REPORT

FIGHTING PIKE DATA CENTER

WILLISTON, WILLIAMS COUNTY, NORTH DAKOTA

NOISE IMPACT ASSESSMENT
RWDI # 2509411 REV2
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SUBMITTED TO

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1. INTRODUCTION

RWDI was retained by Critical Data House to conduct a Noise Impact Assessment (NIA) for the proposed Fighting Pike Data Center (the Project) in Williston, North Dakota. Williston, ND, has not enacted noise ordinances specific to permitted noise emissions for industrial developments, therefore, this NIA also suggests noise emission criteria limits suitable for residential and commercial receptors in the area surrounding the Project development. This NIA was prepared to evaluate the environmental noise emissions of the Project development phases and includes preliminary mitigation recommendation for the Project equipment to meet the suggested criteria limits. This NIA evaluates noise associated with Project operations and does not evaluate noise impacts from the construction of the Project.

All work was completed by technical staff experienced in acoustic assessment, as detailed in **Appendix A**.

1.1 Project Description

The Project is located west of Highway 2 and north of 56 Street NW on the north side of Williston, ND. The Project consists of a data center campus development undertaken in three (3) phases. Each phase will consist of two or three data center buildings, each with fifty (50) chillers operating continuously. Each building has one (1) associated 100 MVA transformer. Each data center building has twenty-five (25) associated Caterpillar 3516 series diesel engine driven back-up power generators.

The Project is located on land currently zoned C-2 general commercial, R-2 single and two-family residential and R-4 high-rise multifamily residential. There are lands directly adjacent that are zoned for agricultural development.

1.2 Executive Summary

The predicted result of a computer aided noise propagation model indicates the initial design of the Project sound source emissions will exceed suggested criteria limits without appropriate mitigation. This NIA suggests criteria limits for the study area in the absence of defined limits for industrial development allowable decibel levels, for discussion purposes. The initial design utilizes the client provided equipment size and noise ratings from which RWDI has developed octave band sound power levels for input to the noise propagation model.

Sound source mitigation recommendations are presented for the chillers and 100 MVA transformers. The applied mitigation predicts compliance of the fully developed Project site at the existing dwellings, hotel and business, with seven (7) data center buildings and associated chillers in continuous operation.

The predicted results for emergency generator testing of one engine per building indicates that Phase 1 will comply only with the implementation of additional noise mitigation. Due to the theoretical origin of the sound power levels, the noise model has limitations when it comes to predicting tonal sounds from the Project, however, a low-frequency noise (LFN) preliminary calculation indicates that LFN will not be a primary concern related to Project environmental sound emissions.

2. FUNDAMENTALS OF NOISE

This section of the report provides basic information about noise and presents some of the terms used within the report.

2.1 Sound, Noise, and Acoustics

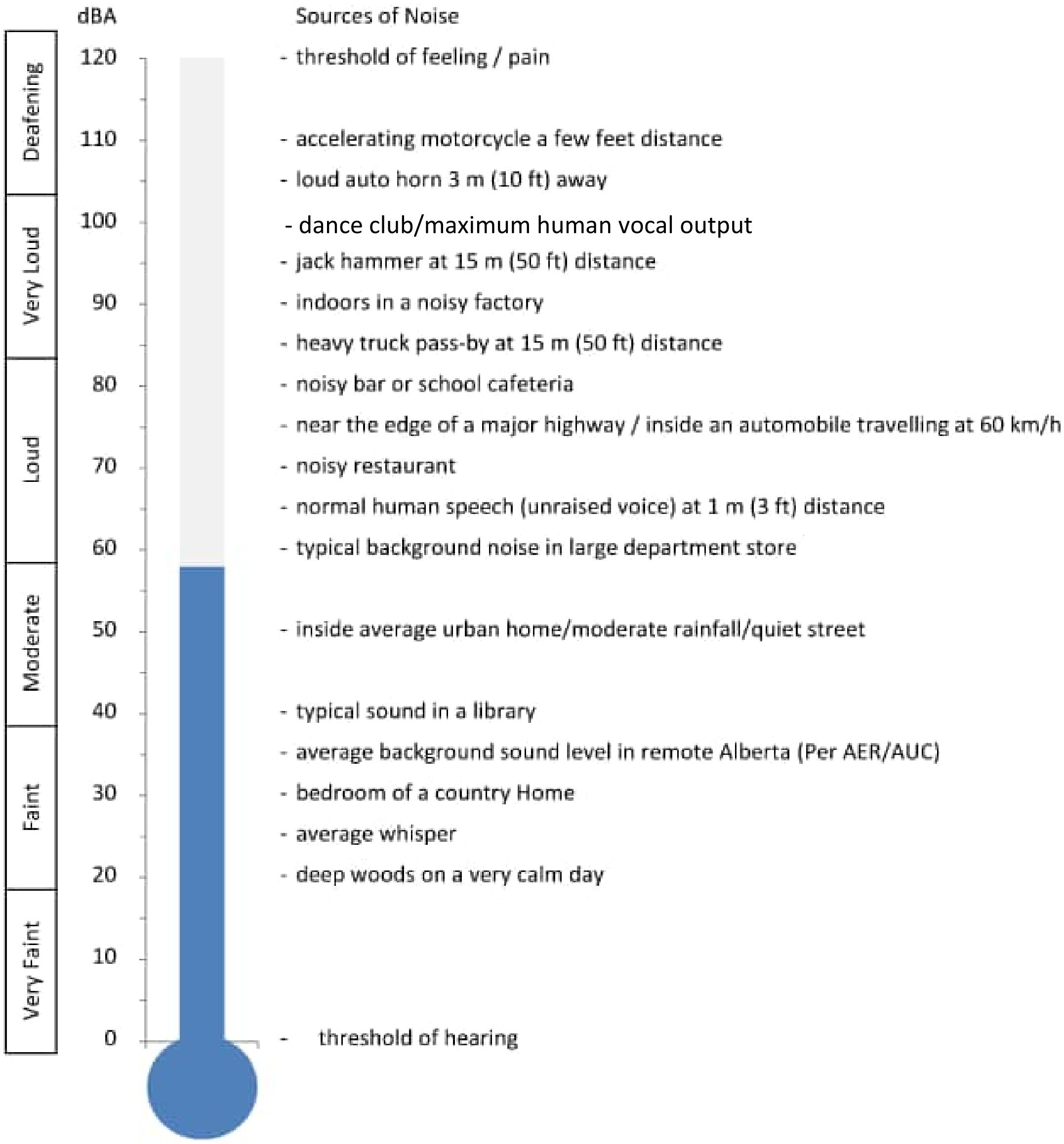
Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic, or stationary noise, the medium of concern is air. Noise is defined as sound that is loud, unpleasant, unexpected, or unwanted.

2.2 Frequency and Hertz

A continuous sound is described by its frequency (pitch) and its amplitude (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding) and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting out at 20 Hz all the way to the high pitch of 20,000 Hz.

2.3 Sound Pressure Levels and Decibels

The amplitude of a sound determines it loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measure in units of micro-Newton per square inch meter (N/m^2), also called micro-Pascal (μPa). One μPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels abbreviated dB. Exhibit D illustrates references sound levels for different noise sources.



Graphic 1: Typical A-Weighted Noise Levels

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, (A-weighted scale) and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive the change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g. doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

2.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear. A numerical method of rating human judgment of loudness.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time varying noise level. The energy average noise level during the sample period.

Noise: Any unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying.

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

2.7 Sound Propagation

As sound propagates from a source it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity and turbulence can further impact have far sound can travel. Computer aided modeling was conducted to calculate sound propagation factors for the purposes of this study, as described in Section 3.1 below.

2.8 Environmental Noise Descriptors

As environmental sound levels vary over time, a single number descriptor known as the Energy Equivalent Sound Level or LEQ is used to quantify sound levels. It is defined as the steady continuous sound level, over a specified time period, that has the same acoustic energy as the actual varying sound levels occurring over the same time period. The LEQ values are reported as A-weighted sound levels expressed in units of dBA (A-weighted decibels). The A-weightings are assigned to account for the frequency response of the human ear, which is most sensitive to mid-frequency sounds. The LEQ in dBA is the primary sound level criteria for comparing the predicted daytime and nighttime Project sound emissions to the regulating criteria.

Noise criteria typically have different allowable sound levels for daytime, defined as 07:00 to 22:00 hours, and nighttime, defined as 22:00 to 07:00 hours. The Daytime LEQ is the predicted A-weighted energy equivalent sound level over the daytime period hours. Similarly, the Nighttime LEQ is the predicted A-weighted energy equivalent sound level over the nighttime period hours.

3. ASSESSMENT APPROACH

Environmental sound from the Project has been estimated using predictive modelling to determine the impact at the evaluation points. The assessment was completed by:

- Identifying evaluation point based on publicly available zoning maps;
- Determining suitable criteria limits;
- Calculating sound emissions from the Project where information is not available;
- Modelling provided or calculated sound emissions to predict sound levels at evaluation points;
- Comparing predicted results with suitable recommended limits;
- Developing preliminary noise mitigation recommendations for design considerations; and
- Preliminary evaluation for low-frequency noise (LFN).

This report details the methods and model used in the NIA.

3.1 Computer Modelling

Modelling for this assessment was conducted using DataKustik CadnaA (Version 2023 - 201.5366) sound level prediction software set to use the environmental sound propagation calculation methods prescribed by the ISO Standard 9613 (ISO 1993, 1996). The ISO 9613 sound propagation method predicts sound levels under moderately developed temperature inversion and downwind conditions, which enhance sound propagation to the receptor. The evaluation was based on summertime weather conditions, resulting in the least amount of atmospheric attenuation.

The modeling inputs considered the following factors:

- Source sound power level;
- Distance attenuation;
- Source-receptor geometry including source heights and ground elevation;
- Barrier effects of the site structures;
- Duration of events;
- Ground attenuation factors for different ground cover surfaces (i.e., water, hard ground and absorptive ground); and
- atmospheric attenuation from meteorological effects on sound propagation (i.e., temperature and relative humidity).

