GLACIER RIDGE WIND PROJECT

Sound Modeling Assessment for the Glacier Ridge Wind Project

Glacier Ridge Wind Project, LLC

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EXECUTIVE SUMMARY

Glacier Ridge Wind Project, LLC., is developing the Glacier Ridge Wind Project in North Dakota. Glacier Ridge Wind Project, LLC., has instructed DNV KEMA Renewables, Inc. (DNV GL) to carry out a sound modeling assessment of the proposed wind project. The results of the work are reported here.

The site is located in Barnes County, North Dakota, approximately 6 miles northeast of Valley City, North Dakota. The Project layout currently consists of 99 Vestas V126 wind turbine generators operating in Noise Mode 0, and one transformer. According to the Customer, 87 of the 99 turbines modeled in this report are planned for construction. In order to provide additional flexibility in future siting of wind turbines, all 99 turbines and the transformer have been included in the sound modeling assessment. The cumulative sound contribution of the neighboring Ashtabula I and III projects is also considered.

The sound pressure level (SPL) at each receptor for the aggregate of all wind turbine generators and transformers associated with the Project was calculated based on the ISO 9613-2 method. The results indicate that the calculated sound levels are within the allowable limits under North Dakota noise regulations at each of the 49 receptors located within 1 mile (approximately 1,600 m) of a project turbine or transformer.

1 INTRODUCTION

This report is issued to Glacier Ridge Wind Project, LLC ("Customer") pursuant to a written agreement arising from the *Proposal for Siting Study Support for the Glacier Ridge Wind Project* dated 31 May 2016, DNV GL Document No. 130652-USPO-P-01-A. The Customer has requested that DNV KEMA Renewables, Inc. (DNV GL) perform Project Development services, including a sound modeling assessment for the Glacier Ridge Wind Project (the "Project") located in Barnes County, North Dakota.

The Project layout considered for the sound assessment currently consists of 99 Vestas V126 STE wind turbine generators operating in Noise Mode 0 at a hub height of 285 feet (87 m). This layout includes 12 alternate locations. These turbines can have an effect on the sound levels experienced at receptors in the vicinity of the site. The neighboring Ashtabula I and III projects are also considered in the assessment.

The objective of this assessment is to predict the sound levels generated by the Project's wind turbine generators at all receptors within a mile of the Project, using the ISO 9613-2 method [1] and in accordance with the North Dakota Administrative Code Energy Conversion Facility Siting Criteria, Chapter 69-06-08-01(4) [2] and Barnes County Development Code, Section 6.10 [3].

2 ENVIRONMENTAL SOUND BACKGROUND

Sound levels are expressed in the decibel unit and are quantified on a logarithmic scale to account for the large range of acoustic pressures to which the human ear is exposed. A decibel (dB) is used to quantify sound levels relative to a 0 dB reference. The reference level of 0 dB is defined as a sound pressure level of 20 micropascals (µpa), which is the typical lower threshold of hearing for humans.

Sound levels can be presented both in broadband (sound energy summed across the entire audible frequency spectrum) and in octave band spectra (audible frequency spectrum divided into bands). Frequency is expressed in the Hertz unit (Hz), measuring the cycles per second of the sound pressure waves. The audible range of humans spans from 20 to 20,000 Hz. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighting filter is applied to closely approximate the human ear's response to sound. This scale is commonly used in environmental and industrial sound. Sound expressed in the A-weighted scale is denoted dBA.

A sound source has a certain sound power level (PWL) rating which describes the amount of sound energy per unit of time. This is a basic measure of how much acoustical energy it can produce and is independent of its surroundings. Sound pressure is created as sound energy flows away from the source. The measured sound pressure level (SPL) at a given point depends not only on the power rating of the source and the distance between the source and the measurement point (geometric divergence), but also on the amount of sound energy absorbed by environmental elements between the source and the measurement point (attenuation). Sound attenuation factors include meteorological conditions such as wind direction, temperature, and humidity; sound interaction with the ground; atmospheric absorption; terrain effects; diffraction of sound around objects and topographical features; and foliage.

3 APPLICABLE REGULATIONS

The Glacier Ridge Wind Project is regulated by the North Dakota Public Service Commission (PSC) which has specific noise ordinances under the North Dakota Administrative Code Energy Conversion Facility Siting Criteria Chapter 69-06-08-01(4) [2]. The intent of this report is to verify the Project is in compliance with the North Dakota PSC and Barnes County zoning regulations.

The North Dakota Administrative Code Energy Conversion Facility Siting Criteria, Chapter 69-06-08-01(4) states:

> *(4) Additional avoidance areas for wind energy conversion facilities. A wind energy conversion facility site must not include a geographic area where, due to operation of the facility, the sound levels within one hundred feet of an inhabited residence or a community building will exceed **fifty dBA.** The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building*.

The zoning regulations for Barnes County, North Dakota do not contain any provisions specific to noise from wind energy facilities or wind turbines. General noise regulations state (Section 6.10) [3]:

> *6.10 Sustained noise of over seventy-five (75) decibels during the day and sixty-five (65) decibels at night is not allowed*.

For the purposes of this assessment, the more conservative limit of 50 dBA was applied.

4 DESCRIPTION OF THE WIND PROJECT SITE

4.1 Site description

The site is located in Barnes County, North Dakota approximately 45 miles (72 km) west of Fargo, North Dakota.

The proposed wind project is situated in relatively simple terrain, consisting of flat farm land, with wind turbine base elevations ranging from 1,245 feet to 1,510 feet. The ground cover on and near the site is primarily comprised of farm land and open fields. Dwellings are interspersed throughout the Project site.

4.2 Wind project layout

The proposed turbine layout, which consists of 99 Vestas V126 3.45 MW STE wind turbine generators at a hub height of 285 feet (87 m) operating in Noise Mode 0 and one transformer, has been provided by the Customer [4]. The layout includes 12 alternate turbines locations. The coordinates of each turbine and one transformer are presented in Appendix A.

4.3 Adjacent wind projects

NExtEra Energy Resources owns the operational wind projects Ashtabula I and Ashtabula III, located immediately to the northwest of the Glacier Ridge project. Ashtabula I and III respectively consist of 131 GE sle 1.5 MW and 39 GE xle 1.6 MW wind turbine generators at a hub height of 262 feet (80 m). In the assessment, these wind projects were considered as external cumulative sources of noise. The wind turbine locations for these projects were obtained from the Customer and confirmed with Google Earth imagery.

The closest Ashtabula I turbine is located approximately 1660 feet (506 m) from T60 of the Glacier Ridge project and approximately 1490 feet (454 m) from the nearest receptor in this report.

The closest Ashtabula III turbine is located approximately 3.7 miles (5,971 m) from T77 of the Glacier Ridge project and approximately 3.4 miles (5,432 m) from the nearest receptor in this report.

Sound power level information for the GE sle 1.5 MW and GE xle 1.6 MW wind turbines, as well as the respective transformer locations and sound power levels, were retrieved from the Ashtabula III Wind Energy Center Acoustic Assessment [5].

The coordinates for Ashtabula I and III turbines and transformers are shown in Appendix A.

4.4 Receptor locations

A list of 128 receptors to be considered as sound receptors was provided by the Customer and validated by DNV GL using available aerial imagery. Of the 128 total identified receptors provided by the Customer [6], results for 49 receptors located within 1 mile (approximately 1,600 m) of the project turbines are reported here. It should be noted that results up to a distance of 100 feet from receptors are computed, and the highest result is presented in Section 6, in order to comply with [2]. Coordinates of each receptor center are presented in Appendix B.

5 SOUND ASSESSMENT

5.1 Description of the sound source

The sources of sound considered in this analysis are the Project wind turbine generators and transformer. Sound associated with other sources in the vicinity of the Project, such as construction activities, have not been considered.

