

February 25, 2019

Dan Brugeman, Asset Manager  
Nickel Road Operating  
600 17<sup>th</sup> Street, Suite 2800 South  
Denver, Colorado 80202

Subject: 72 Hr. Sound Level Survey & Noise Impact Model  
Location: Drake Pad Site – Weld County, Colorado

ATTN: Mr. Brugeman

The following Ambient Sound Level Survey and Noise Impact Model was developed for your Drake Pad Site located West of Ault, Colorado. The noise levels produced by the drilling and fracturing operations at the site should not exceed the noise standards set forth by the Colorado Oil & Gas Conservation Commission, AESTHETIC AND NOISE CONTROL REGULATIONS section of the ordinance. The following report identifies the noise sources for drilling and fracturing operations and includes noise mitigation models for both scenarios.

### Site Location and Conditions

The Drake Location is located approximately 0.5-mile North of W Hwy 14 west of Ault, Colorado. There is a tree line west of the pad site next to the nearest receivers with the topography of the location being predominately flat. Entrance Road and Drill Site coordinates are below.

#### **Entrance Road Coordinates**

40°34'53.86"N  
104°50'11.47"W

#### **Drill Site Coordinates**

40°35'16.82"N  
104°50'15.42"W

### Sound Level Survey Instrumentation

A Brüel and Kjær 2250 Type 1 Hand-held Analyzer sound level meter was programmed, field calibrated, and deployed at the drill site. The meter was programmed to measure the A-weighted as well as C-weighted sound levels. The metering system was installed on a t-post approximately 5 feet above ground level in a locked weatherproof enclosure for security purposes. Figure 1 displays the drill site and the ambient noise measurement location.

(Continued on Next Page)

#### Texas Office

3208 FM 920  
Weatherford, Texas 76088  
Office: (817) 594-4446 Fax (817) 594-4472

#### Colorado Regional Office

2700 E. Bridge Street - Suite C  
Brighton, Colorado 80603  
Office: (720) 517-2552

#### Pennsylvania Regional Office

800 Imperial Industrial Park Drive  
Oakdale, Pennsylvania 15071  
Office: (304) 670-0095 Fax (817) 594-4472

**C.O.G.C.C.- AESTHETIC AND NOISE CONTROL REGULATIONS**

- a. The goal of this rule is to identify noise sources related to oil and gas operations that impact surrounding landowners and to implement cost-effective and technically feasible mitigation measures to bring oil and gas facilities into compliance with the allowable noise levels identified in subsection c. Operators should be aware that noise control is most effectively addressed at the siting and design phase, especially with respect to centralized compression and other downstream “gas facilities” (see definition in the 100 Series of these rules).
- b. Oil and gas operations at any well site, production facility, or gas facility shall comply with the following maximum permissible noise levels.

<b>ZONE</b>	<b>7:00 am to next 7:00 pm</b>	<b>7:00 pm to next 7:00 am</b>
Residential/Agricultural/Rural	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

The type of land use of the surrounding area shall be determined by the Director in consultation with the Local Governmental Designee taking into consideration any applicable zoning or other local land use designation. In the hours between 7:00 a.m. and the next 7:00 the noise levels permitted above may be increased ten (10) dB(A) for a period not to exceed fifteen (15) minutes in any one (1) hour period. The allowable noise level for periodic, impulsive or shrill noises is reduced by five (5) dB(A) from the levels shown.

**Ambient Sound Level Survey**

A 72-hour pre-drilling ambient noise survey was taken at the Drake Pad Site from Friday, February 15, to Sunday, February 17, 2019, to measure and document the pre-drilling ambient sound levels at the site. During the duration of the ambient measurement high wind activity was recorded. On Saturday 2/16/2019 winds were recorded as high as 39 mph in a Northwestern direction. Noise sources observed by the noise technician during the survey included: heavy nearby road traffic, traffic at the Waste Management Plant to the east and strong winds.

**Ambient Measurement Results**

The ambient sound level data collected at the site is attached in both a graphed and tabular form, along with the established 72-hour ambient sound levels. The measured 3-day average sound level was 52.3 dBA and 80.4 dBC. The weather during the ambient measurement was also recorded via a mobile weather station. The data recorded by the weather station can be found in figures 6 to 8.

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### **Summary of Findings**

We can expect the following Hourly LAeq averages to be produced by the unmitigated operational equipment during specific operations, which can be measured at the receiver to the southwest.

Operations Type	Expected Sound Levels
Drilling	50-56 dBA
Fracturing	55-60 dBA

If at any time during the operations, the noise levels remain above the maximum permissible noise levels, mitigation techniques may be utilized.