Table 1 describes the configuration of the calculation parameters used to complete the environmental sound modelling. Large structures, such as data center buildings, were included in the modelling for the Project, therefore reflections are included in the analysis results. Source directivity was not applied to potentially directional sources, such as exhaust outlets, and all sources emit in free-field propagation.

Table 1: Model Configuration Parameters

Parameter	Model Settings	Description/Notes
Calculation Standard	ISO 9613 only	All sources and attenuators treated as required by the cited standard.
Source Directivity	Vertical sources applied to larger structures	Directivity of the source emission was not included. The barrier effect of buildings and barriers were included, if applicable.
Ground Absorption	Overall terrain 0.7; hard surfaces 0.2 (index value 0 to 1)	Values used for undeveloped/unplanted ground. Applied to the entire modelling domain. Hard surfaces apply to paved areas.
Temperature and Humidity	50°F / 70% Relative Humidity	Modelled summertime conditions resulting in the least amount of atmospheric attenuation.
Wind Conditions	Default ISO 9613	The propagation conditions in the ISO 9613 (1996) standard are valid for wind speeds between 4 and 18 km/h; all points are considered downwind.
Terrain	Terrain applied	Terrain in the area is modelled at 1 m resolution in the vertical direction to account for any natural barriers within the study area
Reflections	2	Only Project buildings modelled.
Search Radius	2000 m	All sources within this radius of a receptor or grid point are calculated.

4. STUDY AREA AND RECEPTORS

4.1 Study Area

The Project will be situated in Williston, North Dakota. The proposed Project site is located on lands currently zoned as C-2 general commercial, R-2 Single and Two Family Residential and R-4 Highrise Multifamily Residential. The Williston Planning and Zoning Map and preliminary site plan are included in **Appendix B**.

Figure 1 shows the Project site, surrounding area, and evaluated receptors.

4.2 Existing Conditions

The existing environmental sound conditions in the study are characterized by traffic sounds from Highway 2 and possible industry sounds from nearby oil and gas facilities. Traffic sounds from Highway 2 are anticipated to cause an elevated daytime sound level and somewhat less elevated level above ambient conditions during the nighttime. Continuously operating oil and gas facilities contribute to the overall background soundscape throughout the daytime and nighttime periods. The existing acoustic conditions were not established through measurement or detailed modelling as part of this NIA.

Establishing the existing background sound levels by conducting a sound monitoring program prior to start of Project construction is recommended if the Project sound contribution is anticipated to cause permanent increase to overall environmental sound levels.

4.3 Receptors

A hotel, R1, located on C-2 zoned land is considered as a residential receptor for this NIA; places of rest are typically categorized as residential receptors. An existing commercial business, R2, on C-2 zoned land east of the proposed Project development site is considered a commercial receptor. R3 is included as a boundary condition receptor placed along the southwestern fenceline. Two existing single-family dwellings, R4 and R5, on agricultural zoned land are included in the assessment. The locations of the receptors are shown in **Figure 1**.

In the environmental sound propagation model, all receptors were placed at a height of 5 ft to best represent the measurement procedure or the average height of a person, and at the nearest property line for each receiver. The hotel receptor was also evaluated at a height of 15 ft to represent a second story receptor. Table 2 presents the receptor designation, parcel identification as indicated from Williams County GIS open data site and UTM NAD 83 Zone 13 coordinates.

Table 2: Receiver Locations

Receptor	Zone Classification, (Receiver Description)	Parcel Designation	Coordinates (UTM NAD 83 Zone 13)	
			Easting (m)	Northing (m)
R1	C-2 General Commercial, (Hotel)	01-025-00-00-01-012	602114	5342707
R2	C-2 General Commercial, (Business)	01-025-00-00-05-044	602109	5343057
R3	Boundary Condition, (Vacant Lot)	01-465-00-00-08-060	601158	5342610
R4	A Agricultural, (Existing Single Family Dwelling)	46-155-01-00-22-055	600423	5343109
R5	A Agricultural, (Existing Single Family Dwelling)	01-798-55-01-26-150	601965	5341652

5. SUGGESTED LIMITS FOR EVALUATION

The Project is in the City of Williston in Williams County, North Dakota. The City of Williston enacted a loud noise ordinance (CoW, 2024) that is directed at nuisance offenses related to loud noise and loudspeakers, and not related to regulating sound levels from industrial developments. Available information indicates that neither Williams County nor the state of North Dakota have specific regulations relating to industrial noise emissions.

5.1 Suggested Noise Criteria Limits for Continuous Sound

In the absence of specific regulations regarding development noise emissions at the state, county or municipal level, the following limits are suggested for guidance on determining the suitability of the proposed development. The suggested limits are based on limits set for comparable jurisdictions (SCC, 2004; SCCC, 2015; IPCB, 2018). Environmental sound limits typically consider the density of population in the study area (i.e., urban versus rural), proximity to transportation corridors such roadways, railways or aircraft approach, and different limits for daytime (07:00 to 22:00) and nighttime (22:00 to 07:00) periods.

RWDI is aware of a similar data center development in the City of Santa Clara. The limits set for Santa Clara County (SCC, 2004) and the City of Santa Clara limits (SCCC, 2015) were evaluated, and RWDI is of the opinion that the SCC limits more closely match the Project study area than the SCCC limits.

Additional consideration for the elevated noise levels for the commercial hotel receptor, considered a multi-family residential receptor for this evaluation, is reflected in the 5 dB increase in nighttime criteria limit, above the R-2 Single-Family Dwelling limit of 45 dBA. The suggested criteria are specific to the Project Study area and additional discussion with regulators is warranted to establish city-wide or county-wide noise criterion for industrial developments. The State of Illinois (IPCB, 2018) has developed clear octave-band criteria limits for electric power generation to guide industry in the planning and development of new industrial sites. The lower single family dwelling nighttime limit of 45 dBA is also set in other state and international regulatory documents.

The Project study area is located predominantly in a general commercial zone adjacent to a major thoroughfare and residential, commercial and agricultural zoned parcels. Baseline pre-construction monitoring may be beneficial to establish the actual sound levels at receptors.

Table 3 lists the suggested criteria limits for the residential and commercial land classifications during daytime and nighttime periods. The suggested limits are consistent with and comparable to other state and international limits.

Table 3: Suggested Criteria Limits for Daytime and Nighttime Hours

Receptor - Zone Classification, Description (Current Land-use)		Sound Level Limits [1] (dBA)	
		Daytime (07:00 to 22:00)	Nighttime (22:00 to 07:00)
Residential	Zone R-2, Zone A, Single-Family Dwelling, Duplex (Vacant Lot, Existing Single-Family Dwellings)	55	45
	Zone R-4, Multi Family Dwelling (Townhouse, Apartment Complex, High-Rise, Hotel)	55	50
Commercial – Zone C-2 (Business)		60	55
Industrial – Zone M-1, M-2		75	70

Notes: 1 – Suggested Criteria Limits for the purposes of this NIA

5.2 Suggested Low- Frequency Noise Evaluation

The predicted dBC-dBA value is used as an indication for the possibility of LFN, following standard acoustical practice. A dBC-dBA value above the 20 dB threshold at a receptor is indicative of significant low frequency sound in the modelled sound sources. Evaluating the initial condition (dBC-dBA>=20dB) for determining a LFN is done at the design stage. This calculation is a preliminary determination for the possibility of LFN.

6. MODELLED SOURCES AND PREDICTED RESULTS

6.1 Modelled Noise Sources

The Project consists of a data center campus development undertaken in three (3) phases. Each phase will consist of two or three data center buildings, each with fifty (50) chillers operating continuously. Each building has one (1) associated 100 MVA transformer. Each data center building has twenty-five (25) associated Caterpillar 3516 series diesel engine driven back-up power generators. The operation of the back-up generators will be only for emergency use during grid power outages; however, the generators may operate for extended periods depending on the severity of the outage. Each engine has an associated 3000 kVA transformer. Generator operational testing will occur periodically, with approximately one (1) engine per phase being run for one (1) hour per day. The data center buildings are modelled at 33-feet in height, conservatively representing the lowest design height considered for reduced noise barrier effects. A summary of the client supplied equipment sound data and chiller manufacturers' comparable chiller data is presented in **Appendix C**.

The following is a summary of the modeled phases, considering each building listed includes (50) Chillers, (25) Engine Driven Power Generators, (25) 3000 kVA Transformers, (1) 100 MVA Transformer:

- Phase 1: Building 1.1 and Building 1.2.
- Phase 2: Building 2.1, Building 2.2 and Building 2.3, including Phase 1 equipment.
- Phase 3: Building 3.1 and Building 3.2, including Phase 1 and Phase 2 equipment.

A listing of the proposed Project sources sound power levels that were modelled are presented in Table 4.

6.2 Noise Sources Not Included

Building heating ventilation and air-conditioning (HVAC) equipment needs are unknown currently, thus, HVAC sources are not included in this NIA. It is expected that building HVAC equipment selected will not significantly add to the environmental sound emissions, as HVAC sources are typically much quieter than industrial chiller and engine sources. Low-noise options and placement considerations can readily reduce the overall impact of HVAC sources. No other continuously operating sound generating equipment has been identified on the site.

6.3 Construction Noise Sources

Construction sources are not considered in this NIA, crew usage time and make/model of construction equipment is not known.

