APPENDIX D – REVISED PRE-CONSTRUCTION WIND TURBINE NOISE ANALYSIS

Pre-Construction Wind Turbine Noise Analysis

for the proposed

Deuel Harvest North Wind Farm

January 2019

Prepared for:

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1. Introduction

This report describes a pre-construction noise analysis conducted by Hankard Environmental for the proposed Deuel Harvest North Wind Farm (the Project) in support of its Energy Facility Permit. Deuel Harvest Wind Energy LLC (Deuel Harvest, the Applicant), an affiliate of Invenergy LLC (Invenergy), is developing the up to 310.1 megawatt (MW) Project to be located in Deuel County, South Dakota. Deuel Harvest intends to construct and operate the Project, which is located in the townships of Portland, Lowe, Altamont, Glenwood, Clear Lake, and Herrick. Figure 1-1 shows the general location of the Project, which is bordered by 166th Street to the north, State Line Road to the east, County Highway 309 to the south, and County Highway 443 to the west.

This report assesses potential sound levels of the Project and confirms compliance with the Zoning Ordinance of Deuel County, Section 1215: Wind Energy System (WES) Requirement of 45 dBA at non-participating residences. Our analysis confirmed that sound levels will not exceed 44.9 dBA at non-participating residences. Described herein are the applicable noise standard, the Project and its environs, the methods and data used to model noise levels, the results of the noise level predictions, and demonstration of compliance with the Zoning Ordinance.

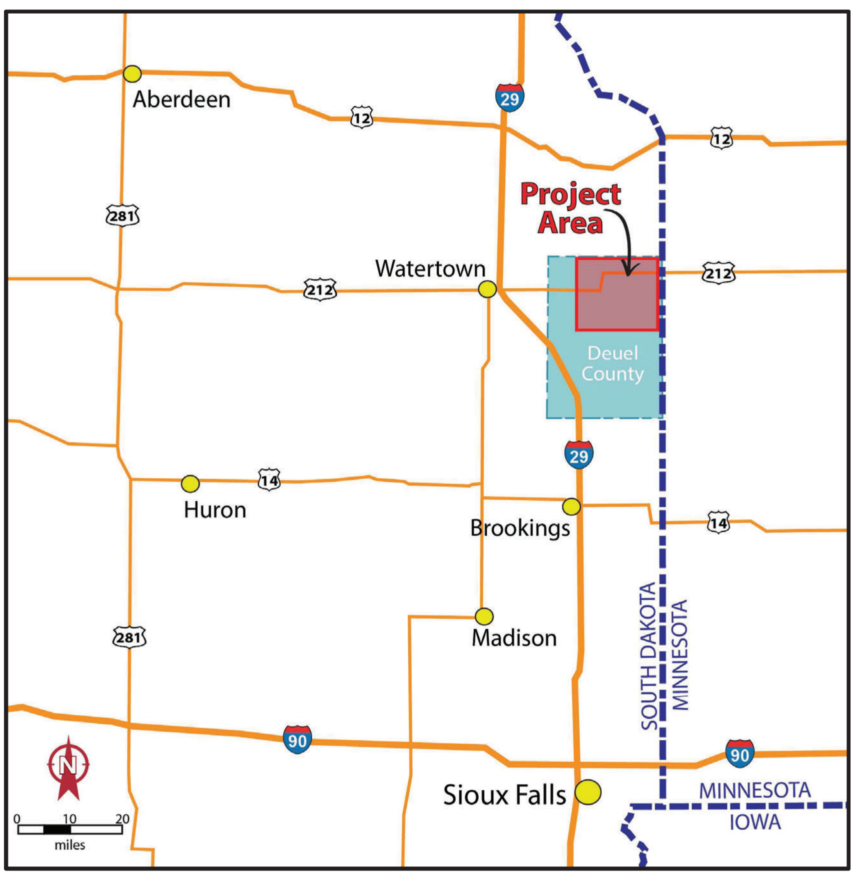


Figure 1-1. General Location of the Proposed Deuel Harvest North Wind Farm

2. Applicable Noise Standards

On May 23, 2017, the Board of County Commissioners passed Ordinance 82004-01-23B, which amended the Deuel County Zoning Ordinance, Section 1215.03: General Provisions, Paragraph 13: Noise & Shadow Flicker, Subparagraph a to read:

> *a. Noise level shall not exceed 45 dBA average A-Weighted Sound pressure at the perimeter of existing residences, for non-participating residences.*

This amendment became effective on June 20, 2017. This is the only numerical noise limit applicable to wind energy systems in Deuel County, South Dakota. There are no other *numerical* local, state or federal noise limits applicable to the Project.

There is one other noise-related requirement at the state level: South Dakota Administrative Rule 20:10:22:33.02 requires that an application for an Energy Facility Permit include "Anticipated noise levels during construction and operation." The noise levels reported herein are those expected during operation. Construction noise levels will be typical of those produced by standard construction equipment.

3. Project Description

The Project is located in a predominantly agricultural area of central-eastern South Dakota; wind turbines and associated facilities are thus sited primarily on agricultural lands. The Project will consist of up to 112 wind turbines generating up to 300 MW of electrical power with a nameplate capacity of 310.1 MW. Associated facilities include graveled roads to access each turbine and below-surface electrical cabling to collect and transmit the power to a project substation. Deuel Harvest is proposing one layout for the Project, which is approximately 42,000 acres in size, and was selected based upon review and analysis of wind resources, economic considerations, landowner interest, availability of easements, access to transmission routes, interconnection of the Project to existing transmission facilities and lines, geographic features, and environmental resources. The Project is located in an area with a strong wind resource and is situated near existing electric transmission infrastructure.

Table 3-1 lists the two turbine types that were analyzed for noise compliance. The layout analyzed includes 111 units of General Electric (GE) model 2.82-127 wind turbines and 13 units of GE 2.3-116 wind turbines, all fitted with Low Noise Trailing Edge (LNTE) blades. Note that while the sound modeling included 124 turbines, only up to 112 turbines will be installed: 10 of the GE 2.82-127 wind turbines included in the noise analysis are alternates, and two of the GE 2.3-116 wind turbines included in the noise analysis are alternates. The layout is shown graphically in the figures in Appendix A. Also shown in the figures are the locations of all 122 non-participating and 109 participating residences within two miles of any turbine or the 34.5 kV to 345 kV transformer. The geographic coordinates of each modeled receptor and each Project noise source (turbines and transformers) are provided in Appendix B and C, respectively.

Table 3-1. Project's Wind Turbine Noise Sources

Turbines					Transformers	
Model	Blades	Rotor Diameter (m)	Hub Height (m)	Number of Turbines	Type	Number
GE 2.3-116	LNTE	116	80.0	13	standard utility scale	2
GE 2.82-127	LNTE	127	88.6	111*		

* The total number of wind turbines in the noise model is 124, which includes 12 alternates.

4. Noise Modeling Method

Noise levels from the proposed Deuel Harvest North Wind Farm were predicted using the modeling method set forth in International Organization for Standardization (ISO) Standard 9613-2: Attenuation of Sound During Propagation Outdoors. The method was implemented using the SoundPLAN v7.4 acoustical modeling program and the modeling program results were cross-checked with a spreadsheet calculation. Figure 4-1 shows a representative three-dimensional view of the SoundPLAN model of the Project.