### **Noise Impact Model Results**

The *unmitigated noise impact models* for drilling and fracing are included as Attachments 9 & 12. It displays an estimated sound level of 50-56 dBA for drilling and 55-60 dBA for fracing operations at the receiver. The *mitigated noise impact models* are included as Attachments 10, 11, 13 and 14. It displays the estimated sound levels to be between 42-46 dBA for drilling and 45-48 dBA for fracing operations with the installation of a noise barrier around the perimeter of the pad site. It displays the estimated sound levels to be between 42-52 dBA for drilling and 45-55 dBA for fracing operations with the installation of a noise barrier on the southern and western sections of the pad site. The nearest occupied structure (residence), is located approximately 1,120 feet to the southwest of the pad site. The noise barrier would decrease the overall noise level of the drilling operations by 4-8 dBA and 6-11 dBA for fracing operations at the receiver.

### **Noise Impact Potential**

The typical primary noise sources generated by gas well drilling operations include the drilling rig engines, compressors, generators, mud pumps, shakers, and ancillary support equipment. Drilling sound levels vary from drill site to drill site depending on the type of drilling rig (top drive, rotary table, etc.) and depending on the drilling rig orientation at the site. The highest drilling related noise levels are typically measured on the generator side of the rig.

The maximum noise levels generated during gas well fracturing operations are produced from the truck mounted engines which drive the high-pressure pumps. Support equipment such as sand trucks, water pumps and generators have a small contribution to the over-all noise levels of the operations. Off-site fracturing noise levels typically do not vary greatly from operator to operator, but the off-site transmission of the noise can be affected by the surrounding topography of the fracture site.

Noise impact models were created to evaluate and predict the noise impact potential of typical drilling and fracturing operations on the site's adjacent surroundings. Noise mitigation measures were included in the models to portray possible noise reduction levels.

The results of the noise impact models are included in Figures 9 to 14 to this report. Figures 9 & 12 display the *unmitigated sound levels* for drilling and fracturing operations. Figures 10, 11, 13 & 14 display the *mitigated sound levels* for drilling and fracturing operations.

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Please contact us if you have any questions or comments.