Table 4: Project Sound Power Levels

Item	Type[1]	Qty	Levels at Octave Band Center Frequencies (dB)									Overall Sound Power		Source
			31.5	63	125	250	500	1,000	2,000	4,000	8,000	(dBA)	(dB)	
Transformers														
Transformer - 3000 kVA	P	16	68	77	80	75	75	67	60	52	40	74.6	83.5	2
Transformer - 100 MVA	P	1	115.3	121.3	123.3	118.3	118.3	112.3	107.3	102.3	95.3	118.7	127.3	3
Chillers														
Chillers – 500 ton	P	50	107	107	107	104	104	101	97	91	91	105.9	113.4	4
Caterpillar 3516 Series Engine Driven Power Generators														
Engine Casing Enclosure	P	25	123.4	113.2	106.6	108.7	106	102	99.8	95.8	102.7	109	124.2	5, 7
Silenced Engine Exhaust	P	25	138.9	128.7	111.7	112.4	106.1	103.7	99.3	102	100.6	111.4	139.3	5, 7
Radiator Fan Outlet	P	25	108	111	111	108	105	101	98	95	87	107.2	116.4	6, 7

Notes: 1 – Represents the following source types: P – Point Source, L – Line Source, A – Area Source, and V – Vertical Area Source.
2 – Transformer 3000 kVA (Bies and Hansen, 2009).
3 – Transformer 100 MVA overall sound power based on client-provided sound pressure level of 92 dBA at 20-feet (see Appendix C).
4 – Based on Trane Acoustics Program sound data output for 500-ton chiller (see Appendix C).
5 – Based on Caterpillar manufacturer's Gas Engine Rating program sound data.
6 – Based on calculated theoretical sound power level for axial flow fan (Bies and Hansen, 2009).
7 – Caterpillar Engine, Exhaust and Radiator sound sources combined and calibrated to overall generator package enclosure client-provided sound pressure level of 85 dBA at 23-feet (see Appendix C).

6.4 Operational Scenarios Evaluated

For the continuous operations and emergency operations scenarios, all Project sound sources have been conservatively modeled as operating 24-hours per day at maximum sound power. For the generating testing scenario, all continuously operating equipment at Phase 1 in combination with one (1) engine driven power generator per building have been considered operating 24-hours per day at maximum sound power. This NIA considers seven (7) operational scenarios for evaluation:

6.4.1 Emergency Operation; Scenarios 1-3

1. Emergency Operations Scenario 1: All Phase 1 equipment.
2. Emergency Operations Scenario 2: All Phase 2 equipment, plus all Phase 1 equipment.
3. Emergency Operations Scenario 3: All Phase 3 equipment, plus Phase 1 and Phase 2 equipment.

6.4.2 Continuous Operation; Scenarios 4-6

4. Continuous Operations Scenario 4: Only Phase 1 chillers and 100 MVA transformer.
5. Continuous Operations Scenario 5: Only Phase 1 and Phase 2 chillers and 100 MVA transformers.
6. Continuous Operations Scenario 6: Only Phase 1, Phase 2 and Phase 3 chillers and 100 MVA transformers.

6.4.3 Generator Testing; Scenario 7

7. Generating Testing Scenario 7: Only Phase 1 chillers and 100 MVA transformer, and one (1) engine driven generator for each Phase 1 Building 1.1 and Building 1.2. Testing of the two (2) engine driven power generators is to occur during daytime period only. Due to each building having twenty-five (25) engine driven generators, it is assumed that one generator will be tested per day, yielding a running test of each generator approximately once per month. The testing scenario considers the engine running continuously over the duration of the daytime period; thus, the predicted level is representative of the worst-case daytime sound level when the engine is running. Normal nighttime operations of the chillers is included and mirrors the Phase 1 operations Scenario 4.

6.5 Predicted Results

Table 5 shows the predicted initial condition unmitigated results for the emergency operations Scenarios 1-3, the continuous operations Scenarios 4-6 and the Phase 1 continuous operations with generator testing Scenario 7. In most scenarios evaluated, the predicted Project overall A- weighted sound pressure level (dBA) is above the suggested limits. Exceedance of the suggested criteria limits in indicated in red test.

Table 5: Predicted Results and Assessment of Compliance with Suggested Limits

Receptor		Predicted Facility Sound Level for Each Scenario (dBA)							Suggested Criteria Sound Level (dBA)
		Scenario 1 (Phase 1 Emerg.)	Scenario 2 (Phase 2 Emerg.)	Scenario 3 (Phase 3 Emerg.)	Scenario 4 (Phase 1 Ops.)	Scenario 5 (Phase 2 Ops.)	Scenario 6 (Phase 3 Ops.)	Scenario 7[1] (Phase 1 Testing.)	
Daytime (07:00 – 22:00)									
R1_Hotel	5-feet	58.8	62.2	63.2	51.8	55.9	57.0	52.7	55
R1_Hotel	15-feet	60.7	64.5	65.2	53.9	58.8	59.4	55.0	55
R2_Business		62.3	65.8	66.2	55.7	59.6	60.1	56.6	60
R3_Boundary		64.1	67.1	73.2	57.1	60.7	66.3	57.5	75
R4_Existing_Dwelling		52.0	56.2	58.2	47.8	51.7	53.4	48.0	55
R5_Existing_Dwelling		52.2	56.4	57.5	46.4	49.7	50.8	46.7	55
Nighttime (22:00 – 07:00)									
R1_Hotel	5-feet	58.8	62.2	63.2	51.8	55.9	57.0	51.8	50
R1_Hotel	15-feet	60.7	64.5	65.2	53.9	58.8	59.4	53.9	50
R2_Business		62.3	65.8	66.2	55.7	59.6	60.1	55.7	55
R3_Boundary		64.1	67.1	73.2	57.1	60.7	66.3	57.1	70
R4_Existing_Dwelling		52.0	56.2	58.2	47.8	51.7	53.4	47.8	45
R5_Existing_Dwelling		52.2	56.4	57.5	46.4	49.7	50.8	46.4	45

Notes: 1 – Testing of the Emergency Generators only occurs during the daytime period.

Predicted environmental sound from the Project are above the suggested limits for most scenarios evaluated. Mitigation is recommended for the theoretical Project sound power levels presented in Table 4.

Figures 2-8 show the predicted unmitigated sound contours of the proposed Project continuous operations sound sources at a receptor height of 5-feet.

6.6 Low Frequency Noise

The predicted Project sound level results have been reviewed to determine if there is potential for an LFN condition at the receptors. The difference between the predicted Project mitigated Scenario 6, Phase 3 continuous operations, sound level dBC and dBA weighted value at the receptors evaluated are shown in Table 6.

Table 6: Low Frequency Noise Assessment

Receptor ID		C-Weighted Sound Level (dBC)	A-Weighted Sound Level (dBA)	dBC-dBA	dBC-dBA>=20 dB? (Yes/NO)
R1_Hotel	5-feet	56.3	47.2	9.1	No
	15-feet	59.0	49.9	9.1	No
R2_Business		58.8	50.5	8.3	No
R3_Boundary		63.2	56.9	6.3	No
R4_Existing_Dwelling		51.6	41.8	9.8	No
R5_Existing_Dwelling		50.7	40.0	10.7	No

The predicted dBC-dBA value is below the 20 dB threshold for potential LFN at each of the receptors, therefore the initial condition (dBC-dBA>=20dB) for determining a LFN is not met. This calculation is a preliminary determination for the possibility of LFN.

6.7 Tonal Sounds

Tonal issues may be present due to the types of noise sources assessed. Facilities with large numbers of fans and large numbers of engines with similar design may result in acoustic phenomena such as constructive and destructive interference of the waveform or significant tonal characteristics from the chiller fans resultant blade-pass frequency. Such phenomena are difficult to assess at the design stage and equally difficult to mitigate post-construction in this case due to the large number of sources proposed with the fully developed Project. Further discussion with the chiller and transformer equipment suppliers requesting more detailed sound data and potential mitigation solutions, is recommended.

Electrical equipment may emit tonal sounds under certain operating conditions. Manufacturers' sound level data does not typically contain detailed octave band data to allow for a pre-construction evaluation of tonal sounds, similarly the single value sound rating provided for the 100 MVA transformer is lacking third-octave band data necessary for determination of a tone. A follow-up sound survey or measurements of a similar data center installation is recommended to determine the potential of prominent discrete tones from the proposed facility. The presence of a tone may cause greater annoyance at a receptor as compared to a non-tonal steady-state sound source and a tonal penalty may be applied to tonal sources in certain jurisdictions. A tonal penalty of +5 dB is a typical penalty applied to tonal sources where identified. Tonal penalties have not been applied to the 3000 kVA transformer as those sources operate intermittently in emergency scenarios, nor to the 100 MVA transformer theoretical sound levels from the power utility representative, as presented in **Appendix C**.

7. RECOMMENDATIONS

Based on the results from the environmental noise modelling, the most significant sources were evaluated for mitigation. The source contributions from the various equipment have different predicted sound pressure levels at the receptors adjacent to the Project, due to various environmental sound propagation factors (i.e., path of propagation, topography, source directivity, meteorological conditions, etc.).

7.1 Preliminary Design Recommended Mitigation for Continuous Operations

RWDI has evaluated Scenario 6, Phase 3 continuous operations, order ranked sources for mitigation. Mitigating the loudest predicted sources have the greatest effect on predicted receptor sound levels. The loudest sources are mitigated first to achieve the target criteria sound level. Recommended mitigation strategies for the highest priority sources are provided below.

1. The 100 MVA transformers are predicted to be the loudest sound source at the controlling receptor (R1, 15-feet). The supplier sound rating has this source listed at 92 dBA at 20-feet as a starting sound pressure level. The supplier sound rating also lists this source at 72 dBA at 20-feet at 75 MVA capacity. RWDI has applied a 20 dB reduction to this source as preliminary reduction to the overall sound power level, corresponding to the 75 MVA capacity sound level rating.

2. The chillers are the next predicted loudest source. A reduction of 9 dB from the available Trane Acoustics Program sound data output for the 500-ton chiller is required for compliance with the suggested limits. Discussion with the chiller supplier on the most suitable technology to achieve the reduction is recommended. A 9 dB reduction can be achieved by a combination of low-noise fans, internal mitigation applied to the chiller compressors, fan inlet and outlet silencers, or localized barrier placement to impede the propagation path.

The above applied mitigation allow for predicted compliance with the suggested limits at all receptors evaluated for Scenarios 4-6 Continuous Operations and Scenario 7 Phase 1 Generator Testing.