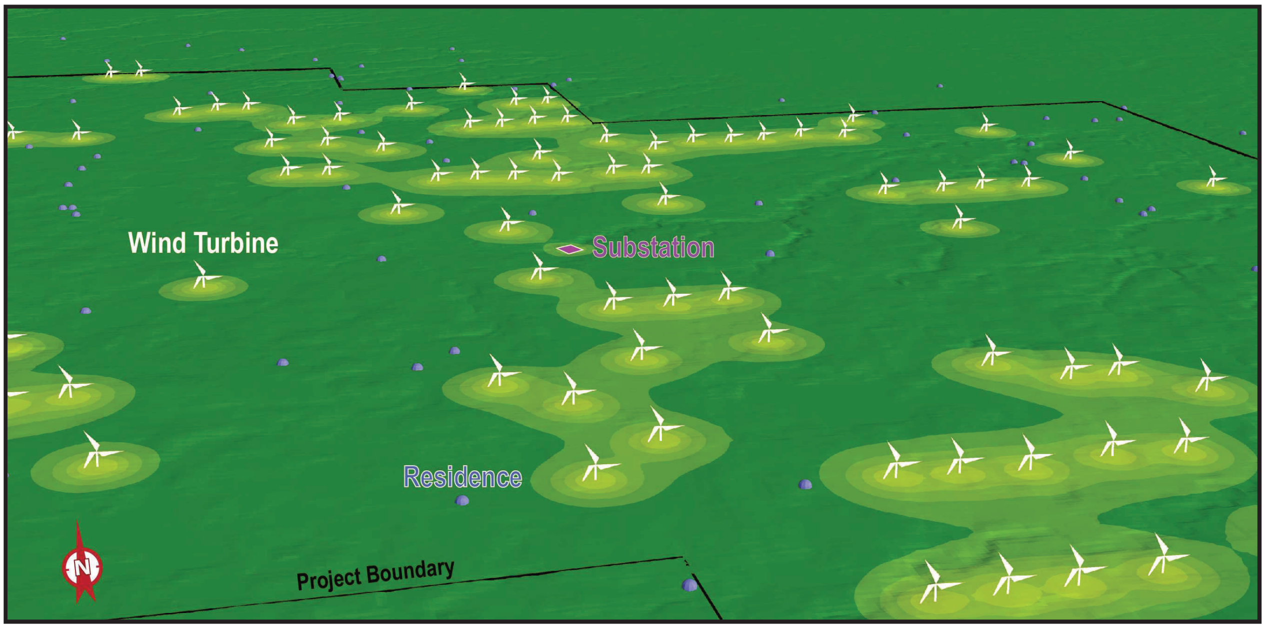


Figure 4-1. Three-Dimensional View of the SoundPLAN Noise Model

There are several parameters in the ISO 9613-2 method, including the locations of the noise sources and receivers, noise source level and frequency characteristics, terrain and ground type, and atmospheric propagation conditions. The ISO method assumes optimal acoustic propagation in all directions, specifically that a "well-developed, moderate ground-based temperature inversion" is present or, equivalently, that all receptors are downwind of all noise sources at all times. The specific ISO 9613-2 settings used in this analysis are described below.

Receptors

In the SoundPLAN model, receptors (prediction points) were located at each of the 122 non-participating and 109 participating residences located within the Project study area, which includes any residence located within approximately two miles of any turbine or main transformer. The geographic locations of the residences were provided by Deuel Harvest. Ground elevations were determined using Digital Elevation Model (DEM) data from the U.S. Geological Survey (USGS) National Elevation Dataset. In accordance with ISO 9613-2, each receptor's height was set to 1.5 meters (5 feet) above the ground. The location of each receptor is shown in the figures in Appendix A. The geographic coordinates and ground elevation of each modeled non-participating and participating receptor are listed in Appendix B and C, respectively.

Noise Sources

In the SoundPLAN model, each turbine was represented as an acoustical point source located at its hub height, which is 80 meters above the ground for the GE 2.3-116 units, 88.6 meters above the ground for the GE 2.82-127 units, and three meters for the transformers. No directivity was applied to any noise source, thus assuming maximum acoustic output in all directions, and all turbines were assumed to be operating in normal mode (versus noise-reduction mode). The locations of the turbines were provided by Deuel Harvest (State Permit Layout_Rev1 (124 WTGs Numbered.shp)). The location of the substation containing the two main step-up (34.5 kV to 345 kV) transformers was also provided by Deuel Harvest. The location of each turbine is shown in the site plan figures in Appendix A. The geographic coordinates, ground elevation, and hub-height elevation of each modeled turbine and transformer are listed in Appendix D. The ground elevation for each turbine location was determined using DEM data from the USGS National Elevation Dataset.

Table 4-1 lists the octave band sound power levels for all modeled noise sources in the Project. The levels are expressed in terms of unweighted decibels (dB) for each of nine standard frequency bands, as defined by the American National Standards Institute (ANSI) Standard S1.11: Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters. The noise level data for each turbine was provided by the manufacturer and was determined according to International Electrotechnical Commission standard 61400-11. This standard requires wind turbine sound power levels to be reported for a number of wind speed bins across the operating range of the turbine. In general, sound levels increase with increasing winds speeds, up to approximately 10 m/s at hub height. Noise levels do not further increase above this wind speed because the turbines reach a maximum rotational speed. This relationship between wind speed and noise level holds true for each octave band. This analysis used octave band noise levels reported by the manufacturer for the 10 m/s wind speed at hub height, as this is the speed at which the overall noise level first reaches its maximum level. The manufacturer's uncertainty factor was not applied to this data.

Table 4-1. Source Sound Power Levels

Source	Octave Band Sound Power Level (dB)									Overall Sound Power Level (dBA)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz	8,000 Hz	
GE 2.3-116 LNTE*	118.3	115.3	111.7	107.2	102.5	99.5	98.1	92.3	74.6	106.0
GE 2.82-127 LNTE*	122.3	118.8	113.3	106.8	103.6	103.8	101.5	94.0	78.0	108.5
Transformer	95.0	100.8	102.7	97.2	97.8	91.6	86.4	81.6	72.5	98.0

* For 10 m/s hub-height wind speed

The Project's collector substation will contain two transformers, switch gear, metering, electrical control and communication systems, and other equipment required to transform Project wind-generated power. The only significant noise-producing equipment are the Project's main step-up transformers. The noise analysis assumed the simultaneous operation of two 120 MVA transformers at the substation. The sound power levels from the transformers are listed in Table 4-1. The substation location is shown in the figures in Appendix A. Ground elevations for the transformers were determined using the USGS National Elevation Dataset. The transformers were modeled as point sources located 3 meters (10 feet) above the ground, with no barriers or directivity reductions. The spectral shape of transformer noise emissions was estimated using published data and adjusted to match the overall sound power level of 98 dBA, which is a typical and achievable level estimated for utility-scale transformers.

Terrain and Ground Effect

The terrain in the project area was modeled by importing DEM data from the U.S. Geological Survey National Elevation Dataset into SoundPLAN. The acoustical effect of the ground was modeled using the ISO 9613-2 General Method. This requires the selection of ground absorption factors for the ground near the source, near the receiver, and in between. Ground factors range from 0.0 to 1.0 and represent the proportion of sound that is absorbed or reflected when sound waves interact with the ground. A value of 0.0 represents completely reflective ground material such as pavement or flat water, and results in a higher level of sound reaching a receptor. A value of 1.0 represents absorptive material such as thick grass, crops, or fresh snow, and results in a lower level of sound reaching a receptor. For this project, we conservatively assumed a ground factor of 0.0 (completely reflective). Actual ground conditions could at times be 0.0 when the ground is completely frozen, but would generally be closer to 0.5 when the ground is covered with new snow or crops, or when the ground is bare and unfrozen.

Atmospheric Conditions

The air temperature, relative humidity, and atmospheric pressure were set to conditions of 10°C, 70%, and 1 atmosphere, respectively. These values represent the lowest amount of atmospheric absorption of sound available in the ISO 9613-2 method, and result in the highest levels of sound reaching the receptors.

Validation of Noise Prediction Method

The noise level prediction method employed on the Project has been validated by Hankard Environmental by comparing predicted noise levels to those measured at operating wind farms. Most notably, Hankard Environmental compared the noise levels measured over the course of four months near an operating Illinois wind farm employing similar turbines to the noise levels predicted by an acoustical model of that project using the methods described above. The validation compared the predicted levels to the very highest turbine-only noise levels measured. The result of that comparison is that for a majority of the time, actual turbine noise levels will be lower than those predicted. This is because, in addition to the conservative ground attenuation factor and atmospheric absorption conditions, sound levels were calculated assuming maximum turbine operations (which will not always be the case) and the ISO 9613-2 method assumes that all receptors are downwind of all noise sources at all times (a physical impossibility for this turbine layout).

The noise level modeling method employed on this Project has been validated by many acoustical consultants, including Hankard Environmental. Hankard Environmental has conducted numerous wind turbine noise level compliance surveys, and routinely compares the results of these measurements with corresponding predicted levels using the same methods employed on this Project. We consistently find that our predicted levels are at least 1 dBA higher than the loudest measured hourly turbine only noise levels.