Broadband sound power levels and octave band distributions for the Vestas V126 3.45 MW STE (serrated trailing edges) wind turbine generators, at a hub height of 285 feet (87 m), were provided by the Customer [7]. This acoustic emissions data was determined in accordance with the IEC 61400-11 standard [8]. At the request of the Customer, an uncertainty level of 2 dBA was added to the maximum wind turbine acoustic emission. The maximum wind turbine acoustic emission plus the 2 dB uncertainty level (total of 109.3 dBA) is considered in this assessment and is presented in Table 5-1.

Table 5-1 Vestas V126 3.45 MW STE Mode 0 acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband
Sound Power Level [dBA]	80.7	89.2	94.8	100.6	104.5	105.0	99.6	91.3	69.6	109.3

For the transformer, a broadband sound power level of 116.6 dBA was estimated based on standard NEMA TR.1 Table 0-1 [9] and IEEE standard C57.12.90-2006 [10] for one 330 MVA, 345 kV utility scale transformer, as specified by the customer. A typical transformer octave band distribution was estimated, as shown in Table 5-2. The sound power level of the transformer includes a 5 dB penalty for tonality.

Table 5-2 Transformer acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband
Sound Power Level [dBA]	73.8	93.0	105.1	107.6	113.0	110.2	106.4	101.2	92.1	116.6

5.2 Ashtabula I and III wind projects

The octave band sound power levels used to model the GE sle 1.5 MW wind turbines belonging to Ashtabula I Wind Energy Center are shown in Table 5-3. These were taken from the Ashtabula III Wind Energy Center Acoustic Assessment [5].

Table 5-3 Ashtabula I Wind Energy Center – GE sle 1.5 MW acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband
Sound Power Level [dBA]	N/A	87.1	96.0	99.2	100.6	99.9	96.5	89.3	80.1	106.0

The octave band sound power levels used to model the GE xle 1.6 MW wind turbines belonging to Ashtabula III Wind Energy Center are shown in. These were taken from the project acoustic assessment [5].

Table 5-4 Ashtabula III Wind Energy Center – GE xle 1.6 MW acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband
Sound Power Level [dBA]	N/A	86.8	95.6	101.2	102.8	102.1	99.3	91.1	88.2	108.0

For the Ashtabula III transformer, a broadband sound power level of 108.4 dBA was used, using the octave band sound power levels in the acoustic assessment [5]. This includes a 5 dB tonal penalty as per industry best practice. A typical transformer octave distribution was used in the acoustic assessment, as shown in Table 5-5.

Table 5-5 Ashtabula III Wind Energy Center – Transformer acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
Sound Power Level [dB]	105	111	113	108	108	102	97	92	85	108.4

For the Ashtabula I transformer, details were not provided in the acoustic assessment report. Therefore, a broadband sound power level of 111.4 dBA was estimated using the Ashtabula III transformer sound power levels [5] and adding 3 dBA due to the total capacity of the Ashtabula I project being substantially larger than Ashtabula III. It should be noted that the Ashtabula I transformer has negligible sound contribution to Glacier Ridge receptors. The overall broadband value includes a 5 dB tonal penalty as per industry best practice. The modeled octave band sound power levels, scaled up from Table 5-5, are shown in Table 5-6.

Table 5-6 Ashtabula I Wind Energy Center – Transformer acoustic emission summary

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
Sound Power Level [dB]	108	114	116	111	111	105	100	95	88	111.4

5.3 Assessment methodology

The sound pressure level (SPL) at each receptor for the aggregate of all wind turbine generators and transformers associated with the Glacier Ridge Wind Project were calculated using CadnaA 4.2 acoustic modeling software based on the ISO 9613-2 method [1]. The simulation was run for the wind speed corresponding with the maximum sound power level (PWL) of the turbines and the maximum sound power level of the transformer. The hub height of the turbines is 285 feet (87 m). The Glacier Ridge transformer was modeled as a point source at a height of 16 feet (4.9 m)above ground level, assuming the transformer is raised 1 foot (0.3 m) above the ground. The transformers for Ashtabula I and III was modeled as point sources at a height of 14.8 feet (4.5 m) above ground level. All receptors were modeled at a best practice height of 4.9 feet (1.5 m).

The ISO 9613 standard provides a prediction of the equivalent continuous sound pressure level at a distance from one or more point sources. The method consists of octave-band algorithms (i.e., with nominal mid-band frequencies from 31.5 Hz to 8 kHz) for calculating the attenuation of the emitted sound. The algorithm takes into account the following physical effects:

- Geometrical divergence – attenuation due to spherical spreading from the sound source
- Atmospheric absorption – attenuation due to absorption by the atmosphere
- Ground absorption – attenuation due to the acoustical properties of the ground

The ISO 9613 standard calculates attenuation under meteorological conditions favorable to propagation from sources of sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as it commonly occurs at night. In other words, though a physical impracticality, the ISO 9613-2 standard treats every receptor as being downwind from every source of sound emission (in this case, turbines and transformers).

The ISO 9613-2 standard accounts for ground effect by assigning a numerical coefficient (G) with a value ranging from 0 to 1. A G = 0 equates to hard ground (paving, water, ice, concrete, tamped ground, and other ground surfaces with a low porosity), while a G = 1 equates to porous ground (ground covered by grass, trees, or other vegetation, and other ground surfaces suitable for the growth of vegetation such as farming land). Though the ground use on and around the site is farming, a mixed (semi-reflective) global ground factor of G = 0.5 was used in this assessment, with the exception of G = 0 for water bodies.

Additionally, temperature, barometric pressure, and humidity parameters were selected to represent conditions favorable to sound propagation, and topographical information to accurately represent terrain in three-dimensions was included in this assessment.

Specifically, the ISO 9613-2 parameters were set as follows:

- Ambient air temperature: 50ºF (10ºC)
- Ambient barometric pressure: 101.32 kPa
- Humidity: 70%
- Overall ground factor: 0.5
- Topography included

Additional attenuation from foliage was not considered in this assessment, implying that the lower sound levels are expected in areas where there is foliage present in the line of sight between any turbine and a sound receptor. Similarly, because the model assumes every receptor is downwind of every sound source at all times, lower sound levels are expected at times when a receptor is upwind of any sound source [1].

The wind turbine and transformer sound emission ratings used for each octave band were those specified in Table 5-1 to Table 5-6. The sound impact was calculated for each receptor and the calculated sound level was then compared with the applicable sound limit.

No distinction was made between daytime or night time sound emissions in the simulation because the project is assumed to be operating at maximum capacity at all times.

6 RESULTS

Detailed maps illustrating predicted sound pressure levels at receptors located in the vicinity of the Project is presented in Figure 6-1 to Figure 6-8.

The results of the sound study are presented for all sound receptors in tabular format in Appendix B. For each receptor, the following information is provided:

- ID;
- Coordinates in UTM projection and NAD83 Datum;
- Sound levels in dBA at the receptor location at 4.9 feet (1.5 m) above ground level. The results presented are for the highest value within 100 feet (30.5 m) of a given receptor, in order to comply with [2];
- Closest wind turbine; and
- Distance to the closest wind turbine.

The sound pressure levels at each of the 49 receptors located within 1 mile (approximately 1,600 m) of a project turbine are within the allowable limits under the applicable regulations. The highest modelled result is 48.3 dBA at receptor ID 57.