Compliance with the suggested criteria limits is predicted if the sound power level of the final selected chiller is 96.9 dBA or less.

7.2 Mitigation for Emergency Operations

Reducing the predicted sound level for the emergency operation scenarios will require reductions applied to the engine generator enclosure, engine exhaust silencer and radiator fan and ventilation openings. Supplier sound data is requested for that type of mitigation evaluation. Testing of the engine driven power generators is to occur during daytime period only.

7.3 Predicted Results with Applied Mitigation

Table 7 shows the predicted applied mitigation results for the emergency operations Scenarios 1-3, the continuous operations Scenarios 4-6 and the Phase 1 continuous operations with generator testing Scenario 7. The predicted Project overall A- weighted sound pressure level (dBA) is below the suggested limits for all operations and testing scenarios evaluated with the recommended applied mitigation. Exceedance of the suggested criteria limits in indicated in red text.

Table 7: Predicted Results and Assessment of Compliance with Applied Mitigation

Receptor		Predicted Facility Sound Level for Each Scenario (dBA)							Suggested Criteria Sound Level (dBA)
		Scenario 1 (Phase 1 Emerg.)	Scenario 2 (Phase 2 Emerg.)	Scenario 3 (Phase 3 Emerg.)	Scenario 4 (Phase 1 Ops.)	Scenario 5 (Phase 2 Ops.)	Scenario 6 (Phase 3 Ops.)	Scenario 7[1] (Phase 1 Testing.)	
Daytime (07:00 – 22:00)									
R1_Hotel	5-feet	57.9	61.2	62.2	42	46.1	47.2	47.1	55
	15-feet	59.8	63.3	64	43.6	49.4	49.9	49.7	55
R2_Business		61.3	64.7	65.2	46.4	50.2	50.5	50.9	60
R3_Boundary		63.2	66.1	72.3	46	49.6	56.9	50.3	75
R4_Existing_Dwelling		50.1	54.4	56.5	35.8	39.8	41.8	38.7	55
R5_Existing_Dwelling		51	55.4	56.6	35.5	38.3	40	38.3	55
Nighttime (22:00 – 07:00)									
R1_Hotel	5-feet	57.9	61.2	62.2	42	46.1	47.2	42	50
	15-feet	59.8	63.3	64	43.6	49.4	49.9	43.6	50
R2_Business		61.3	64.7	65.2	46.4	50.2	50.5	46.4	55
R3_Boundary		63.2	66.1	72.3	46	49.6	56.9	46.0	70
R4_Existing_Dwelling		50.1	54.4	56.5	35.8	39.8	41.8	35.8	45
R5_Existing_Dwelling		51	55.4	56.6	35.5	38.3	40	35.5	45

Notes: 1 – Testing of the Emergency Generators only occurs during the daytime period. Scenarios 4-6 Continuous Operations with applied mitigation and Scenario 7 Phase 1 Generator Testing complies with the daytime limits at all receptors.

8. CONCLUSIONS

This Noise Impact Assessment has found that the predicted environmental sound levels from the Project as evaluated will exceed the suggested criteria limits. Implementation of the above recommendations is predicted to allow for development of all proposed phases based on the information available at this time. Discussion with the chiller and transformer equipment suppliers requesting more detailed sound data and input on potential mitigation solutions, is recommended along with further study as more detailed design progresses.

The model considered Project design data, including but not limited to, equipment lists, building lists, plot plans, and available equipment specifications provided by the developer.

9. STATEMENT OF LIMITATIONS

This report entitled Fighting Pike Noise Impact Assessment Rev 2, February 7, 2025, was prepared by Rowan Williams Davies & Irwin Inc. ("RWDI") for Critical Data House ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends the continued involvement of an acoustic consultant throughout the development of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

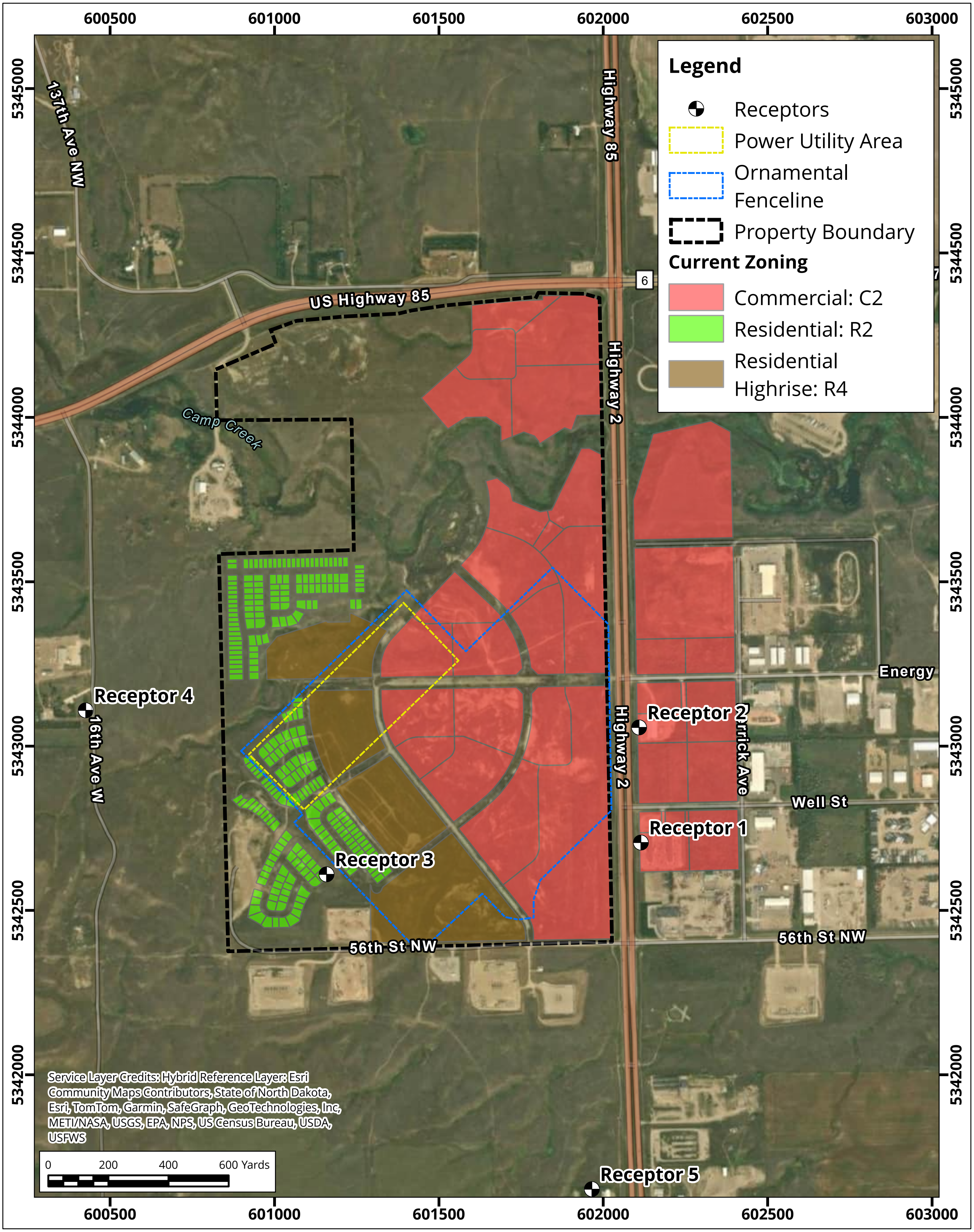
The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

10. REFERENCES

1. Bies and Hanson, 2009. Engineering Noise Control Theory and Practice – Fourth Edition. New York, USA.
2. Crocker, M. J. (2008), Handbook of Noise and Vibration Control (ed. M.J. Crocker), John Wiley & Sons Inc., Hoboken, NJ, USA.
3. International Organization for Standardization (ISO). (1996), *International Standard ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*. Geneva, Switzerland.
4. International Organization for Standardization (ISO). (1993), *International Standard ISO 9613-1, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of Absorption of Sound by the Atmosphere*. Geneva, Switzerland.
5. City of Williston (CoW), 2024, Code of Ordinances Chapter 12-52 Loud Noise, Code 1957, § 15.17; amended 1-9-2024 by Ord. No. 1154
6. Santa Clara County (SCC), 2004, Section B11-152. Exterior noise limits., Chapter VIII. CONTROL OF NOISE AND VIBRATION, Division B11. ENVIRONMENTAL HEALTH, Title B. REGULATIONS, Code of Ordinances SCC
7. Santa Clara City Code (SCCC), 2015, Chapter 9.10 REGULATION OF NOISE AND VIBRATION, Title 9. PUBLIC PEACE MORALS AND WELFARE, Charter of the City of Santa Clara CA
8. Illinois Pollution Control Board (IPCB), 2018. Subtitle H: Noise: Part 900: Part 900: General Provisions, Title 35 Procedural and Environmental Rules.