5. Predicted Noise Levels

Non-Participating Residences

Noise levels from the full and continuous operation of 111 GE 2.82-127 LNTE turbines, 13 GE 2.3-116 LNTE turbines, and two main step-up transformers were predicted at each residence. Table 5-1 lists the predicted turbine noise levels at the 12 non-participating residences where the loudest levels are predicted. All of these predicted levels are less than the County's 45 dBA limit. Predicted noise levels at all other non-participating residences are lower. Overall, levels range from 24 dBA to less than 45 dBA, with an average of 36 dBA. The predicted noise levels at each of the 122 non-participating residences are listed in Appendix B.

Table 5-1. Highest Predicted Noise Levels ($L_{eq\ (1\ Hr)}$) at Non-Participating Residences

Receptor ID	Noise Level (dBA)	Receptor ID	Noise Level (dBA)
292	44.9	203	43.6
294	44.9	293	43.6
259	44.5	202	43.4
275	44.0	198	43.3
200	43.7	257	43.3
694	43.7	272	43.3

Participating Residences

Table 5-2 lists the 12 participating residences where the highest noise levels are predicted. Overall, levels range from 28 dBA to less than 50 dBA, with an average of 40 dBA. Predicted noise levels at all other participating residences are lower. The predicted noise levels at each of the 109 participating residences are listed in Appendix C.

Table 5-2. Highest Predicted Noise Levels ($L_{eq\ (1\ Hr)}$) at Participating Residences

Receptor ID	Noise Level (dBA)	Receptor ID	Noise Level (dBA)
770	49.8	698	48.0
744	48.8	741	48.0
764	48.5	745	47.7
750	48.4	713	47.6
290	48.1	771	47.6
291	48.0	767	47.4

Predicted Noise Level Contours

Noise levels are indicated graphically in the form of noise level contours in the figures in Appendix E. Each of the green contour lines encircles one or more turbines to indicate the positions at which the predicted noise level is 45 dBA. All of the area between a contour line and any turbine that it surrounds has a predicted noise level in excess of the 45 dBA level. All of the area outside of a contour has a predicted noise level less than the 45 dBA level.

6. Construction Noise Levels

Construction for a wind turbine farm is expected to include the wind turbine sites, substation, access roads, and underground transmission lines. The construction will generate temporary noise from a variety equipment. Table 6-1 provides a list of potential construction equipment for each type, phase and sub-phase for construction of a wind farm project. In general, each individual wind turbine site is estimated to take about two to three weeks to construct, with the substation taking about three to four months and the entire wind farm around twelve months.

Table 6-1. Potential Construction Equipment to be Employed on a Wind Turbine Project

Type	Phase	Sub-Phase	Equipment
Turbines	Site Preparation	Clearing	Chainsaw, Feller Buncher, Grapple Loader, Log Truck
		Road/Site	Dozer, Excavator, Grader, Roller, Dump Trucks
		Foundation	Drill Rig, Track Hoe, Dozer, RT Crane, Concrete Truck
	Installation	Delivery	Fork Lift, RT Crane, Tractor Trailer
		Components	Crawler Crane
	Site Finishing	---	Dozer, Moto Grader, Skid Steer, Seed Drill
Substation	Site Preparation	Clearing	Chainsaw, Feller Buncher, Grapple Loader, Log Truck
		Road/Site	Dozer, Excavator, Grader, Roller, Dump Truck
		Foundation	Drill Rig, Track Hoe, Dozer, RT Crane, Concrete Truck
	Construction	Delivery	Fork Lift, RT Crane, Tractor Trailer
		Components	Fork Lift, Bucket Truck, Truck Crane
	Site Finishing	---	Dozer, Moto Grader, Skid Steer, Seed Drill
Roadways	Site Preparation	---	Chainsaws, Feller Buncher, Grapple Loader, Log Truck
	Construction	---	Dozer, Moto Grader, Back Hoe, Dump Truck, Roller
	Site Finishing	---	Dozer, Moto Grader, Skid Steer, Seed Drill
Underground Electrical Collections	Trenching	---	Trencher, Track Hoe, Horizontal Drill
	Installation	---	Cable Layer
	Site Finishing	---	Track Hoe, Skid Steer, Seed Drill

Construction noise at off-site receptor locations will usually be dependent on the loudest one or two pieces of equipment in operation at a particular time. Noise levels from diesel-powered equipment at 50 feet generally range from 80 dBA to 95 dBA. Table 6-2 provides a list of common construction equipment, its maximum noise level expected at 50 feet, the typical duration a particular piece of equipment is used in any one-hour period, and the resulting hourly equivalent noise level ($L_{eq\ (1\ Hr)}$) for the piece of equipment.

Table 6-2. Noise Source Characteristics of the Construction Equipment

Equipment	L_{max} Noise Level at 50 ft (dBA)	Usage Factor (%)	$L_{eq(1\ Hr)}$ Noise Level at 50 ft (dBA)
Back Hoe	82	40	77.6
Belly Dump Truck	88	40	84.0
Bucket Truck	82	20	74.7
Cable Layer	70	50	67.0
Chain Saw	91	20	83.7
Concrete Truck	88	20	81.4
Crawler Crane	89	16	80.6
Dozer	86	40	81.7
Drill Rig	86	20	79.1
Dump Truck	81	40	76.5
Excavator	85	40	80.7
Feller Buncher	89	40	85.0
Fork Lift	69	40	65.0
Grapple Loader	83	40	79.1
Horizontal Drill	88	25	82.0
Log Truck	78	40	74.3
Moto Grader	89	40	85.0
Roller	84	40	80.0
RT Crane	89	16	80.6
Seed Drill	83	50	80.0
Semi Trucks	78	40	74.3
Skid Steer	83	40	79.1
Track Hoe	82	40	77.6
Tractor Trailer	78	40	74.3
Trencher	83	50	80.4
Truck Crane	87	16	80.6

Construction noise from the Project is not expected to create any significant impacts. That said, the following steps could be taken by the Project to minimize the impact of construction noise:

- Limit any necessary nighttime work near residences to quiet activities such as finishing,
- Maintain equipment to manufacturers' specifications, particularly mufflers,
- Use ambient controlled broadband backup alarms versus tonal back-up alarms,
- Minimize backing up on site of delivery trucks to the degree practicable,
- Provide a 24-hour telephone complaint number for residents to use if needed,
- Attempt to resolve any legitimate problems in a prompt manner,
- Notify residences of expected construction schedule for the entire Project.

7. Conclusions

Noise levels from the full and continuous operation of the Project were predicted at each non-participating and participating residence located within two miles of any Project noise source. Noise levels are predicted to be less than 45 dBA at all non-participating residences. The noise modeling (prediction) method used in this analysis has been demonstrated by Hankard Environmental and other acoustical consultants to result in predicted levels that are at least 1 dB higher than the loudest measured hourly turbine-only noise levels. Therefore, we confidently conclude that noise levels from the Project, once operational, will be less than the Deuel County limit under any circumstances. A majority of the time, when either turbines are at less than full operation, or off, or when atmospheric conditions are less than ideal for sound propagation, noise levels will be significantly less than those reported herein