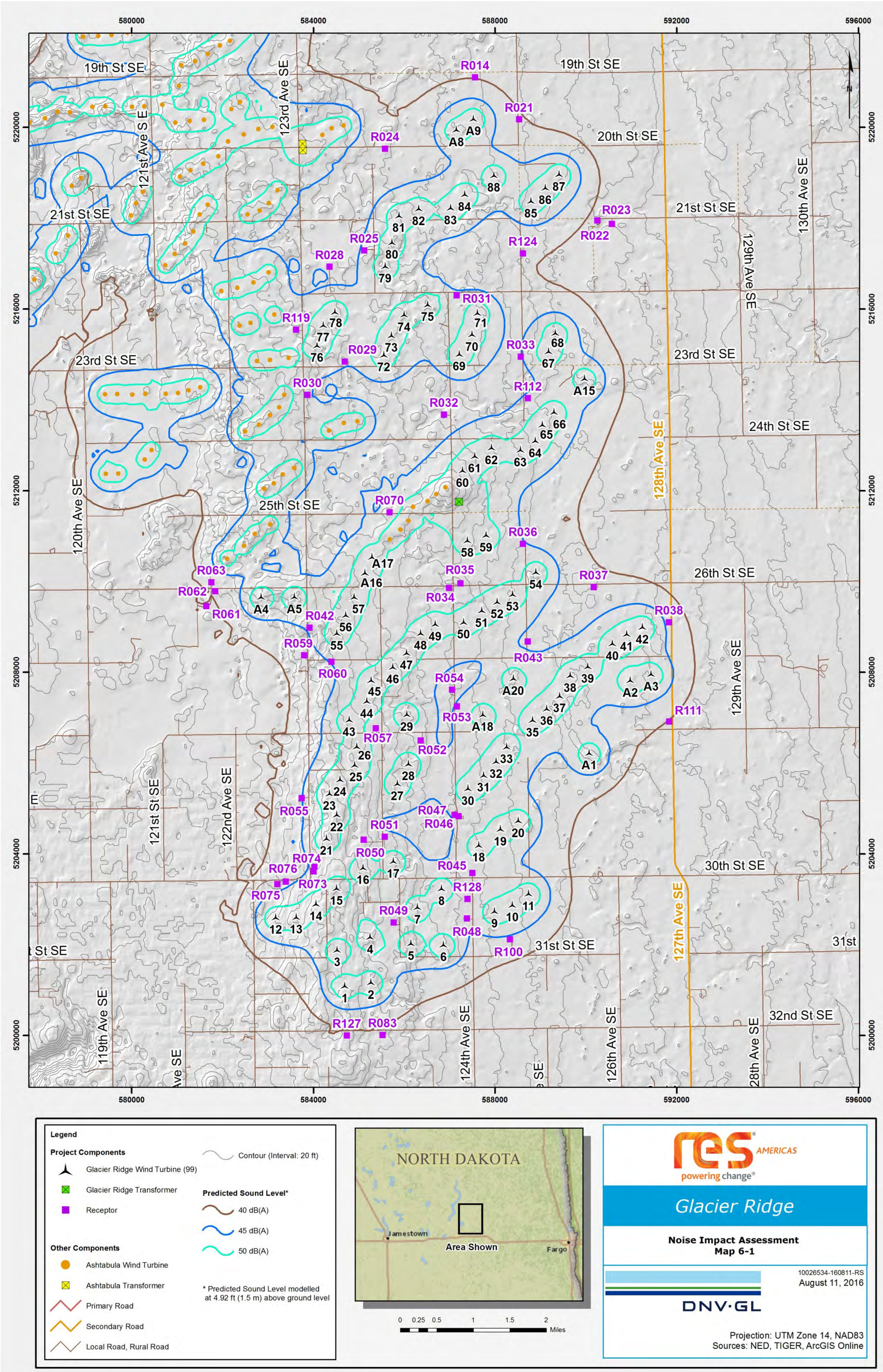

Figure 6-1 Modeled sound levels at Glacier Ridge Wind Project

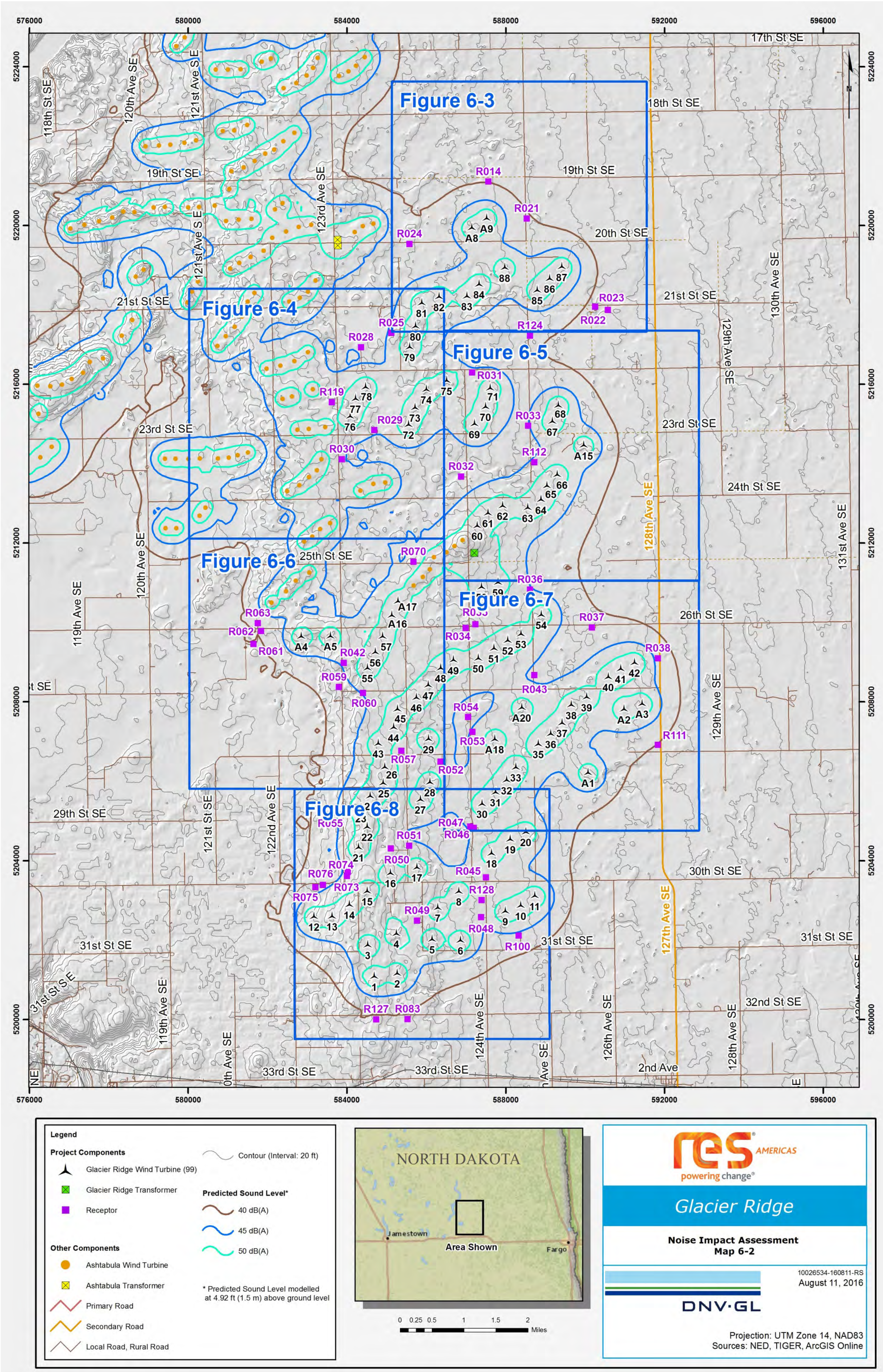

Figure 6-2 Key Map for Detailed Figures

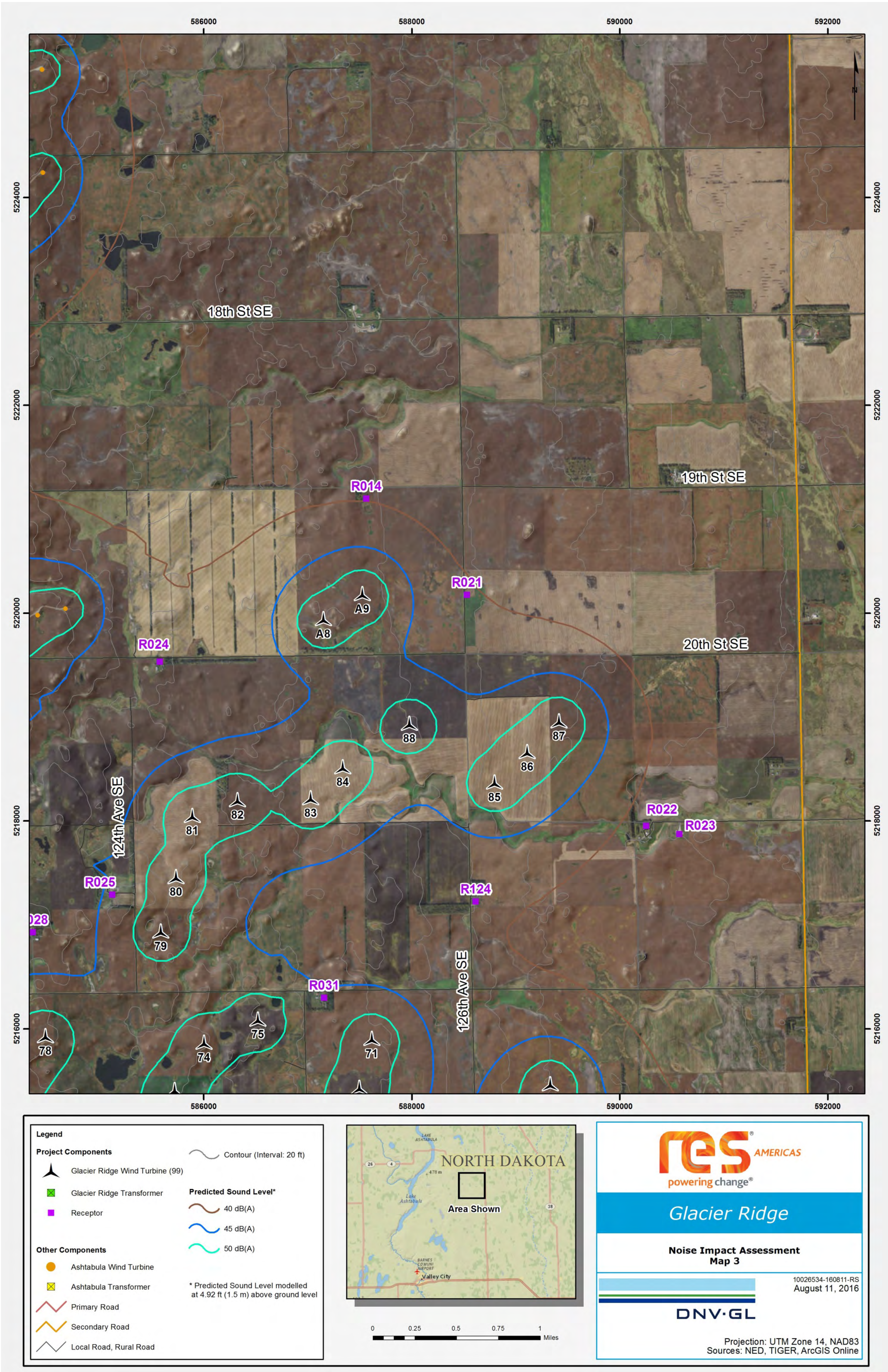

Figure 6-3 Detailed Isocontour Map 1

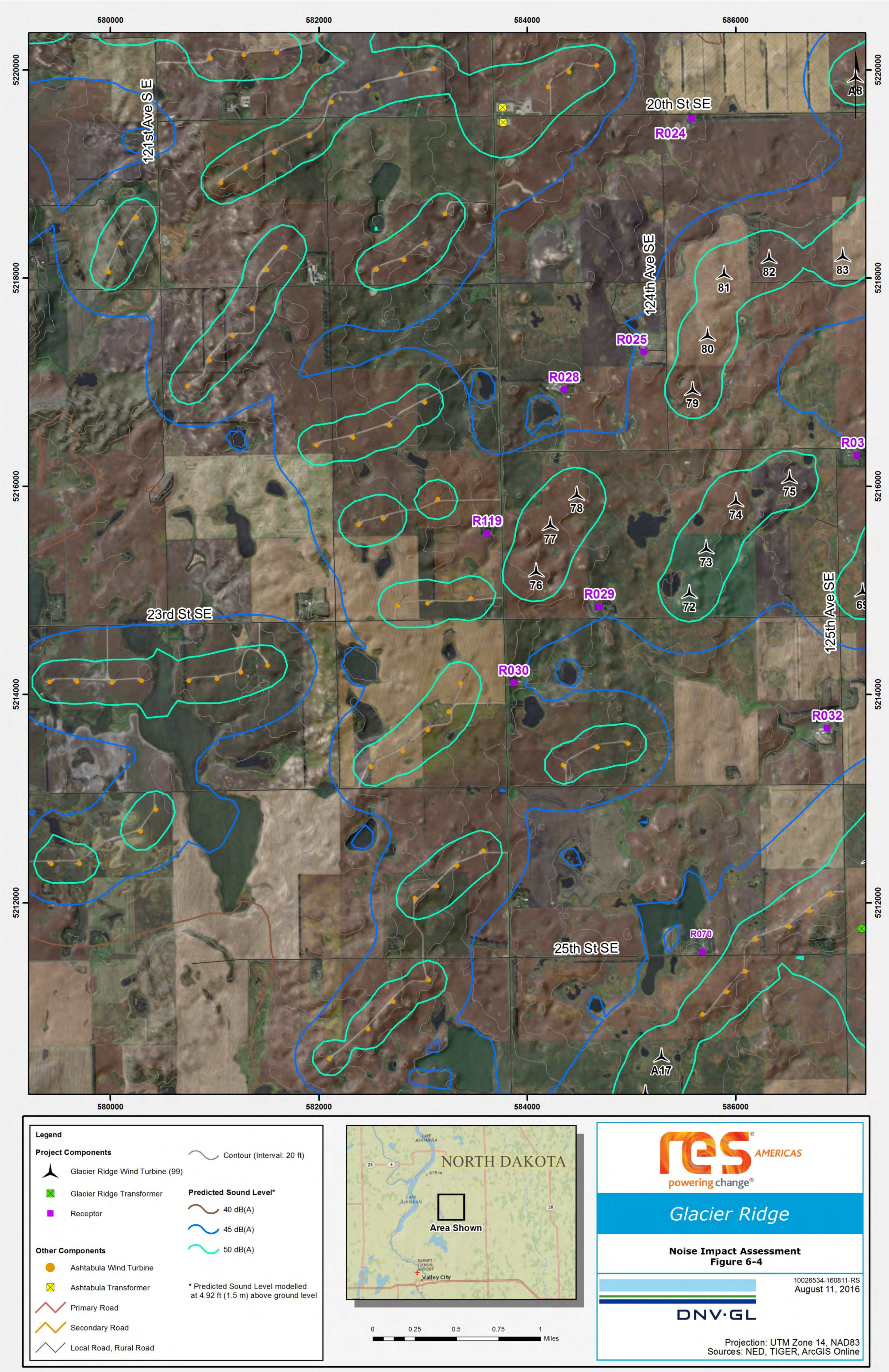

