	1.5	54	21	54	17	60	50
R-037	491,702	4,938,734	286	1.5	54	21	54	17	60	50
R-038	492,412	4,938,760	288	1.5	55	21	55	19	60	50
R-039	492,213	4,938,735	290	1.5	51	21	51	18	60	50
R-040	492,714	4,938,640	282	1.5	52	20	52	19	60	50
R-041	490,802	4,941,074	284	1.5	54	25	54	18	60	50
R-042	490,901	4,941,192	282	1.5	52	26	52	19	60	50
R-043	490,988	4,941,145	281	1.5	53	27	53	19	60	50
R-044	491,130	4,941,145	278	1.5	54	23	54	20	60	50
R-045	491,310	4,941,170	279	1.5	55	25	55	17	60	50
R-046	491,369	4,941,152	280	1.5	56	25	56	22	60	50
R-047	491,468	4,941,165	282	1.5	56	26	56	22	60	50
R-048	491,634	4,941,132	282	1.5	56	28	56	24	60	50
R-049	492,514	4,941,395	282	1.5	53	24	53	31	60	50
R-050	492,601	4,941,373	282	1.5	53	23	53	32	60	50
R-051	493,946	4,941,124	288	1.5	54	15	54	29	60	50
R-052	494,029	4,941,119	286	1.5	55	15	55	28	60	50
R-053	494,034	4,940,896	284	1.5	56	15	56	29	60	50

Castle Rock Solar Project - Noise Study
Appendix C - Project Operational Noise Modeling Results

Receptor ID	Coordinates (UTM 15N)			Height above ground	Estimated Project Operational Noise Level Preferred		Estimated Project Operational Noise Level Alternate		Project Operational Noise Limit	
	X	Y	Z (ground)		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
	m	m	m		dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA	dBA
R-054	494,777	4,941,867	276	1.5	48	10	48	20	60	50
R-056	490,785	4,941,193	284	1.5	53	25	53	18	60	50
R-057	490,824	4,941,137	283	1.5	54	25	54	18	60	50
R-058	491,649	4,941,160	282	1.5	56	28	56	24	60	50
R-062	493,900	4,940,422	287	1.5	55	16	55	29	60	50
R-064	495,554	4,940,797	276	1.5	52	8	52	17	60	50
R-065	495,660	4,940,750	274	1.5	46	8	46	13	60	50
R-068	491,501	4,938,641	290	1.5	51	20	51	16	60	50
R-070	492,134	4,938,556	290	1.5	50	20	50	17	60	50
R-071	492,799	4,938,639	281	1.5	51	20	51	19	60	50
R-072	492,923	4,938,863	280	1.5	52	20	51	20	60	50
R-074	495,685	4,940,230	272	1.5	45	8	45	12	60	50
R-077	495,642	4,941,662	276	1.5	44	7	44	16	60	50
R-079	495,644	4,941,745	273	1.5	42	7	42	12	60	50
R-080	495,434	4,941,713	276	1.5	46	8	46	13	60	50
R-081	494,735	4,941,860	275	1.5	47	10	47	20	60	50
R-082	495,036	4,941,827	275	1.5	46	9	46	19	60	50
R-084	494,064	4,941,786	278	1.5	49	13	49	25	60	50
R-085	493,901	4,941,824	280	1.5	49	14	49	25	60	50
R-086	494,473	4,941,941	280	1.5	48	11	48	21	60	50
R-087	494,436	4,941,943	280	1.5	48	11	48	22	60	50
R-088	494,543	4,942,030	276	1.5	45	11	45	17	60	50
R-089	494,328	4,941,977	280	1.5	47	12	47	22	60	50
R-090	494,563	4,942,160	278	1.5	45	10	45	20	60	50
R-091	494,754	4,942,199	278	1.5	44	10	44	19	60	50
R-092	494,065	4,942,027	282	1.5	47	13	47	23	60	50
R-093	493,146	4,941,751	282	1.5	48	18	48	29	60	50
R-094	492,727	4,941,676	282	1.5	49	20	50	29	60	50
R-095	492,742	4,941,778	281	1.5	48	24	49	28	60	50
R-096	492,642	4,941,864	281	1.5	48	24	48	27	60	50
R-097	492,735	4,941,862	278	1.5	45	19	45	27	60	50
R-098	492,533	4,941,839	281	1.5	48	24	48	27	60	50
R-099	492,509	4,941,715	282	1.5	49	25	50	28	60	50
R-100	492,645	4,941,608	282	1.5	50	21	50	30	60	50
R-101	492,525	4,941,595	282	1.5	50	26	51	29	60	50
R-102	492,460	4,941,640	282	1.5	50	26	50	28	60	50
R-103	492,344	4,941,764	282	1.5	49	25	49	26	60	50
R-104	492,013	4,941,817	274	1.5	45	21	45	24	60	50
R-105	491,735	4,941,681	280	1.5	49	26	50	23	60	50
R-106	492,717	4,941,558	282	1.5	50	21	51	31	60	50
R-107	492,645	4,941,535	282	1.5	51	22	51	30	60	50
R-108	492,716	4,941,505	282	1.5	51	21	51	31	60	50
R-109	492,674	4,941,408	282	1.5	52	22	52	32	60	50
R-110	492,457	4,941,467	282	1.5	52	27	52	30	60	50
R-111	492,525	4,941,524	282	1.5	51	27	51	30	60	50
R-112	492,291	4,941,524	281	1.5	51	28	51	28	60	50
R-113	492,290	4,941,439	282	1.5	52	28	52	28	60	50
R-114	492,290	4,941,293	282	1.5	54	30	54	29	60	50
R-115	492,195	4,941,325	282	1.5	53	30	54	28	60	50
R-116	492,191	4,941,445	282	1.5	52	29	52	27	60	50
R-117	491,475	4,941,237	282	1.5	54	25	55	22	60	50
R-118	491,373	4,941,309	282	1.5	53	24	54	22	60	50