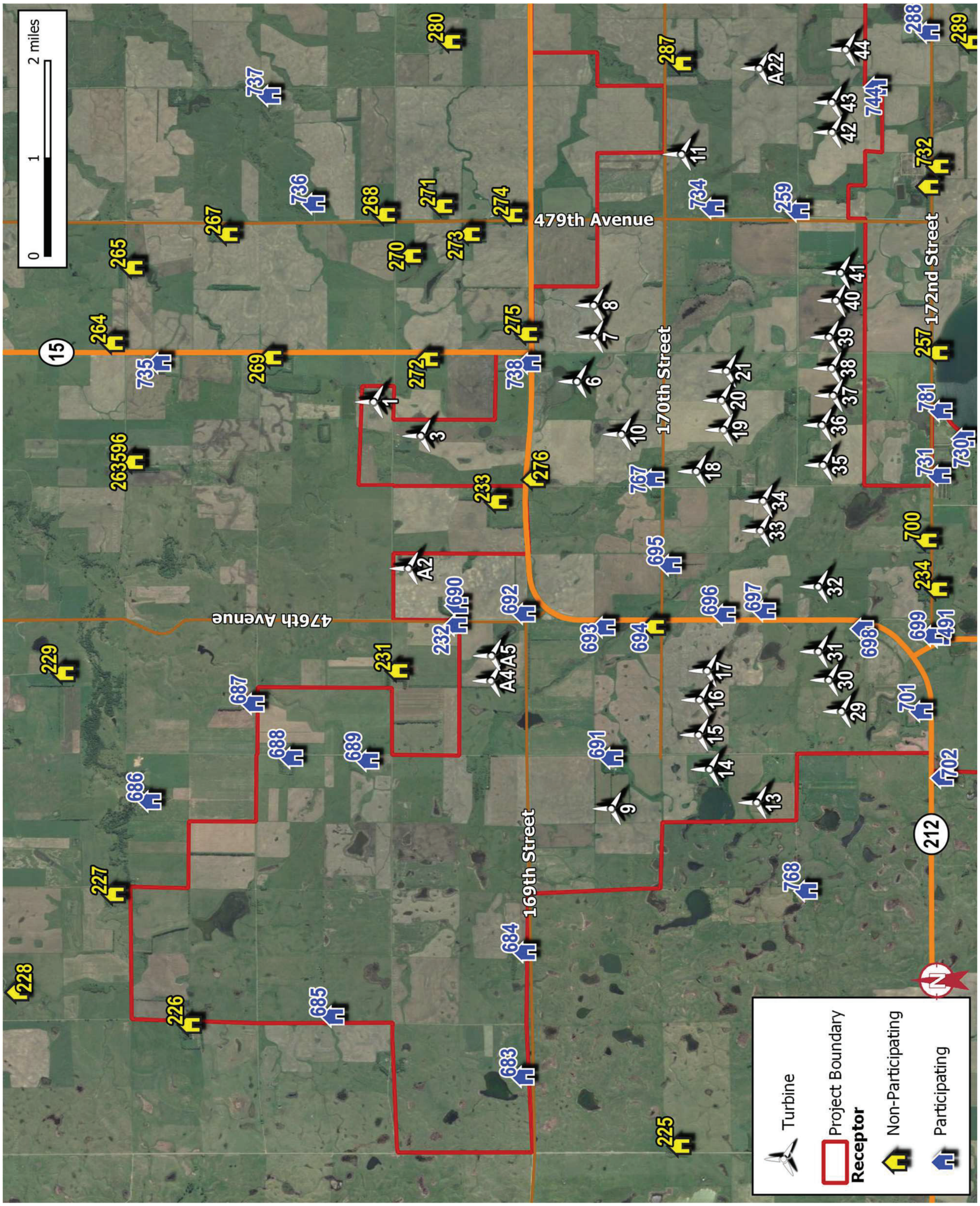
The noise modeling analysis is based on the following assumptions:

1) The use of a 0.0 ground attenuation factor, which results in higher levels of predicted noise than would result from a higher ground factor. Hankard Environmental has found that measured levels never exceed those predicted using 0.0 and are often lower.
2) The model assumes atmospheric conditions that result in efficient sound propagation and therefore higher noise levels. These conditions, primarily wind direction and the presence of either a temperature inversion or a wind gradient, will only be present a certain percentage of time. When they are not present, noise levels will be lower than those reported herein. In addition, the ISO 9613-2 method assumes that all receptors are downwind of all noise sources at all times. For many receptors (those with turbines located in different directions around them), this is not physically possible.
3) All turbines and transformers are modeled without any source directivity. In reality, these sources project different levels of sound in different directions. In the model, they are assumed to radiate their highest levels in all directions.
4) All turbines and transformers are assumed to be operating in their maximum-noise state, which will not always be the case.
5) All of the GE 2.3-116 and 2.82-127 wind turbines are fitted with LNTE blades.

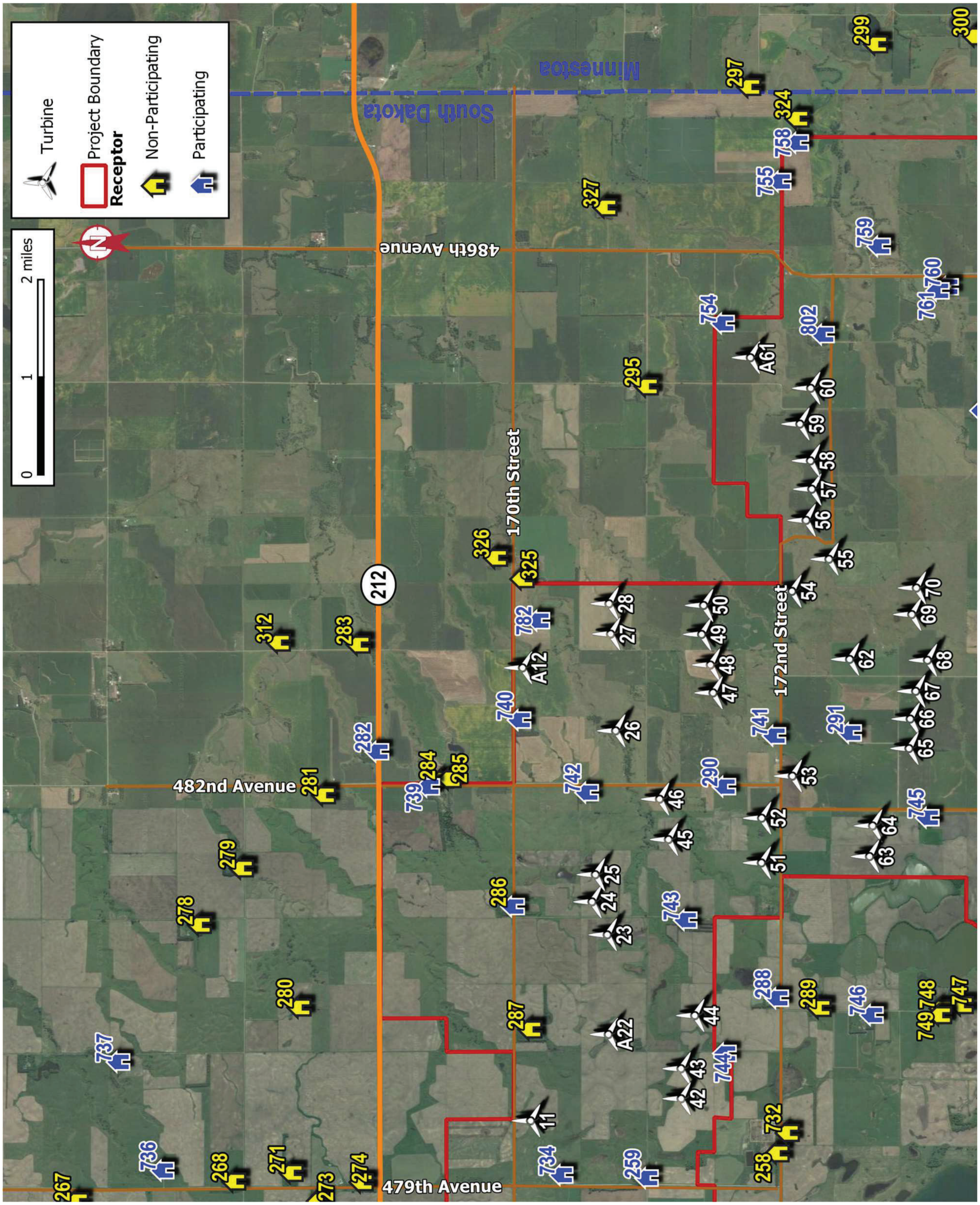
Note that the results described herein are valid for the receptor locations provided, the turbine layout analyzed, and the wind turbine sound power levels as provided by the manufacturer. If the Applicant makes any significant changes to the Project, including layout, turbine type, or mix of standard and LNTE blades, this noise analysis should be updated and compliance with the noise limit again demonstrated.