Figure 6-4 Detailed Isocontour Map 2

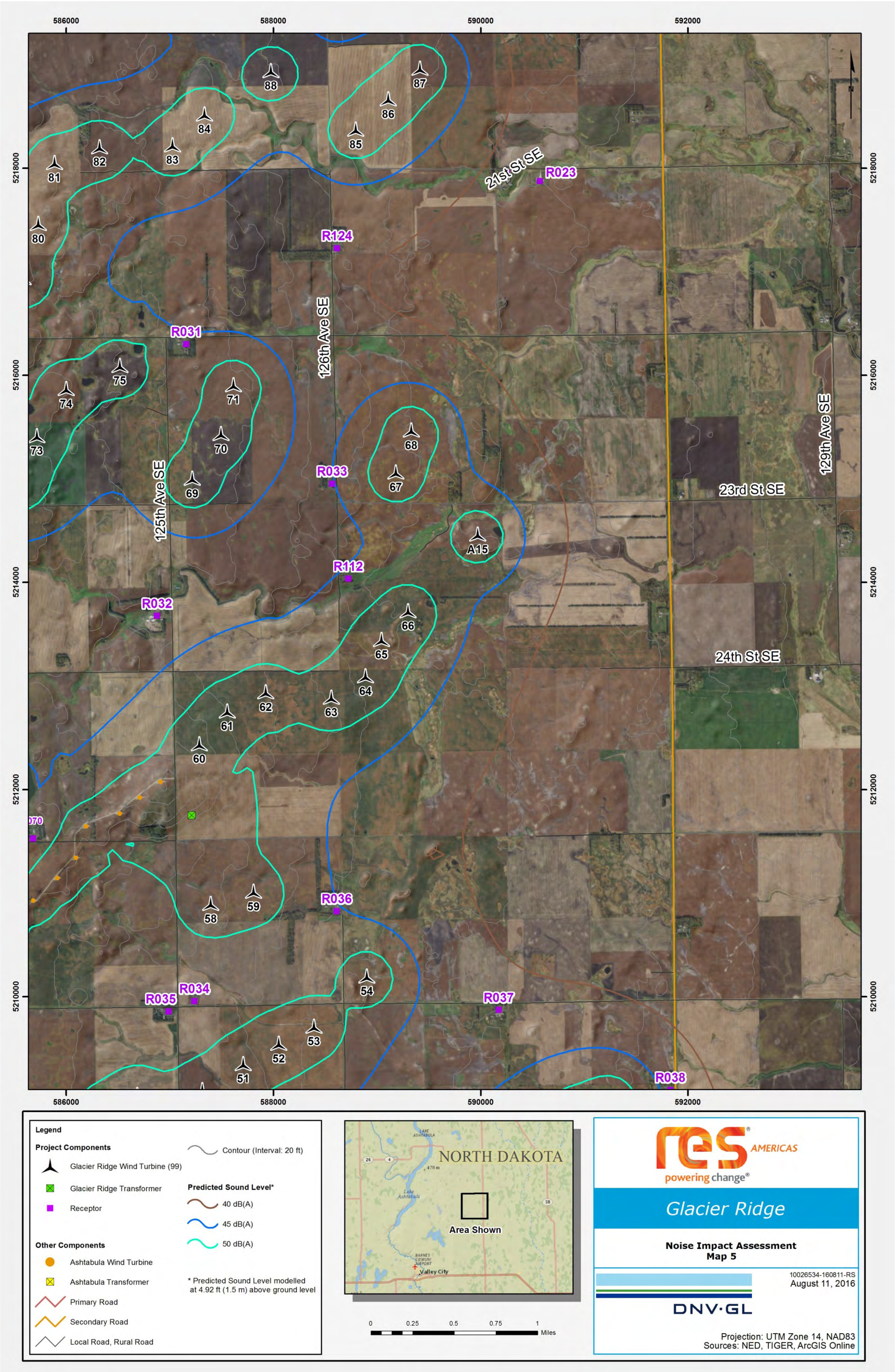

Figure 6-5 Detailed Isocontour Map 3

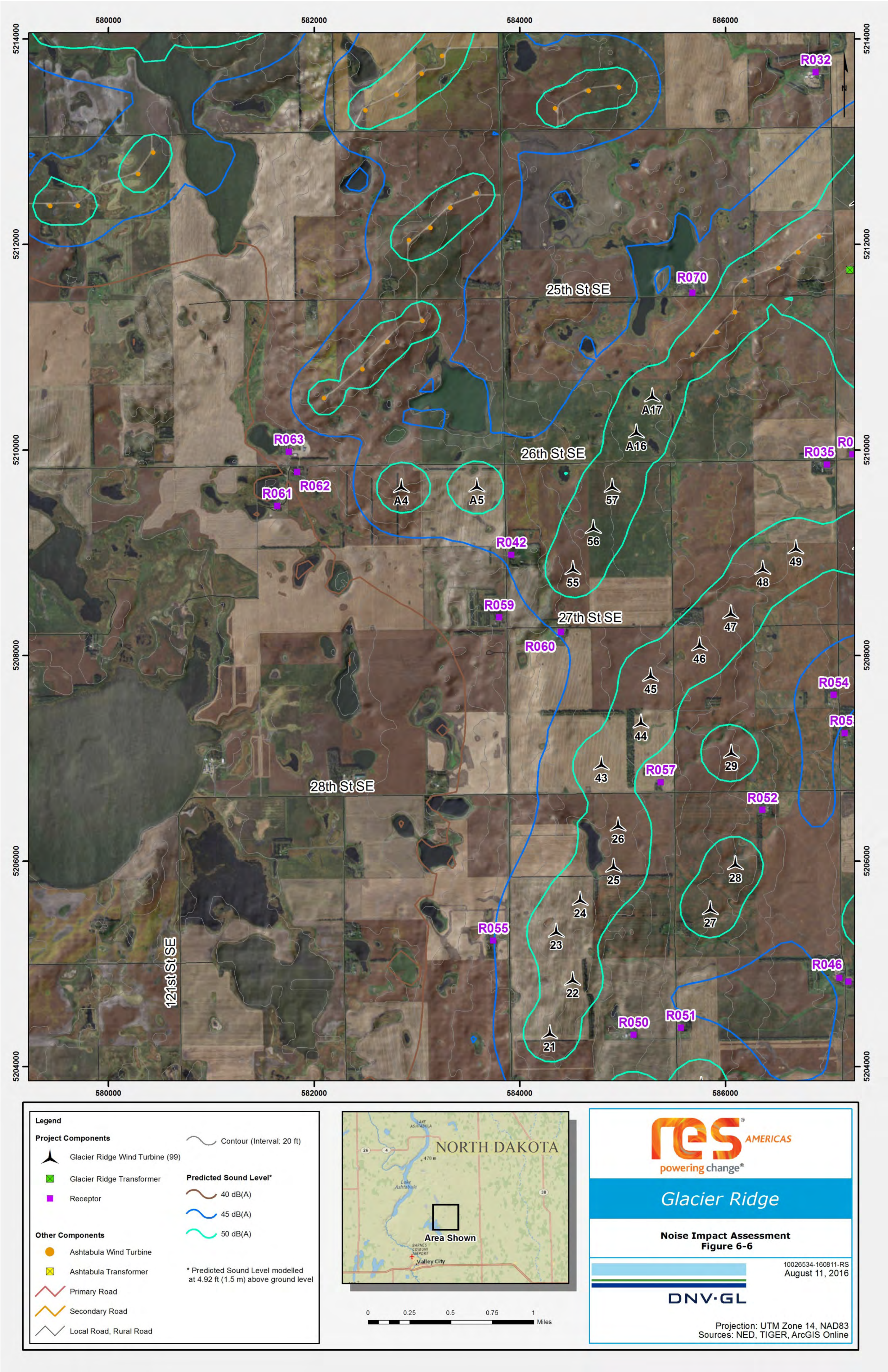

Figure 6-6 Detailed Isocontour Map 4

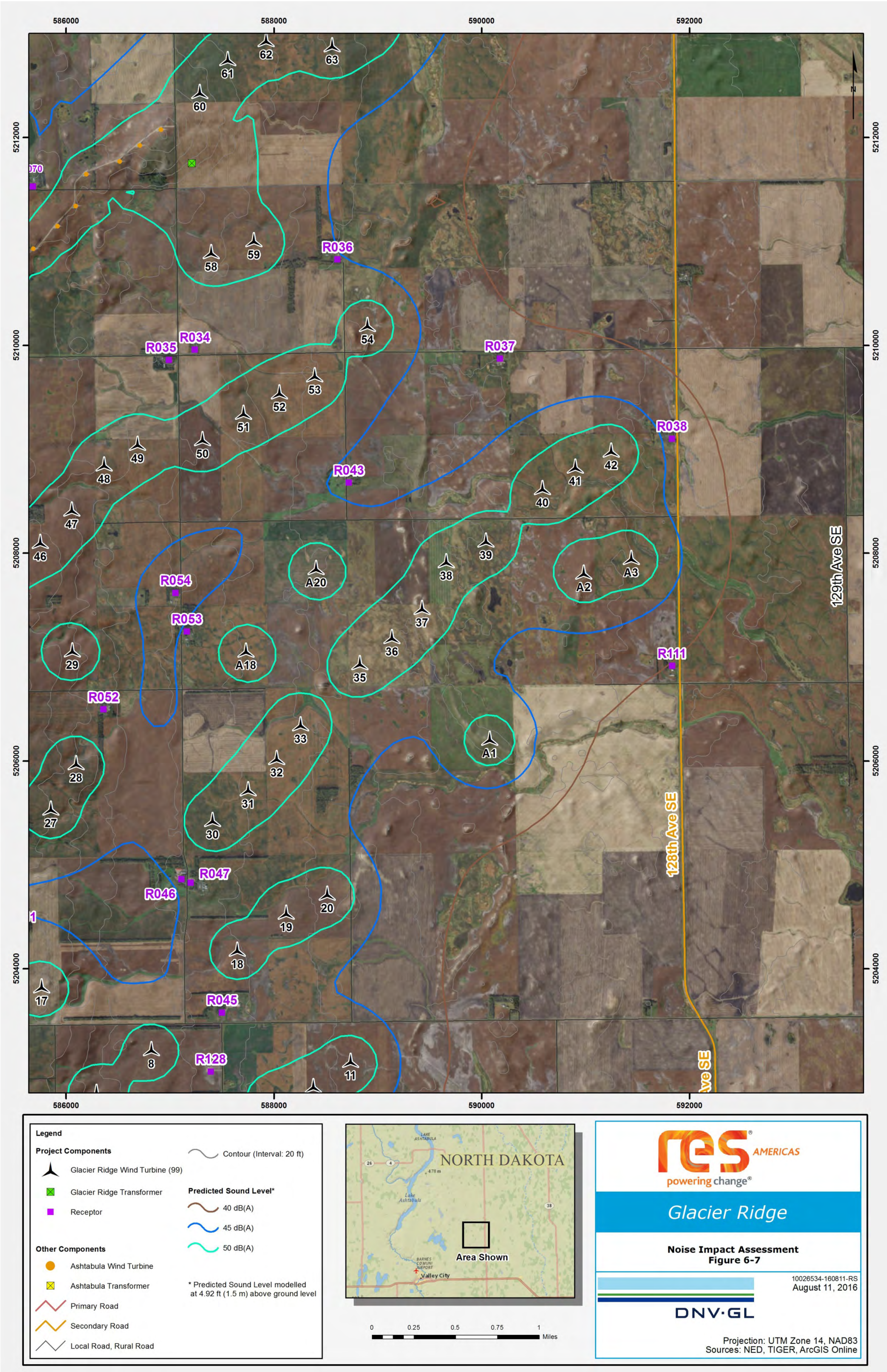

Figure 6-7 Detailed Isocontour Map 5