FIGURES



Study Area

True North

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411

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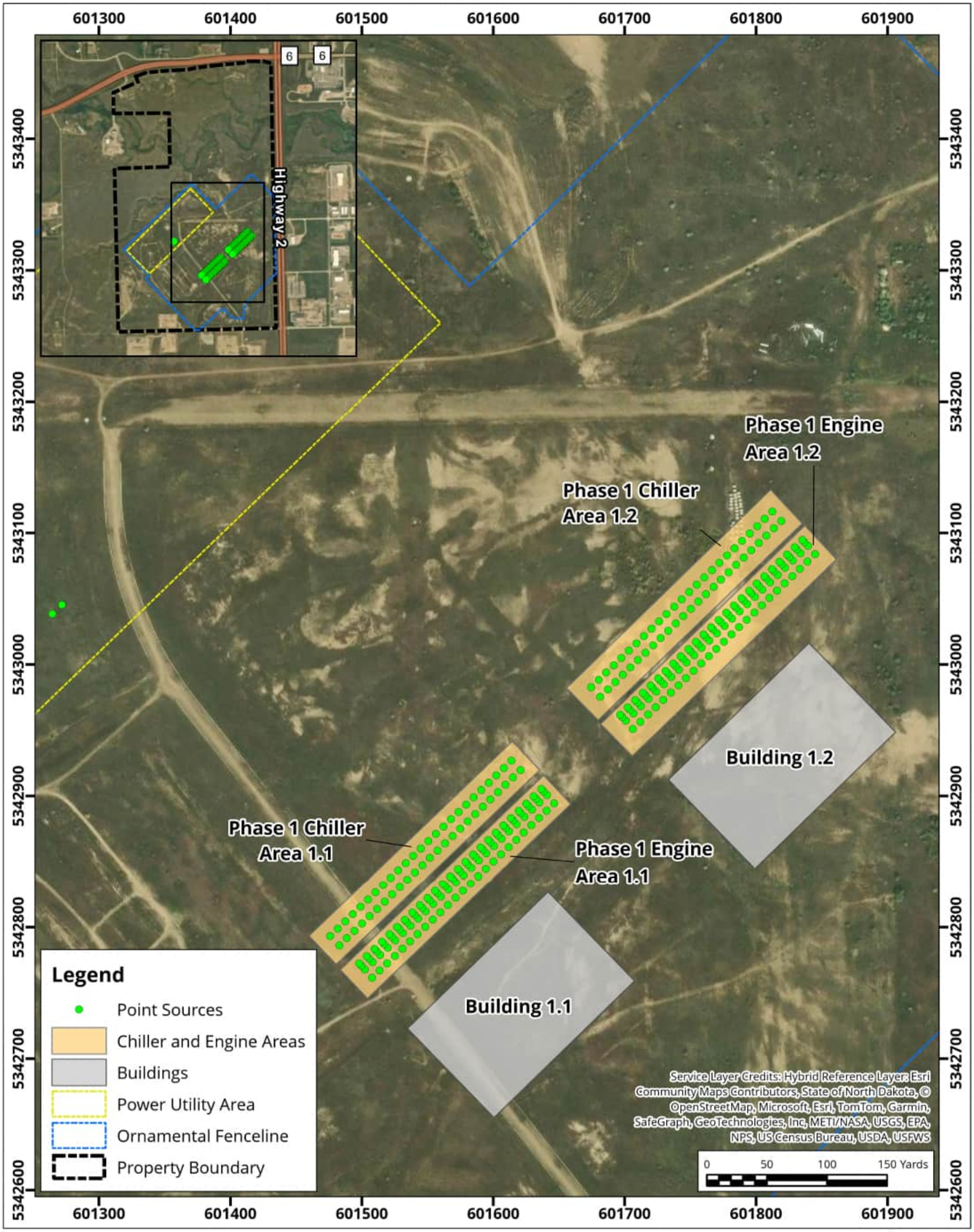
Approx. Scale: 1:16,000	
Date Revised: Feb 5, 2025	



Phase 1 Sound Sources

True North

Drawn by: PIP	Figure: 2
Approx. Scale:	1:4,000
Date Revised:	Feb 5, 2025

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411

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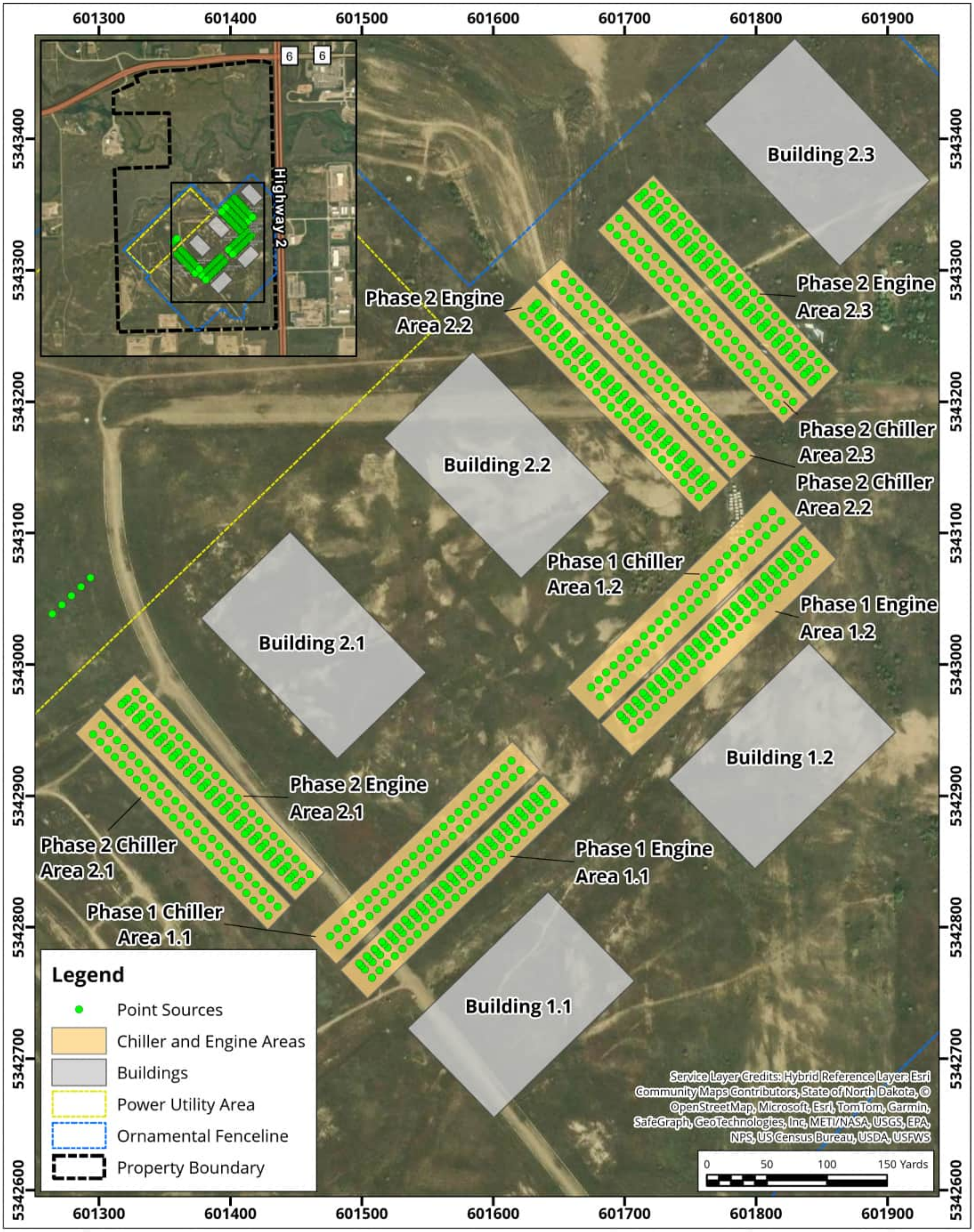

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Phase 2 Sound Sources

True North

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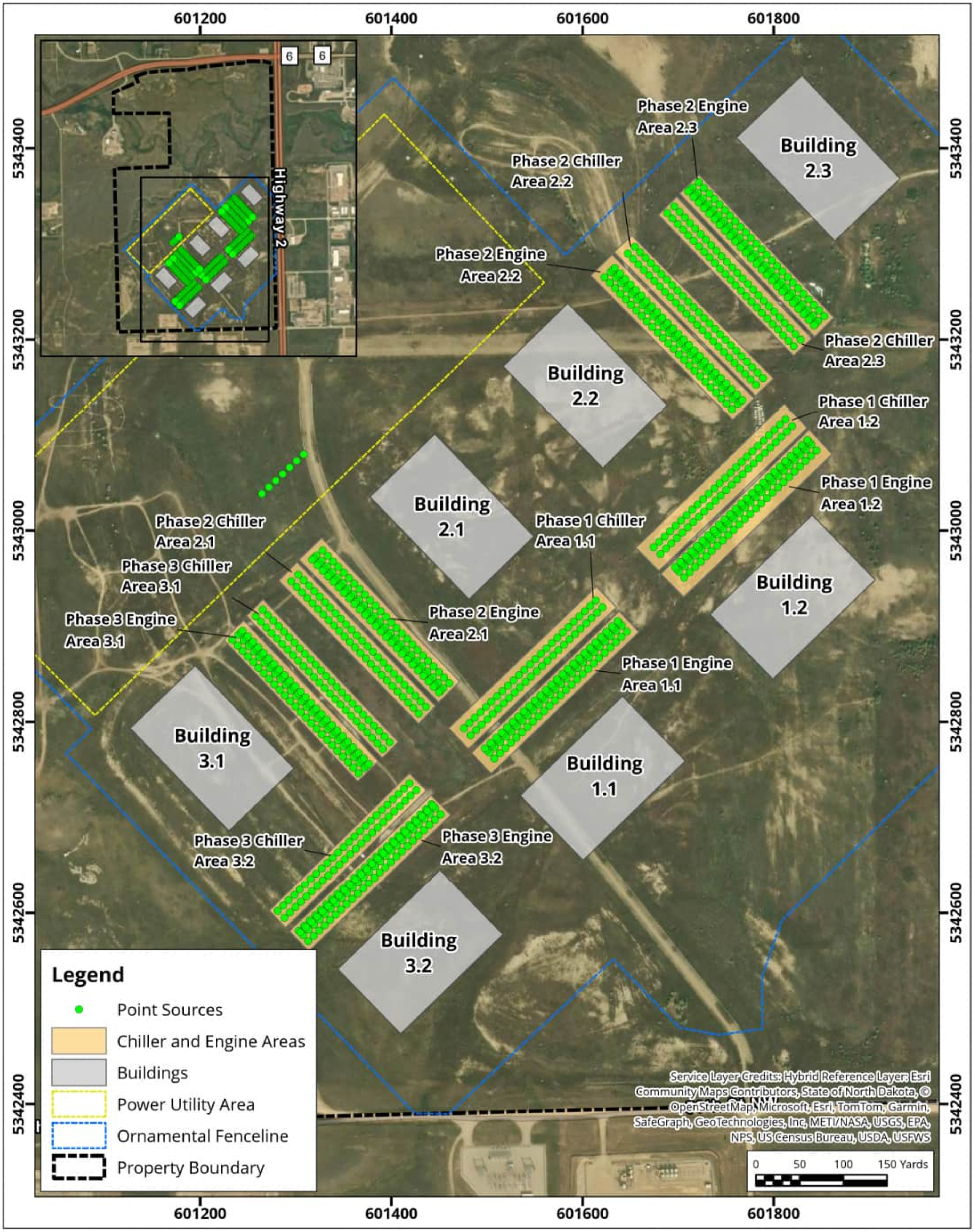
Date Revised:	Feb 5, 2025