APPENDIX A

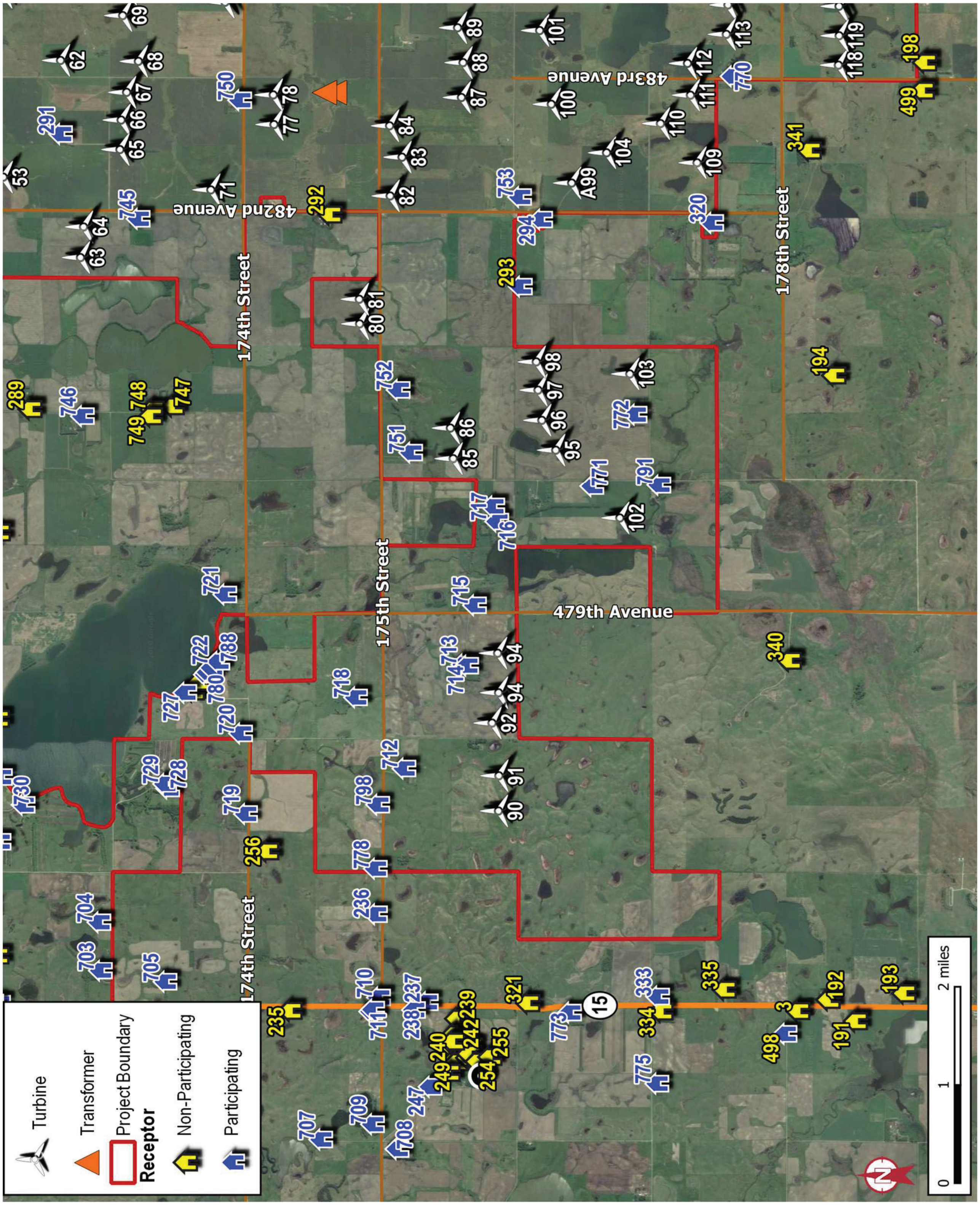
Site Plan Figures



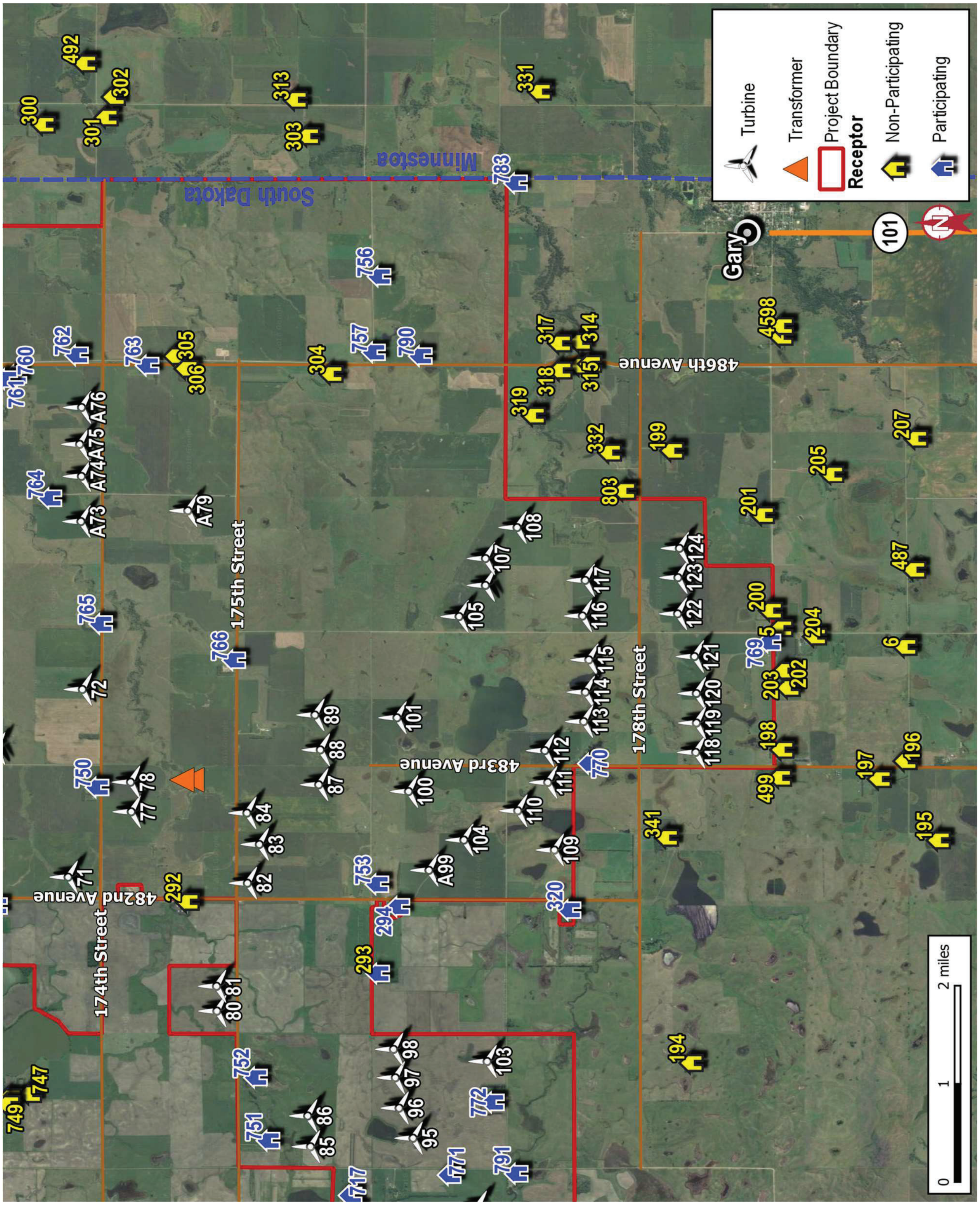
Site Plan – Northwest Area



Site Plan – Northeast Area



Site Plan – Southwest Area



Site Plan – Southeast Area

APPENDIX B

Non-Participating Receptor Locations and Noise Levels

Receiver	UTM 14N NAD83		Ground Elevation	Sound Level
	Easting (m)	Northing (m)	(m asl)	(dBA)
3	683223	4963726	567	27.9
4	699672	4962706	491	33.9
5	696155	4962600	513	43.2
6	695975	4961104	503	36.3
191	683121	4963032	560	26.7
192	683367	4963367	561	27.5
193	683472	4962461	558	26.3
194	690894	4963517	527	36.7
195	693658	4960634	516	34.2
196	694600	4961061	507	36.0
197	694375	4961365	507	36.9
198	694692	4962542	505	43.3
199	698259	4963973	491	40.3
200	696362	4962729	509	43.7
201	697509	4962861	505	41.3
202	695439	4962490	511	43.4
203	695645	4962537	510	43.6
204	696067	4962192	509	40.9
205	698033	4962046	494	36.6
207	698494	4961053	498	33.4
225	676853	4976229	580	30.2
226	678135	4982122	516	27.5
227	679674	4983073	514	28.1
228	678464	4984192	519	24.0
229	682307	4983747	488	29.2
231	682450	4979759	516	40.7
233	684511	4978630	507	41.9
234	683614	4973334	525	41.2
235	683053	4969806	546	33.6
239	683016	4967807	559	32.8
240	682675	4967857	561	32.1
241	682639	4967748	565	32.0
242	682713	4967753	566	32.1
243	682794	4967839	563	32.3
244	682755	4967758	567	32.2
245	682689	4967819	562	32.1
246	682831	4967838	562	32.4
248	682502	4967842	561	31.8
249	682496	4967799	562	31.7
250	682553	4967662	566	31.8
251	682698	4967682	567	32.1
252	682688	4967635	567	32.0
253	682600	4967649	567	31.9

Receiver	UTM 14N NAD83		Ground Elevation	Sound Level
	Easting (m)	Northing (m)	(m asl)	(dBA)
255	682570	4967398	571	31.6
256	684963	4970141	532	35.8
257	686461	4973411	521	43.3
258	688454	4973580	513	42.1
259	688112	4975133	509	44.5
263	684869	4982990	485	31.9
264	686291	4983273	476	31.0
265	687204	4983064	461	31.1
267	687636	4981940	470	32.9
268	687926	4980067	480	36.0
269	686173	4981375	485	36.8
270	687442	4979742	489	37.5
271	688049	4979385	487	37.0
272	686208	4979503	499	43.3
273	687721	4979046	494	38.3
274	687963	4978543	494	39.1
275	686545	4978326	503	44.0
276	684797	4978196	506	42.2
278	690981	4980570	431	33.1
279	691674	4980087	425	33.7
280	690024	4979348	467	35.5
281	692582	4979132	423	35.3
283	694403	4978773	404	35.9
284	692812	4977723	431	38.9
285	692820	4977636	430	39.1
287	689844	4976580	491	42.6
289	690204	4973129	509	41.6
292	692649	4969610	491	44.9
293	691851	4967303	524	43.6
294	692665	4967084	508	44.9
295	697618	4975422	394	39.8
297	701253	4974308	367	33.1
299	701813	4972806	369	32.7
300	701946	4971621	377	32.8
301	702056	4970870	369	32.6
302	702305	4970792	379	32.0
303	701907	4968451	391	32.3
304	699056	4968082	441	37.4
305	699214	4969952	424	40.3
306	699065	4969818	425	40.4
312	694398	4979727	400	33.7
313	702340	4968613	397	31.6
314	699535	4965118	443	36.4

Receiver	UTM 14N NAD83		Ground Elevation (m asl)	Sound Level (dBA)
	Easting (m)	Northing (m)		
315	699248	4965104	464	37.2
316	699274	4964989	455	37.1
317	699510	4965357	457	36.5
318	699184	4965340	452	37.5
319	698631	4965644	462	39.7
321	683225	4966963	563	33.0
324	700890	4973720	372	34.2
325	695248	4976837	410	42.1
326	695494	4977161	403	39.9
327	699753	4975983	370	34.3
331	702530	4965693	405	30.3
332	698214	4964717	483	41.1
334	683171	4965365	577	30.6