Sincerely,

**Kent Grimes**  
**Absolute Noise Control**  
**Project Engineer**  
**(817) 991-0053**

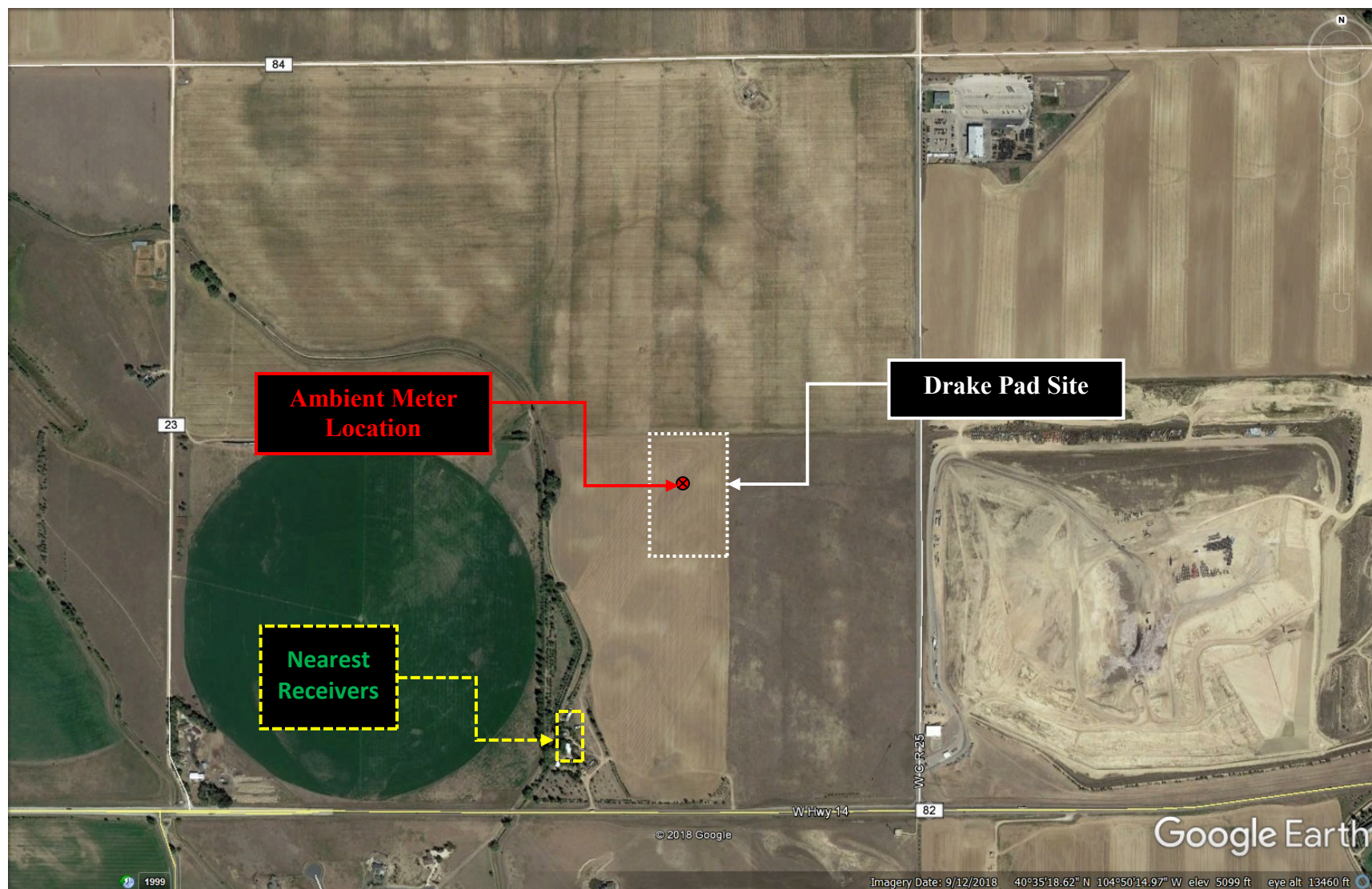


## Attachments

**Texas Office**  
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**Colorado Regional Office**  
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Oakdale, Pennsylvania 15071  
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**Figure 1.**  
**Drake Location & Noise Measurement Location**