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411



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Phase 3 Sound Sources

True North

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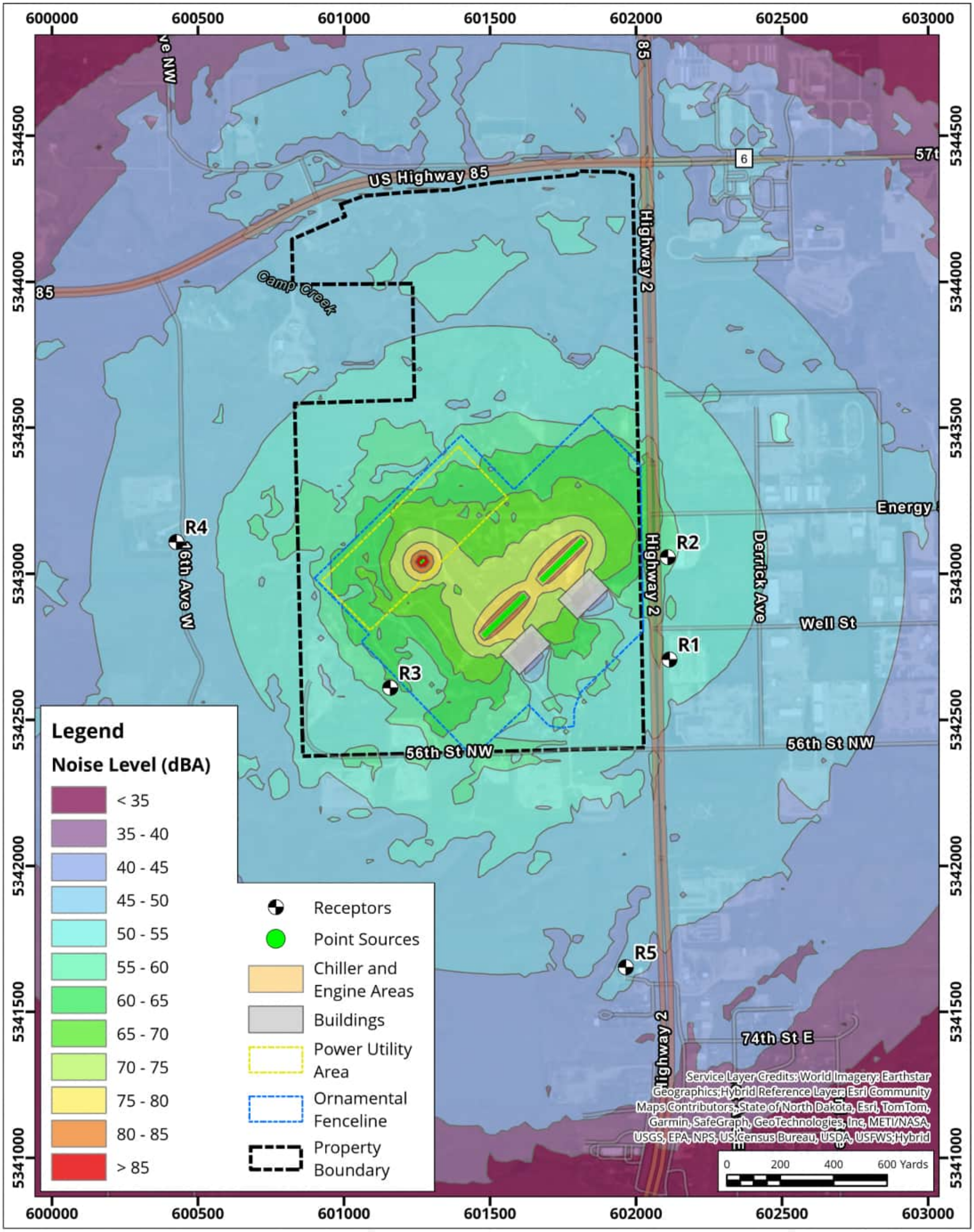
Date Revised:	Feb 5, 2025

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411



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Phase 1 Continuous Operations Predicted Sound Contours

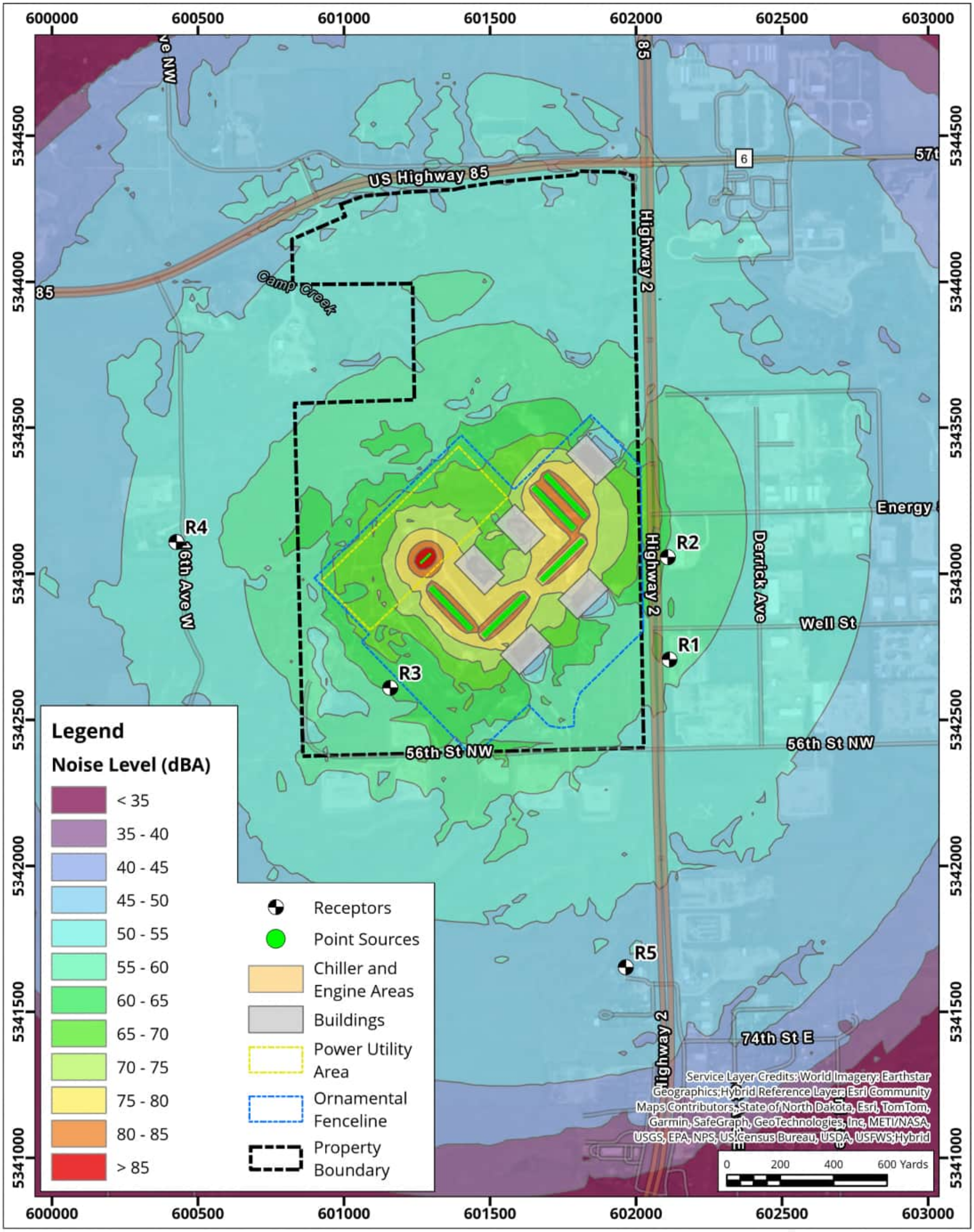
True North

Drawn by: PIP	Figure: 5	
Approx. Scale:	1:18,000	
Date Revised:	Feb 5, 2025	

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411



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Phase 2 Continuous Operations Predicted Sound Contours