335	683454	4964615	564	29.8
340	687436	4963949	526	34.4
341	693591	4963893	504	43.1
487	696907	4961027	498	35.4
492	702697	4971147	374	31.2
494	682785	4967785	566	32.3
495	682367	4967893	557	31.5
496	682741	4967851	563	32.2
499	694354	4962560	510	42.5
596	684871	4982990	485	31.9
598	699800	4962703	491	33.7
694	683066	4976707	520	43.7
700	684197	4973476	523	41.7
724	686903	4971039	523	37.2
725	686879	4971059	523	37.2
726	686858	4971086	520	37.2
732	688701	4973465	514	41.8
747	690288	4971428	507	39.8
748	690240	4971667	506	39.9
749	690160	4971684	505	39.8
779	686978	4971008	521	37.2
803	697749	4964533	483	43.3

APPENDIX C

Participating Receptor Locations and Noise Levels

Receptor	UTM 14N NAD83		Ground Elevation	Noise Level
	Easting (m)	Northing (m)	(m asl)	(dBA)
232	683016	4979077	517	45.5
236	684245	4968817	543	35.6
237	683202	4968178	555	33.3
238	683105	4968328	552	33.1
247	682193	4968103	561	31.4
282	693123	4978509	424	36.8
286	691313	4976830	472	42.7
288	690305	4973639	504	43.3
290	692830	4974347	472	48.1
291	693520	4972863	476	48.0
320	692686	4965034	511	44.2
333	683349	4965409	579	31.1
491	683039	4973297	524	41.3
498	682947	4963870	565	27.6
681	678753	4971111	573	30.1
682	679475	4970841	579	30.7
683	677625	4978124	556	31.1
684	679117	4978144	537	34.7
685	678281	4980416	529	30.0
686	680799	4982675	503	29.9
687	682005	4981475	511	33.6
688	681368	4980996	522	33.8
690	683254	4979073	514	45.1
691	681474	4977172	531	45.1
692	683177	4978266	516	45.2
693	683042	4977308	522	42.2
695	683811	4976537	523	43.7
696	683233	4975874	524	45.9
697	683292	4975394	522	46.6
698	683113	4974215	526	48.0
699	683050	4973378	526	41.8
701	682141	4973482	531	42.7
702	681351	4973209	542	39.0
703	683469	4972089	531	37.1
704	684053	4972124	527	37.4
705	683358	4971312	537	35.5
706	680530	4970175	576	31.2
707	681527	4969395	571	31.5
708	681439	4968478	583	30.5
709	681727	4968780	563	31.2
710	683243	4968751	543	33.4
711	683072	4968840	542	33.1
712	686007	4968526	530	41.2
713	687277	4967856	525	47.6

Receptor	UTM 14N NAD83		Ground Elevation	Noise Level
	Easting (m)	Northing (m)	(m asl)	(dBA)
715	687994	4967739	519	44.2
716	689009	4967501	515	44.0
717	689189	4967555	515	45.2
718	686844	4969130	522	38.9
719	685405	4970407	528	36.1
720	686371	4970494	530	36.8
721	688036	4970732	520	37.7
722	687188	4970836	522	37.2
723	687113	4970889	519	37.2
727	686840	4971175	517	37.2
728	685684	4971347	525	37.0
729	685738	4971385	525	37.0
730	685438	4973071	521	41.1
731	684986	4973346	522	41.9
734	688118	4976155	506	44.1
735	686068	4982710	486	32.3
736	688032	4980926	477	34.4
737	689311	4981492	438	32.4
738	686192	4978291	504	44.9
739	692721	4977888	430	38.3
740	693555	4976821	430	44.5
741	693459	4973767	467	48.0
742	692709	4975986	462	45.5
743	691213	4974762	488	46.0
744	689627	4974245	498	48.8
745	692529	4971903	500	47.7
746	690138	4972500	509	40.4
750	693991	4970730	486	48.4
751	689816	4968557	516	46.6
752	690566	4968730	503	44.8
753	692928	4967345	506	45.0
754	698403	4974533	394	44.5
755	700129	4973909	378	36.0
756	700246	4967543	421	35.0
757	699333	4967582	445	36.8
758	700599	4973713	374	34.9
759	699387	4972695	395	38.9
760	698926	4971866	408	42.3
761	698874	4971975	395	42.0
762	699187	4971136	413	44.1
763	699090	4970287	423	42.4
764	697449	4971401	426	48.5
765	695958	4970746	457	44.6
766	695570	4969140	485	43.0