Castle Rock Solar Project - Noise Study
Appendix C - Project Operational Noise Modeling Results

Receptor ID	Coordinates (UTM 15N)			Height above ground	Estimated Project Operational Noise Level Preferred		Estimated Project Operational Noise Level Alternate		Project Operational Noise Limit	
	X	Y	Z (ground)		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
	m	m	m		m	dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA L _{eq}	dBA
R-119	491,290	4,941,258	280	1.5	53	24	54	17	60	50
R-120	491,225	4,941,319	278	1.5	52	23	52	16	60	50
R-121	491,342	4,941,343	282	1.5	53	24	53	21	60	50
R-122	491,473	4,941,338	282	1.5	53	24	53	22	60	50
R-123	491,289	4,941,383	280	1.5	52	23	52	21	60	50
R-124	491,491	4,941,388	282	1.5	53	24	53	22	60	50
R-125	491,422	4,941,439	282	1.5	52	23	52	22	60	50
R-126	491,176	4,941,409	276	1.5	50	22	50	16	60	50
R-127	491,504	4,941,529	282	1.5	51	23	51	22	60	50
R-128	491,434	4,941,570	281	1.5	50	22	51	21	60	50
R-129	491,397	4,941,531	280	1.5	48	22	48	21	60	50
R-130	491,263	4,941,466	280	1.5	51	22	51	21	60	50
R-131	491,247	4,941,560	276	1.5	47	21	47	16	60	50
R-132	491,182	4,941,578	276	1.5	48	21	48	16	60	50
R-133	491,176	4,941,476	277	1.5	50	22	50	16	60	50
R-134	491,164	4,941,522	275	1.5	48	21	48	16	60	50
R-135	491,508	4,941,614	282	1.5	50	22	50	22	60	50
R-136	491,418	4,941,650	279	1.5	48	21	48	17	60	50
R-137	491,328	4,941,660	280	1.5	49	21	49	20	60	50
R-138	491,485	4,941,690	280	1.5	48	21	49	21	60	50
R-139	491,481	4,941,766	276	1.5	45	21	45	17	60	50
R-140	491,240	4,941,682	275	1.5	46	20	46	16	60	50
R-141	491,282	4,941,726	276	1.5	46	20	46	16	60	50
R-142	491,361	4,941,783	274	1.5	45	20	45	16	60	50
R-143	491,387	4,941,816	274	1.5	45	20	45	16	60	50
R-144	491,502	4,941,855	274	1.5	44	20	45	17	60	50
R-145	491,377	4,941,865	274	1.5	44	20	44	16	60	50
R-146	490,992	4,941,843	274	1.5	45	18	45	14	60	50
R-147	490,899	4,941,796	275	1.5	46	18	46	14	60	50
R-148	490,986	4,941,763	274	1.5	46	19	46	14	60	50
R-149	490,821	4,941,797	274	1.5	43	18	43	13	60	50
R-150	490,988	4,941,689	276	1.5	47	19	47	14	60	50
R-151	490,904	4,941,638	280	1.5	48	19	48	18	60	50
R-152	490,980	4,941,629	276	1.5	47	19	47	14	60	50
R-153	490,940	4,941,545	277	1.5	48	20	49	19	60	50
R-154	490,862	4,941,576	280	1.5	48	19	48	18	60	50
R-155	490,838	4,941,509	282	1.5	49	19	49	18	60	50
R-156	490,918	4,941,467	277	1.5	49	20	49	19	60	50
R-157	490,830	4,941,418	281	1.5	49	24	49	18	60	50
R-158	490,922	4,941,393	278	1.5	49	20	49	19	60	50
R-159	490,856	4,941,340	282	1.5	51	25	51	18	60	50
R-160	490,959	4,941,334	277	1.5	50	21	50	19	60	50
R-161	490,893	4,941,272	280	1.5	51	25	51	19	60	50
R-162	490,990	4,941,271	278	1.5	51	22	51	19	60	50
R-163	490,265	4,941,080	284	1.5	47	21	47	15	60	50
R-164	490,012	4,941,081	284	1.5	45	16	45	14	60	50
R-165	489,976	4,941,080	284	1.5	44	15	45	14	60	50
R-166	493,533	4,940,101	284	1.5	52	18	51	30	60	50
R-167	494,584	4,939,651	274	1.5	45	12	45	16	60	50
R-168	494,578	4,940,111	272	1.5	49	12	49	18	60	50

Notes: R = Sensitive Receptor Location