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

True North

Project #: 2509411

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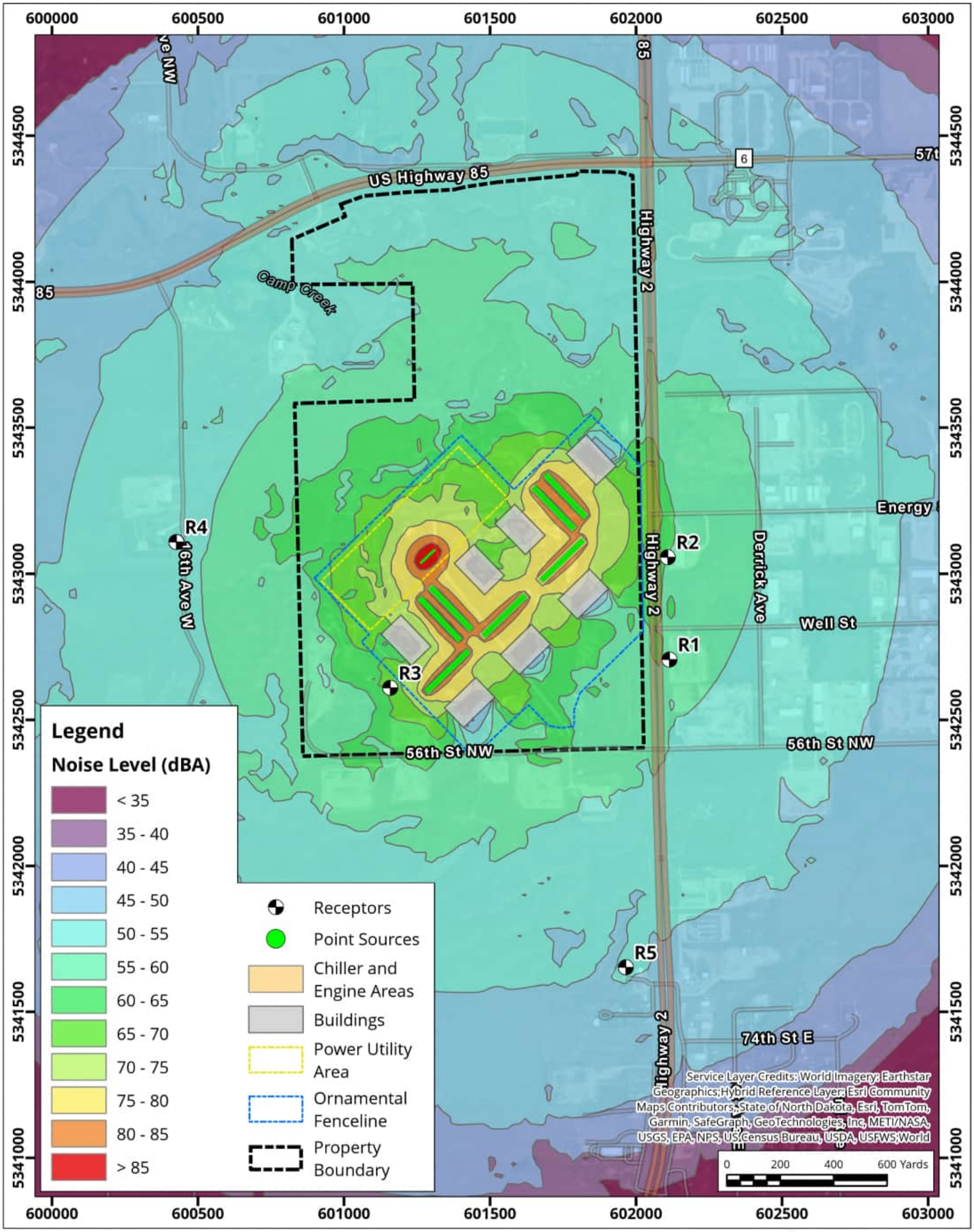

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Phase 3 Continuous Operations Predicted Sound Contours

True North

Drawn by: PIP	Figure: 7	
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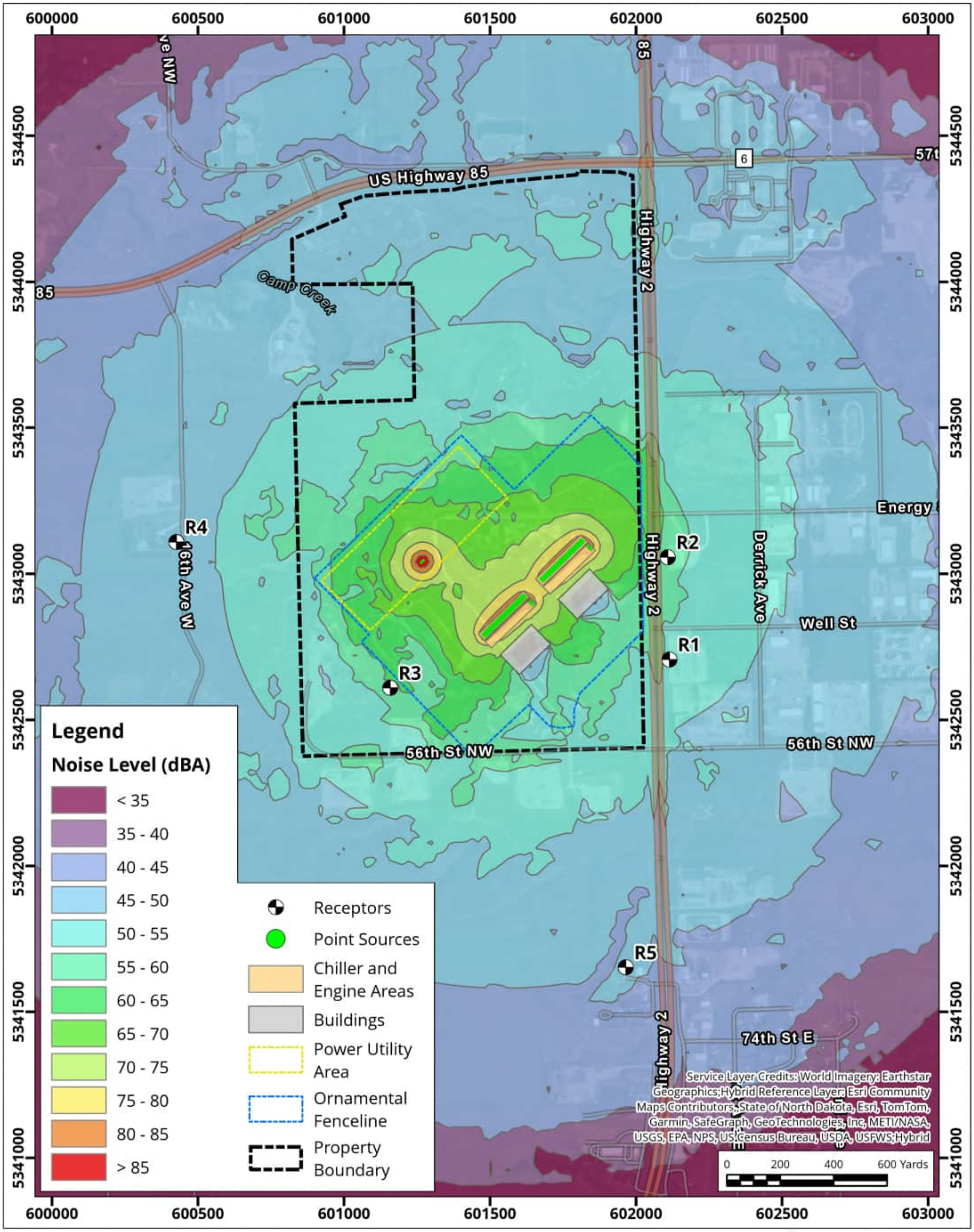
North Dakota Data Center - Williston, North Dakota

Project #: 2509411



Phase 1 Continuous Operations with Generator Testing Predicted Sound Contours

True North

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Date Revised: Feb 5, 2025		

Map Projection: NAD 1983 UTM Zone 13N

North Dakota Data Center - Williston, North Dakota

Project #: 2509411

Map Document: C:\WorkingFolder\Jobs_America\P2509411\P2509411.aprx

APPENDIX A

APPENDIX A: PRACTITIONER BIOGRAPHIES

Michel Parent, C.E.T. Senior Acoustical Consultant

Michel joined RWDI in 2019 as a member of RWDI's Noise, Acoustics and Vibration team, bringing with him a wealth of acoustical consulting experience dating back to 2005. Michel has evaluated sound for regulatory assessment for a wide variety of facilities including gas plants, compressor stations, field gas compressor units, open pit mine operations and large turbine driven pipeline compressor stations, commuter train rail corridors and building land-use planning studies. Through his extensive experience in the preparation of noise impact assessments for the energy industry he has developed a knowledge of oil and gas processing operations and can create reasonable solutions to environmental noise control issues.

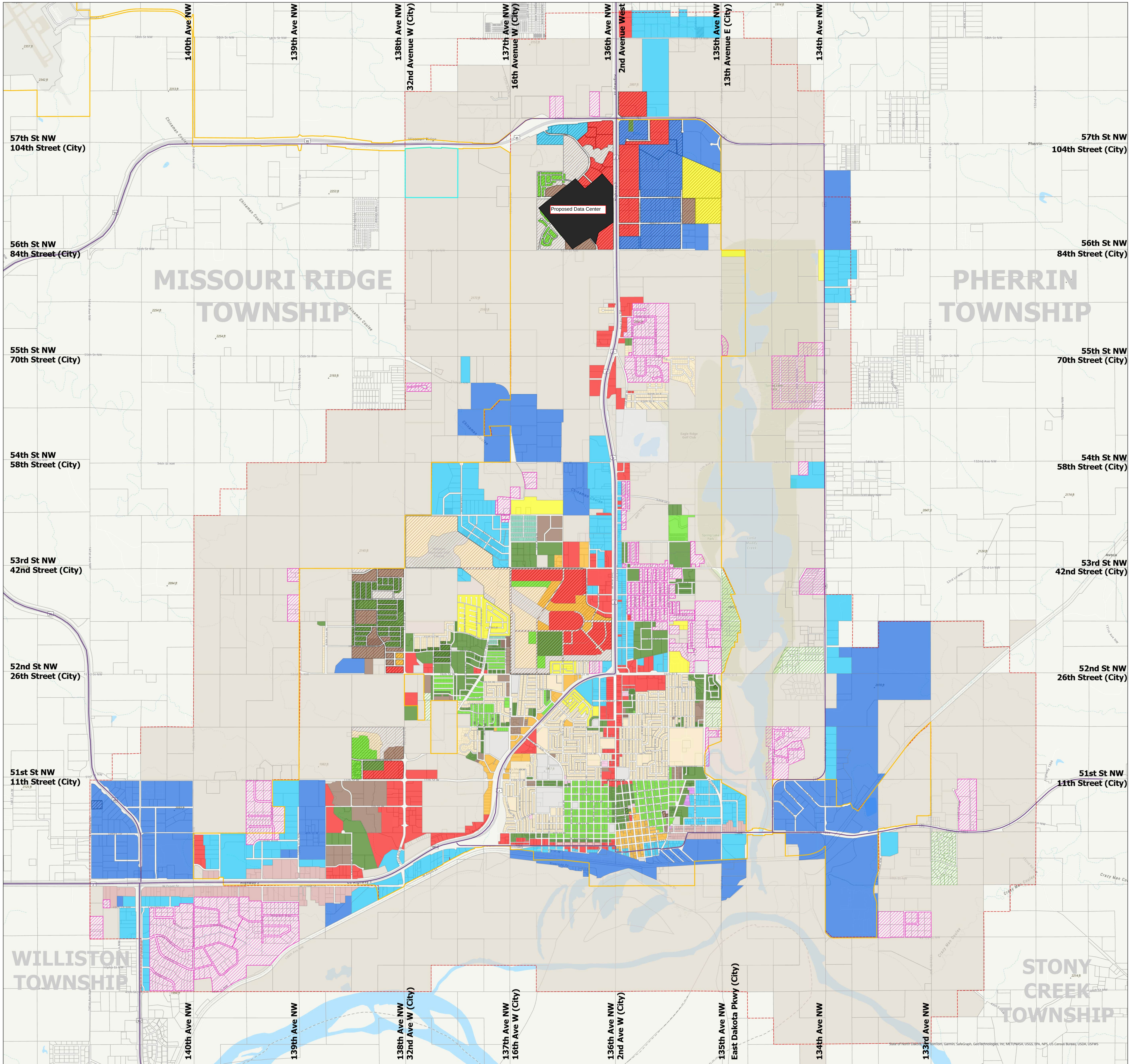
Over the course of his career, Michel has been involved in the on-site sound pressure level measurements of equipment at hundreds of energy industry facilities in western Canada and prepared over 2000 noise models and Noise Impact Assessment reports for client facility license application and regulatory audit needs and conducted over a hundred ambient and comprehensive sound surveys investigating environmental sound at sensitive receptor locations.