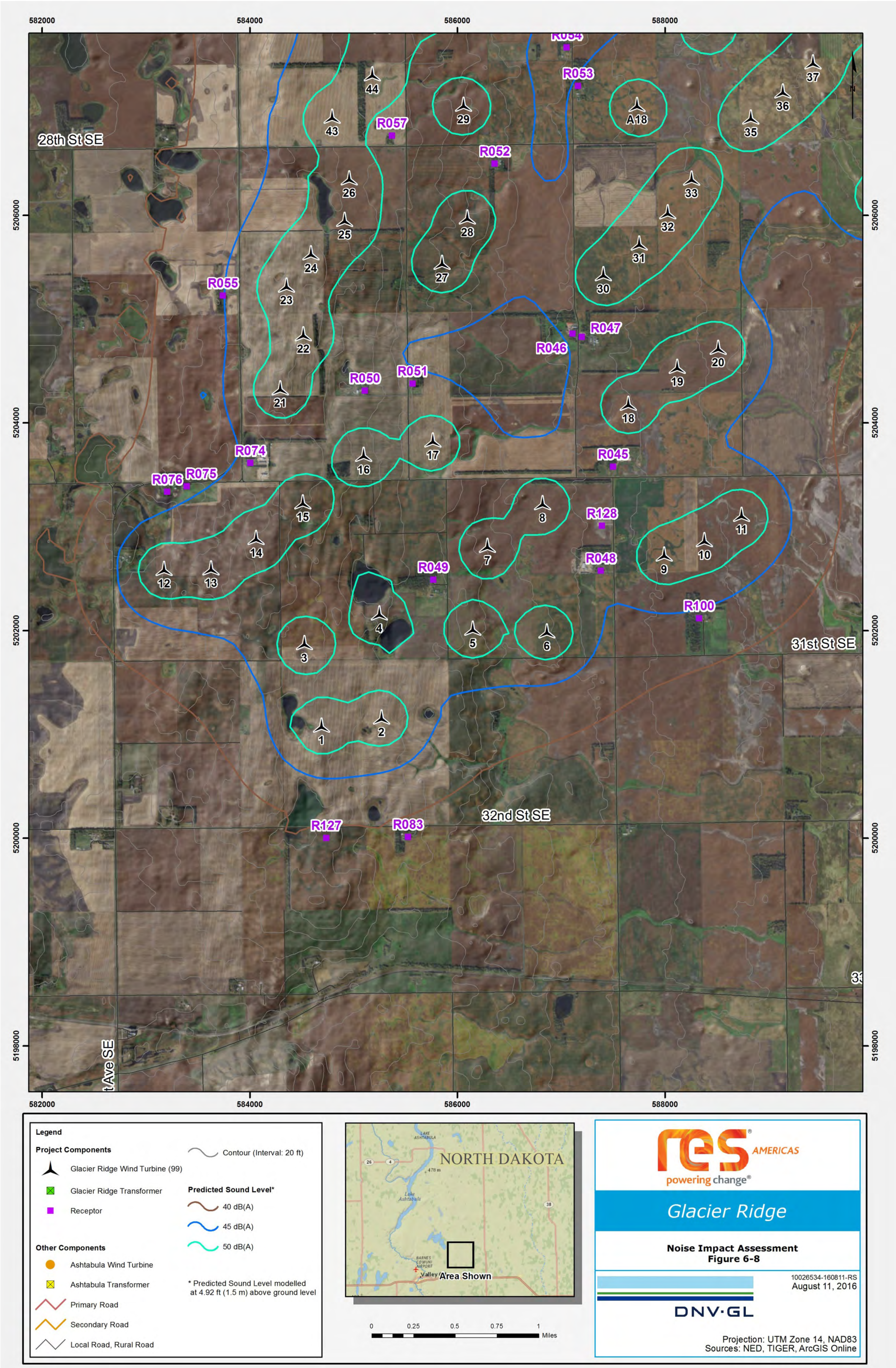

Figure 6-8 Detailed Isocontour Map 6

7 CONCLUSION

An analysis has been conducted to determine the maximum sound levels predicted to be experienced at sound receptors in the vicinity of the Glacier Ridge Wind Project in Barnes County, North Dakota. This analysis was undertaken specifically for the Vestas V126 3.45 MW STE Mode 0 wind turbine generator at a hub height of 285 feet (87 m). 99 turbines (including 12 alternate locations), one transformer, and the adjacent Ashtabula I and III wind projects were included in the model.