Receptor	UTM 14N NAD83		Ground Elevation (m asl)	Noise Level (dBA)
	Easting (m)	Northing (m)		
767	684839	4976774	513	47.4
768	679946	4974799	547	39.3
769	695981	4962736	510	44.6
770	694456	4964843	513	49.8
771	689468	4966375	529	47.6
772	690353	4965883	513	47.1
773	683128	4966458	576	32.3
775	682308	4965389	577	28.8
778	684792	4968834	537	37.0
780	687065	4970935	520	37.2
781	685764	4973353	516	42.8
782	694756	4976632	420	45.9
783	701420	4965944	414	32.5
786	687093	4970914	519	37.2
787	687148	4970867	521	37.2
788	687225	4970791	520	37.2
790	699305	4967020	451	36.9
791	689508	4965573	513	45.2
797	683096	4968817	542	33.2
798	685563	4968828	532	38.9
802	698306	4973333	403	45.4

APPENDIX D

Noise Source Locations

Source ID	UTM 14N NAD83		Ground Elevation (m asl)	Source / Hub Height (m agl)	Source Type
	Easting (m)	Northing (m)			
1	685677.5	4980059.2	498.3	88.6	GE 2.82-127 LNTE
3	685286.2	4979482.5	506.0	88.6	GE 2.82-127 LNTE
6	685993.6	4977635.8	512.4	88.6	GE 2.82-127 LNTE
7	686537.1	4977450.4	512.6	80.0	GE 2.3-116 LNTE
8	686913.8	4977461.8	512.4	88.6	GE 2.82-127 LNTE
9	680870.2	4977077.3	537.2	88.6	GE 2.82-127 LNTE
10	685375.2	4977085.1	514.5	88.6	GE 2.82-127 LNTE
11	688757.1	4976465.5	499.7	88.6	GE 2.82-127 LNTE
13	680991.7	4975340.0	539.9	88.6	GE 2.82-127 LNTE
14	681374.9	4975918.1	540.4	88.6	GE 2.82-127 LNTE
15	681784.7	4976058.6	537.3	88.6	GE 2.82-127 LNTE
16	682204.7	4976059.3	531.3	80.0	GE 2.3-116 LNTE
17	682556.9	4975979.7	526.8	88.6	GE 2.82-127 LNTE
18	684956.0	4976177.0	514.8	88.6	GE 2.82-127 LNTE
19	685464.1	4975867.9	515.2	88.6	GE 2.82-127 LNTE
20	685817.8	4975902.0	513.6	88.6	GE 2.82-127 LNTE
21	686171.6	4975852.6	513.0	88.6	GE 2.82-127 LNTE
23	691010.3	4975614.8	487.6	88.6	GE 2.82-127 LNTE
24	691400.6	4975809.5	478.7	88.6	GE 2.82-127 LNTE
25	691728.5	4975779.1	479.1	88.6	GE 2.82-127 LNTE
26	693463.4	4975588.0	443.6	88.6	GE 2.82-127 LNTE
27	694624.1	4975683.2	427.4	88.6	GE 2.82-127 LNTE
28	694987.1	4975713.8	422.8	88.6	GE 2.82-127 LNTE
29	682114.3	4974358.9	532.8	88.6	GE 2.82-127 LNTE
30	682486.9	4974520.9	528.4	88.6	GE 2.82-127 LNTE
31	682826.0	4974654.8	521.6	88.6	GE 2.82-127 LNTE
32	683605.1	4974679.7	522.9	88.6	GE 2.82-127 LNTE
33	684257.2	4975390.4	521.3	88.6	GE 2.82-127 LNTE
34	684614.4	4975369.8	518.5	88.6	GE 2.82-127 LNTE
35	685075.1	4974663.5	519.7	88.6	GE 2.82-127 LNTE
36	685554.6	4974691.5	518.7	88.6	GE 2.82-127 LNTE
37	685914.1	4974566.8	519.2	88.6	GE 2.82-127 LNTE
38	686240.1	4974595.1	516.4	88.6	GE 2.82-127 LNTE
39	686613.6	4974636.5	514.1	88.6	GE 2.82-127 LNTE

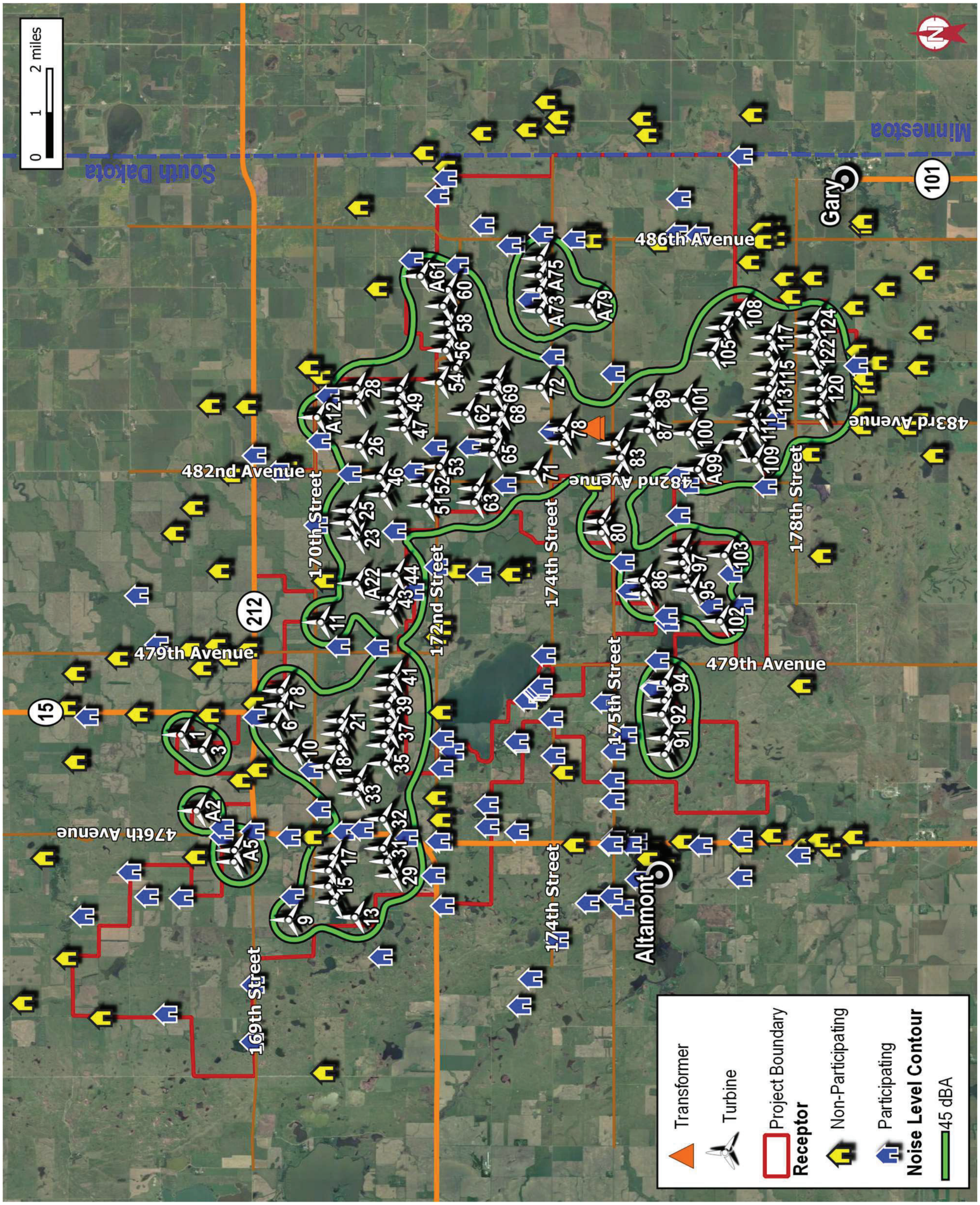
Source ID	UTM 14N NAD83		Ground Elevation (m asl)	Source / Hub Height (m agl)	Source Type
	Easting (m)	Northing (m)			
40	687055.9	4974567.9	516.5	88.6	GE 2.82-127 LNTE
41	687392.0	4974522.8	515.5	88.6	GE 2.82-127 LNTE
42	689073.8	4974673.0	500.4	88.6	GE 2.82-127 LNTE
43	689432.1	4974684.8	496.9	88.6	GE 2.82-127 LNTE
44	690071.1	4974539.5	495.0	88.6	GE 2.82-127 LNTE
45	692176.3	4974916.9	476.5	88.6	GE 2.82-127 LNTE
46	692658.6	4975038.2	472.1	88.6	GE 2.82-127 LNTE
47	693954.5	4974436.9	455.7	88.6	GE 2.82-127 LNTE
48	694288.6	4974478.5	444.3	88.6	GE 2.82-127 LNTE
49	694652.6	4974594.5	436.3	88.6	GE 2.82-127 LNTE
50	695001.4	4974582.1	433.8	88.6	GE 2.82-127 LNTE
51	691929.4	4973797.0	490.5	88.6	GE 2.82-127 LNTE
52	692466.5	4973810.4	478.7	88.6	GE 2.82-127 LNTE
53	692983.4	4973458.1	473.6	88.6	GE 2.82-127 LNTE
54	695203.2	4973530.6	438.5	88.6	GE 2.82-127 LNTE
55	695602.1	4973099.2	438.9	88.6	GE 2.82-127 LNTE
56	696061.0	4973387.0	428.3	88.6	GE 2.82-127 LNTE
57	696437.7	4973330.7	424.2	88.6	GE 2.82-127 LNTE
58	696787.1	4973357.0	420.8	88.6	GE 2.82-127 LNTE
59	697225.0	4973496.8	411.8	88.6	GE 2.82-127 LNTE
60	697658.5	4973381.1	409.9	88.6	GE 2.82-127 LNTE
62	694406.5	4972815.4	466.5	88.6	GE 2.82-127 LNTE
63	692045.0	4972505.6	500.7	88.6	GE 2.82-127 LNTE
64	692414.1	4972479.8	494.9	88.6	GE 2.82-127 LNTE
65	693356.6	4972072.6	481.8	88.6	GE 2.82-127 LNTE
66	693712.0	4972068.8	481.2	88.6	GE 2.82-127 LNTE
67	694046.8	4972013.3	475.7	88.6	GE 2.82-127 LNTE
68	694423.6	4971883.8	473.8	88.6	GE 2.82-127 LNTE
69	694968.0	4972088.2	464.6	88.6	GE 2.82-127 LNTE
70	695288.7	4972042.6	460.7	88.6	GE 2.82-127 LNTE
71	692905.0	4970970.0	490.3	88.6	GE 2.82-127 LNTE
72	695166.0	4970868.0	467.3	88.6	GE 2.82-127 LNTE
77	693713.2	4970238.0	487.5	88.6	GE 2.82-127 LNTE
78	694069.2	4970257.3	485.0	80.0	GE 2.3-116 LNTE