Matthew Johnston, P.Eng. Senior Acoustical Engineer

Matthew Johnston has provided consulting engineering services around environmental noise and acoustics for over 14 years. His project experience includes conducting environmental impact studies and regulatory compliance projects for a variety of industry sectors, including infrastructure, oil and gas, mining, energy production, and manufacturing. Matthew has extensive experience working closely with clients in Western Canada to effectively prepare and execute regulator mandated noise management plans which include monitoring, reporting, and mitigation implementation support.

Matthew works within an experienced and dedicated noise team providing technical expertise and guidance.

APPENDIX B



Legend

- Extraterritorial Jurisdiction
- City Limits
- Parcels
- Truck Routes

Zoning

- A: Agriculture
- C-1: Neighborhood Commercial
- C-2: General Commercial
- C-3: Restricted Commercial
- HCC: Highway Corridor Commercial
- M-1: Light Industrial
- M-2: Heavy Industrial
- M-3: Industrial Park
- P: Park and Open Space
- R-1: Single Family Residential
- R-1A: Rural Residential
- R-1E: Rural Estate
- R-2: Single & Two-Family Residential
- R-3: Lowrise Multifamily & Townhouse
- R-4: Highrise Multifamily Residential
- R-5: Mobile Home Court
- R-6: Manufactured Home Subdivision
- 2O: 2nd Street Overlay District
- PUD Overlay Districts

CITY OF WILLISTON

PLANNING & ZONING ZONING MAP

0 0.5 1 2 3 Miles

Disclaimer*: This map is NOT an official indicator of Zoning.
The Planning Department must verify the Zoning of any property.

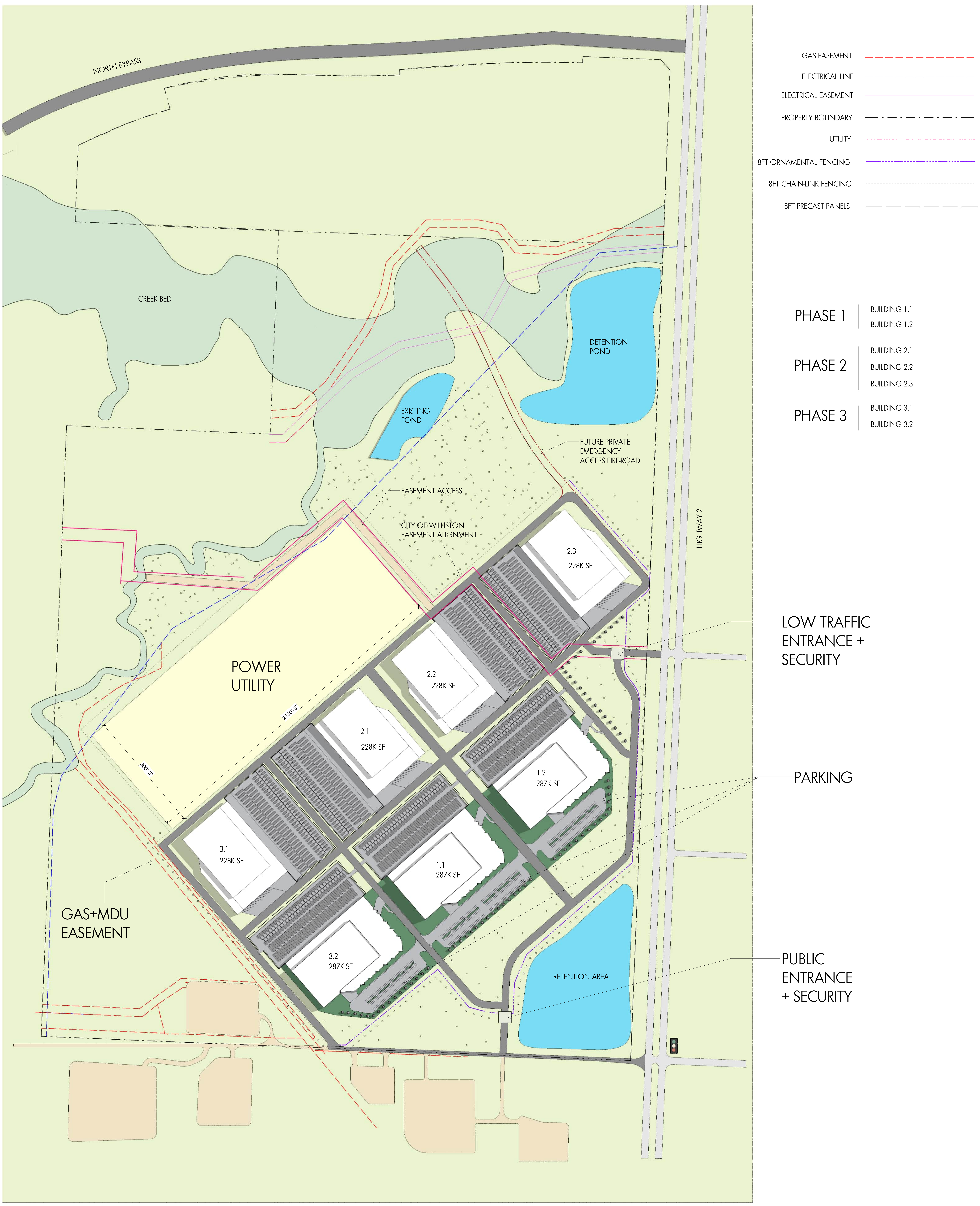
Information displayed on this map is AS IS at the time of the print.
The map is for reference and should NOT be used for legal representation of dimensions or features.
Reproduction of this map for resale is strictly prohibited.

City of Williston
Planning & Zoning Department
113 4th Street East
Williston ND, 58801

Phone: 1-701-577-8104
Email: planning@ci.williston.nd.us

N

Current as of: March 15, 2024



FIGHTING PIKE

PRELIMINARY SITE PLAN

01/29/2025 | JLG 24198 |

APPENDIX C

Selected Sum or Path Report

Project Name:
Location:
Building Owner:
Project ID:

Path1

Element	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Comments
RTAC 60Hz Chiller	107	107	104	104	101	97	91	
Sum	**107**	**107**	**104**	**104**	**101**	**97**	**91**	

NC >65 **RC 101(N)** **106 dBA**

500ton chiller Trane standard data from Trane Acoustics Program

Summary of Client Supplied Equipment Data and Sound Information

100MVA Transformers

From: dhaugen3528@gmail.com <dhaugen3528@gmail.com>
Sent: Thursday, January 16, 2025 2:54 PM
To: Nick Lippert <NLippert@jlgarchitects.com>
Subject: Transformer Noise levels

TECHNICAL
CLARIFICATIONS
1.Transformer will be designed per ANSI/IEEE standards.

Testing - As Per IEEE ANSI 57.12.90
Impulse Test on HV & LV Included
Sound Level Test Included
Partial Discharge Included
Power Factor Included
Megger Test Included
Dissolved Gas Analysis Included
SFRA Included
Routine Included
All tests are as per ANSI/IEEE standard guideline.

Sound pressure not to exceed 72dBA @ 75MVA, overall transformer not to exceed 92dBA. Within 2o feet. For 100 MVA at Fighting Pike

3000kVA Transformers

Transformer	PDM	3000kVA Oil-Filled, Pad-Mounted XFMR, 24.9kV-480/277V, 3PH, 55/65 degree C Rise

Generators

Generator Set Enclosure

- Sound Attenuated (85dBA @ 23'), Weather Protective

Engine:

- CAT 3516 – 16 Cylinder, 1800 RPM

Exhaust System

- Critical Grade Exhaust Silencer mounted EXTERNALLY to the enclosure. The external silencer system allows for easier future addition of emissions controls equipment should it ever be required.

Chillers

For the chillers, do we have any information on the approximate size, number of chillers, or number of fans for each chiller? To calculate the "worst case scenario" let's assume air cooled chillers at 500tons each for each building for a total of 50. Using Trane's reference: https://elibrary.tranetechnologies.com/public/pages/viewers/pdf?projectKey=5fdb788a8fd84100018bb855&itemKey=675c78c058ab005a36029a08. Looks like total to 22 fans between the two circuits on the chiller.