The results indicate that the calculated sound levels are within the allowable limits under the North Dakota Administrative Code Energy Conversion Facility Siting Criteria regulations and the Barnes County regulations at each of the 49 receptors located within a mile (approximately 1,600 m) of the project turbines.

8 REFERENCES

[1] International Organization for Standardization. ISO 9613-2: Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation. 15 December 1996.

[2] North Dakota Administrative Code. Chapter 69-06-08-01. Energy conversion facility siting criteria.

[3] Barnes County Development Code. Section 6.10. Noise. Barnes County, North Dakota. 2016.

[4] Turbine layout locations sent by email, by RES, to B. Moreira, DNV GL, 15 August 2016, “pUSAevg144_wAlternates_NorthDakota_NAD83_USft.csv”.

[5] Tetratech EC, INC. Ashtabula III Wind Energy Center Acoustic Assessment Barnes County, North Dakota, NextEra Energy Resources, July 2010.

[6] Receptor locations sent by email, by RES, to B. Moreira, DNV GL, 20 June 2016, “houses 5_31_16”.

[7] Turbine acoustic specifications sent by email, by RES, to B. Moreira, DNV GL, 13 June 2016, “Vestas_-_3MW_Platform_General_Description_r2.pdf” and “0055-1400_V00 - V126-3_45MW Low Torque Third Octaves.pdf”.

[8] International Electrotechnical Commission. IEC 61400-11 Wind Turbine Generator Systems – Part 11: Acoustic Measurement Techniques. 07 November 2012.

[9] National Electrical Manufacturers Association. NEMA Standards Publication No TR 1-1993 (R2000): Transformers, Regulators, and Reactors. 2000.

[10] C57.12.90-2006 IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.

APPENDIX A – WIND TURBINE GENERATOR AND TRANSFORMER COORDINATES

Glacier Ridge Wind Project wind turbine and transformer coordinates given in UTM Zone 14, NAD 83 Datum.

Customer ID	Easting [m]	Northing [m]
A1	590076	5206196
A2	590981	5207795
A3	591439	5207934
A4	582849	5209629
A5	583584	5209635
A8	587150	5219922
A9	587524	5220163
A15	589971	5214442
A16	585134	5210160
A17	585288	5210512
A18	587730	5207044
A20	588406	5207838
T1	584691	5201066
T2	585268	5201144
T3	584526	5201860
T4	585247	5202145
T5	586148	5202000
T6	586861	5201974
T7	586290	5202798
T8	586821	5203209
T9	587992	5202713
T10	588380	5202851
T11	588737	5203096
T12	583173	5202575
T13	583626	5202581
T14	584061	5202873
T15	584510	5203216
T16	585095	5203673
T17	585763	5203813
T18	587646	5204166
T19	588117	5204521
T20	588513	5204705
T21	584292	5204315
T22	584515	5204835
T23	584354	5205304
T24	584587	5205613
T25	584913	5205936
T26	584956	5206337
T27	585852	5205522
T28	586096	5205960
T29	586058	5207046
T30	587407	5205414

Customer ID	Easting [m]	Northing [m]
T31	587750	5205710
T32	588027	5206010
T33	588256	5206335
T35	588827	5206922
T36	589136	5207175
T37	589425	5207453
T38	589657	5207903
T39	590041	5208102
T40	590586	5208607
T41	590902	5208814
T42	591247	5208969
T43	584793	5206931
T44	585178	5207338
T45	585273	5207795
T46	585749	5208090
T47	586053	5208401
T48	586364	5208835
T49	586685	5209034
T50	587313	5209079
T51	587708	5209332
T52	588051	5209527
T53	588391	5209693
T54	588900	5210177
T55	584516	5208832
T56	584714	5209233
T57	584898	5209633
T58	587395	5210877
T59	587807	5210994
T60	587285	5212419
T61	587554	5212735
T62	587925	5212919
T63	588559	5212869
T64	588889	5213074
T65	589041	5213426
T66	589298	5213703
T67	589180	5215042
T68	589331	5215446
T69	587217	5214981
T70	587494	5215412
T71	587614	5215885
T72	585554	5214964
T73	585717	5215393
T74	586001	5215847
T75	586517	5216070
T76	584083	5215171
T77	584221	5215618

Customer ID	Easting [m]	Northing [m]
T78	584475	5215910
T79	585585	5216917
T80	585730	5217440
T81	585888	5218030
T82	586321	5218182
T83	587027	5218200
T84	587333	5218498
T85	588794	5218350
T86	589109	5218643
T87	589415	5218939
T88	587977	5218917
Transformer	587210	5211751

Ashtabula I Wind Project wind turbine and transformer coordinates given in UTM Zone 14, NAD 83 Datum.

ID	Easting [m]	Northing [m]
Ash-N1	580537	5226982
Ash-N2	580888	5227010
Ash-N3	581367	5227242
Ash-N4	581624	5227421
Ash-N5	583912	5226912
Ash-N6	584200	5227141
Ash-N7	584487	5227433
Ash-N8	579706	5224510
Ash-N9	579914	5224736
Ash-N10	580007	5225014
Ash-N11	579929	5225549
Ash-N12	579983	5225833
Ash-N13	580147	5226374
Ash-N14	583881	5225080
Ash-N15	584164	5225180
Ash-N16	584445	5225233
Ash-N17	580696	5223928
Ash-N18	581004	5223927
Ash-N19	581323	5223937
Ash-N20	581854	5224128
Ash-N21	582085	5224209
Ash-N22	582406	5223456
Ash-N23	582726	5223588
Ash-N24	582984	5223776
Ash-N25	583153	5223970
Ash-N26	583269	5224217
Ash-N27	583802	5223762
Ash-N28	584041	5223879
Ash-N29	584233	5224021
Ash-N30	584452	5224241
Ash-N31	580874	5222381
Ash-N32	581159	5222395
Ash-N33	581488	5222534
Ash-N34	579983	5218061
Ash-N35	580096	5218334
Ash-N36	580247	5218585
Ash-N37	581060	5218914
Ash-N38	581292	5219058
Ash-N39	581574	5219205
Ash-N40	581907	5219363
Ash-N41	582123	5219693
Ash-N42	582470	5219845
Ash-N43	582789	5219965
Ash-N44	583100	5220014
Ash-N45	580742	5216963
Ash-N46	580950	5217211
Ash-N47	581173	5217446
Ash-N48	581357	5217709
Ash-N49	581499	5218081