Source ID	UTM 14N NAD83		Ground Elevation (m asl)	Source / Hub Height (m agl)	Source Type
	Easting (m)	Northing (m)			
80	691347.7	4969141.0	503.5	88.6	GE 2.82-127 LNTE
81	691643.8	4969153.7	497.9	80.0	GE 2.3-116 LNTE
82	692896.9	4968821.3	502.4	80.0	GE 2.3-116 LNTE
83	693367.2	4968693.2	503.4	80.0	GE 2.3-116 LNTE
84	693739.8	4968853.3	496.4	88.6	GE 2.82-127 LNTE
85	689760.4	4967972.5	515.2	88.6	GE 2.82-127 LNTE
86	690127.3	4968017.0	521.9	88.6	GE 2.82-127 LNTE
87	694106.4	4968003.4	506.7	88.6	GE 2.82-127 LNTE
88	694526.1	4967997.1	503.4	88.6	GE 2.82-127 LNTE
89	694943.4	4968074.8	498.9	88.6	GE 2.82-127 LNTE
90	685530.5	4967305.9	547.1	88.6	GE 2.82-127 LNTE
91	685954.6	4967313.2	543.0	88.6	GE 2.82-127 LNTE
92	686585.6	4967413.9	531.1	88.6	GE 2.82-127 LNTE
94	687427.6	4967370.9	528.3	88.6	GE 2.82-127 LNTE
94	686952.3	4967345.9	531.8	88.6	GE 2.82-127 LNTE
95	689898.8	4966747.6	522.6	88.6	GE 2.82-127 LNTE
96	690253.4	4966924.9	521.9	88.6	GE 2.82-127 LNTE
97	690614.7	4966980.9	524.4	88.6	GE 2.82-127 LNTE
98	690953.4	4967012.4	527.2	80.0	GE 2.3-116 LNTE
100	694057.4	4966925.2	515.9	88.6	GE 2.82-127 LNTE
101	694940.1	4967090.9	509.8	88.6	GE 2.82-127 LNTE
102	689096.9	4965955.5	522.2	88.6	GE 2.82-127 LNTE
103	690841.6	4965887.3	520.2	88.6	GE 2.82-127 LNTE
104	693493.8	4966245.3	519.8	88.6	GE 2.82-127 LNTE
105	696180.1	4966384.2	505.7	88.6	GE 2.82-127 LNTE
106	696564.5	4966080.4	493.9	88.6	GE 2.82-127 LNTE
107	696887.8	4966089.6	489.0	88.6	GE 2.82-127 LNTE
108	697272.2	4965722.4	490.0	88.6	GE 2.82-127 LNTE
109	693406.1	4965157.8	512.1	88.6	GE 2.82-127 LNTE
110	693864.8	4965610.3	513.1	88.6	GE 2.82-127 LNTE
111	694217.1	4965261.5	515.2	80.0	GE 2.3-116 LNTE
112	694598.6	4965308.7	514.8	80.0	GE 2.3-116 LNTE
113	694961.9	4964854.0	509.0	88.6	GE 2.82-127 LNTE
114	695316.4	4964845.1	502.3	88.6	GE 2.82-127 LNTE

Source ID	UTM 14N NAD83		Ground Elevation (m asl)	Source / Hub Height (m agl)	Source Type
	Easting (m)	Northing (m)			
115	695706.7	4964814.1	501.1	88.6	GE 2.82-127 LNTE
116	696232.2	4964906.3	495.8	88.6	GE 2.82-127 LNTE
117	696661.7	4964887.5	485.3	88.6	GE 2.82-127 LNTE
118	694632.5	4963500.0	511.8	88.6	GE 2.82-127 LNTE
119	694986.2	4963501.7	509.7	88.6	GE 2.82-127 LNTE
120	695340.9	4963513.9	507.2	88.6	GE 2.82-127 LNTE
121	695785.0	4963550.3	503.7	88.6	GE 2.82-127 LNTE
122	696292.8	4963767.6	497.4	80.0	GE 2.3-116 LNTE
123	696728.7	4963776.6	497.0	88.6	GE 2.82-127 LNTE
124	697081.4	4963770.0	497.6	80.0	GE 2.3-116 LNTE
A2	683682.6	4979586.5	506.3	88.6	GE 2.82-127 LNTE
A4	682362.8	4978561.3	521.2	88.6	GE 2.82-127 LNTE
A5	682663.9	4978561.9	516.2	88.6	GE 2.82-127 LNTE
A12	694185.4	4976724.8	424.8	88.6	GE 2.82-127 LNTE
A22	689815.1	4975566.5	497.4	80.0	GE 2.3-116 LNTE
A61	698004.0	4974113.6	401.0	88.6	GE 2.82-127 LNTE
A73	697183.7	4970946.8	432.9	88.6	GE 2.82-127 LNTE
A74	697735.8	4970958.2	423.8	88.6	GE 2.82-127 LNTE
A75	698120.7	4970991.2	423.7	88.6	GE 2.82-127 LNTE
A76	698564.3	4970981.8	421.0	88.6	GE 2.82-127 LNTE
A79	697352.6	4969671.5	447.9	88.6	GE 2.82-127 LNTE
A99	693117.3	4966652.6	515.7	80.0	GE 2.3-116 LNTE
X-01	694116.5	4969633.4	476.9	3.0	Transformer
X-02	694116.3	4969652.7	476.8	3.0	Transformer

APPENDIX E

Predicted Noise Level Contours



Predicted Noise Level Contours