ID	Easting [m]	Northing [m]
Ash-N50	581675	5218299
Ash-N51	582553	5218083
Ash-N52	582819	5218175
Ash-N53	583022	5218332
Ash-N54	583211	5218617
Ash-N55	581976	5216395
Ash-N56	582327	5216468
Ash-N57	582680	5216587
Ash-N58	583018	5216808
Ash-N59	582380	5215632
Ash-N60	582618	5215692
Ash-N61	583142	5215877
Ash-N62	579415	5214123
Ash-N63	579680	5214126
Ash-N64	580013	5214115
Ash-N65	580299	5214132
Ash-N66	580751	5214134
Ash-N67	581022	5214151
Ash-N68	581252	5214214
Ash-N69	581507	5214280
Ash-N70	582758	5214852
Ash-N71	583044	5214877
Ash-N72	583459	5214924
Ash-N73	579433	5212373
Ash-N74	579702	5212377
Ash-N75	580289	5212686
Ash-N76	580436	5212895
Ash-N77	582499	5213306
Ash-N78	582804	5213457
Ash-N79	583047	5213661
Ash-N80	583246	5213835
Ash-N81	583361	5214109
Ash-N82	582098	5210503
Ash-N83	582472	5210787
Ash-N84	582713	5211052
Ash-N85	583054	5211258
Ash-N86	582923	5212043
Ash-N87	583132	5212162
Ash-N88	583326	5212357
Ash-N89	583579	5212501
Ash-N90	584344	5213323
Ash-N91	584672	5213493
Ash-N92	584968	5213529
Ash-N93	585684	5210929
Ash-N94	585917	5211147
Ash-N95	586094	5211342
Ash-N96	586195	5211647
Ash-N97	586518	5211770
Ash-N98	586711	5211924
Ash-N99	586914	5212076
Ash-O1	578930	5221996

ID	Easting [m]	Northing [m]
Ash-O2	579266	5222012
Ash-O3	579553	5222037
Ash-O4	579906	5222084
Ash-O5	580200	5222143
Ash-O6	577033	5219922
Ash-O7	577389	5220017
Ash-O8	577753	5220106
Ash-O9	578091	5220200
Ash-O10	578369	5220348
Ash-O11	578646	5220335
Ash-O12	579134	5220454
Ash-O13	579420	5220464
Ash-O14	580006	5220454
Ash-O15	580278	5220467
Ash-O16	580674	5220501
Ash-O17	581039	5220915
Ash-O18	581095	5221368
Ash-O19	581398	5221458
Ash-O20	581678	5221621
Ash-O21	581942	5221805
Ash-O22	582167	5221907
Ash-O23	582403	5222119
Ash-O24	582678	5222333
Ash-O25	580959	5220110
Ash-O26	581279	5220146
Ash-O27	581595	5220166
Ash-O28	582192	5220403
Ash-O29	582384	5220560
Ash-O30	584199	5219835
Ash-O31	584402	5219980
Ash-O32	584668	5220042
AshI-Tranformer	583763	5219639

Ashtabula III Wind Project wind turbine and transformer coordinates given in UTM Zone 14, NAD 83 Datum.

ID	Easting [m]	Northing [m]
AshIII-T1	581721	5229602
AshIII-T2	582016	5229633
AshIII-T3	582186	5229853
AshIII-T4	582168	5230781
AshIII-T5	582340	5231145
AshIII-T6	582519	5231456
AshIII-T7	582928	5230353
AshIII-T8	583123	5230550
AshIII-T9	583307	5230758
AshIII-T10	583770	5230782
AshIII-T11	584067	5230996
AshIII-T12	584319	5231298
AshIII-T13	581041	5227910
AshIII-T14	581212	5228164
AshIII-T15	582159	5228049
AshIII-T16	582521	5228018
AshIII-T17	582918	5228061
AshIII-T18	583316	5228276
AshIII-T19	583679	5228371
AshIII-T20	583931	5228483
AshIII-T21	584656	5227984
AshIII-T22	584973	5228196
AshIII-T23	586052	5228815
AshIII-T24	586340	5228838
AshIII-T25	575909	5213922
AshIII-T26	576276	5214162
AshIII-T27	576564	5214424
AshIII-T28	576228	5215256
AshIII-T29	576203	5215966
AshIII-T30	576526	5215948
AshIII-T31	576825	5215990
AshIII-T32	577065	5216137
AshIII-T33	577355	5216291
AshIII-T34	577522	5216565
AshIII-T35	577858	5216655
AshIII-T36	578330	5217223
AshIII-T37	578594	5217617
AshIII-T38	578679	5218712
AshIII-T39	578882	5218888
AshIII-Tranformer	583767	5219495

APPENDIX B – RECEPTOR LOCATIONS AND ASSOCIATED SOUND LEVELS

Receptor ID	UTM Coordinates[1]		Calculated SPL at Receptor [dBA][2]	Nearest Turbine [ID]	Distance to Nearest Turbine [feet]
	Easting [m]	Northing [m]			
R014	587562	5221104	40.0	A9	3089
R021	588531	5220177	40.8	A9	3304
R022	590255	5217954	38.7	T87	4247
R023	590572	5217874	37.1	T87	5159
R024	585578	5219533	41.2	T81	5034
R025	585118	5217293	46.1	T79	1966
R028	584354	5216931	43.1	T78	3372
R029	584690	5214845	45.6	T76	2262
R030	583869	5214113	45.7	T76	3542
R031	587158	5216301	45.9	T71	2025
R032	586878	5213678	42.9	T61	3808
R033	588565	5214953	45.0	T67	2039
R034	587238	5209958	46.4	T51	2568
R035	586989	5209860	46.1	T50	2774
R036	588612	5210827	45.4	T54	2334
R037	590176	5209874	41.5	T41	4216
R038	591832	5209102	44.1	T42	1969
R042	583918	5208982	45.9	T55	2022
R043	588721	5208679	44.7	A20	2947
R045	587501	5203580	45.9	T18	1981
R046	587109	5204862	45.7	T30	2057
R047	587199	5204831	46.0	T30	2032
R048	587383	5202578	45.7	T9	2047
R049	585767	5202491	47.1	T7	1990
R050	585108	5204313	46.5	T16	2100
R051	585569	5204380	45.8	T17	1967
R052	586360	5206498	46.6	T28	1968
R053	587162	5207247	45.5	A18	1980
R054	587053	5207619	44.4	A18	2914
R055	583742	5205228	45.2	T23	2022
R057	585372	5206769	48.3	T26	1968
R059	583799	5208374	42.8	T55	2792
R060	584400	5208230	45.5	T55	2011
R061	581643	5209458	39.0	A4	3997
R062	581835	5209785	41.0	A4	3365
R063	581753	5209984	41.5	A4	3779
R070	585680	5211529	47.7	A17	3574
R073	584021	5203718	46.2	T21	2152
R074	584004	5203615	46.1	T15	2113
R075	583392	5203391	44.2	T13	2769
R076	583205	5203338	43.8	T12	2506
R083	585526	5200014	38.6	T2	3804
R100	588329	5202120	44.3	T9	2238

<table>
<tr><th rowspan="2">Receptor ID</th><th colspan="2">UTM Coordinates[1]</th><th rowspan="2">Calculated SPL at Receptor [dBA][2]</th><th rowspan="2">Nearest Turbine [ID]</th><th rowspan="2">Distance to Nearest Turbine [feet]</th></tr>
<tr><th>Easting [m]</th><th>Northing [m]</th></tr>
<tr><td>R111</td><td>591834</td><td>5206916</td><td>40.0</td><td>A3</td><td>3581</td></tr>
<tr><td>R112</td><td>588722</td><td>5214037</td><td>46.0</td><td>T66</td><td>2185</td></tr>
<tr><td>R119</td><td>583617</td><td>5215549</td><td>47.6</td><td>T76</td><td>1967</td></tr>
<tr><td>R124</td><td>588614</td><td>5217226</td><td>40.9</td><td>T85</td><td>3735</td></tr>
<tr><td>R127</td><td>584738</td><td>5200004</td><td>39.2</td><td>T1</td><td>3487</td></tr>
<tr><td>R128</td><td>587393</td><td>5203011</td><td>46.1</td><td>T8</td><td>1986</td></tr>
</table>

Note 1: Coordinates given in UTM Zone 14, NAD83 Datum
Note 2: Highest value within 100 feet from the receptor center

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