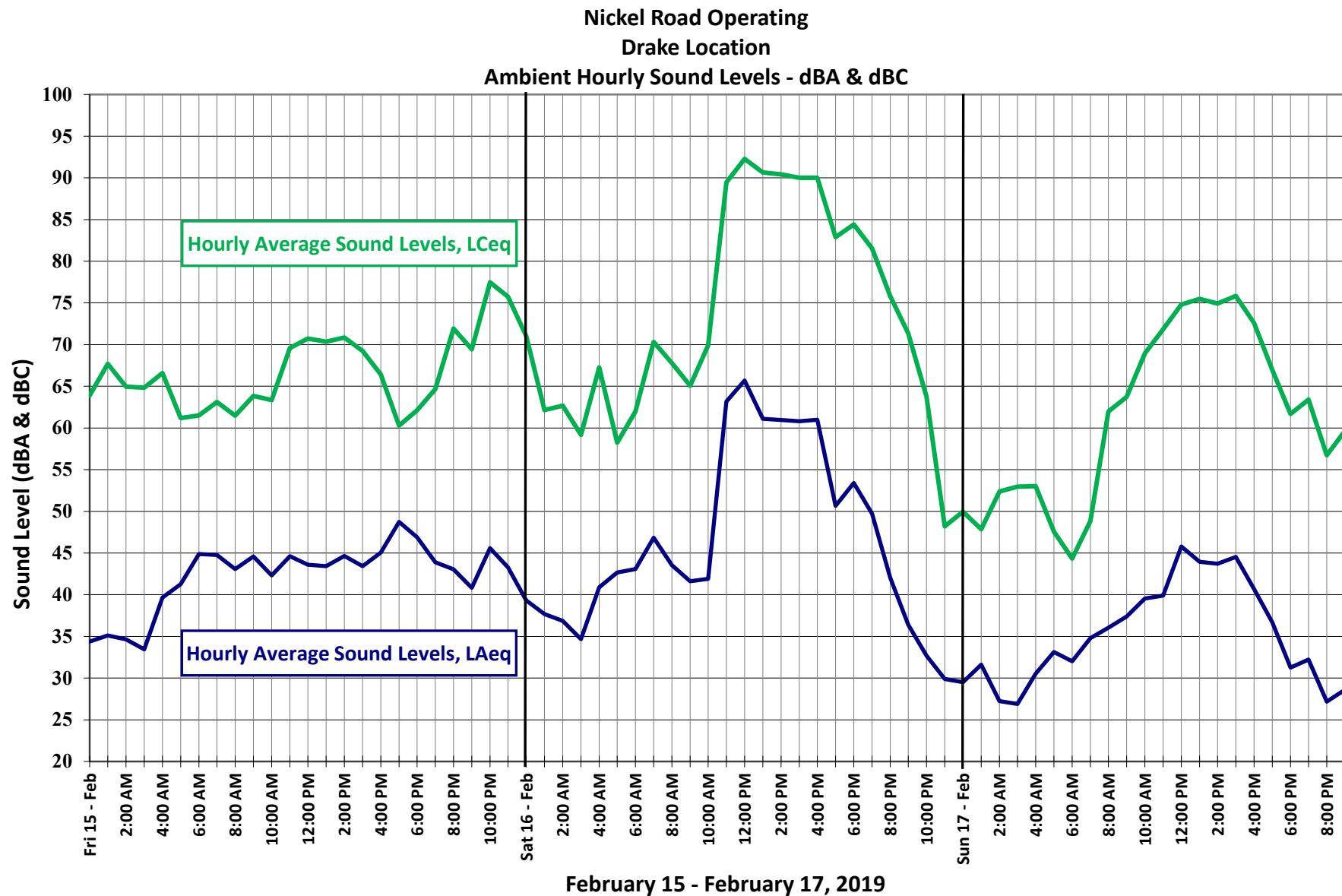


Figure 2.  
Drake Location– Hourly Average dBA & dBC

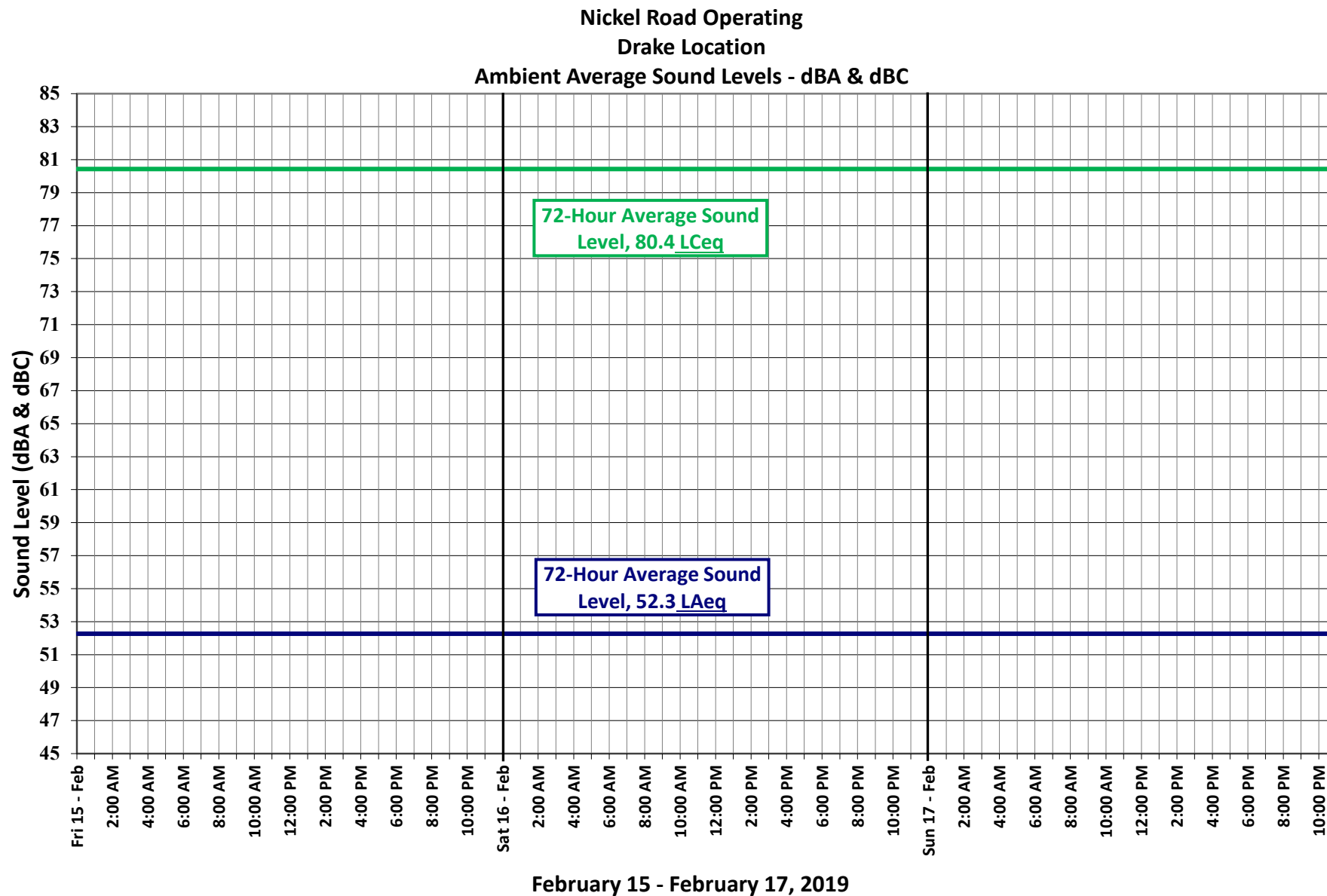
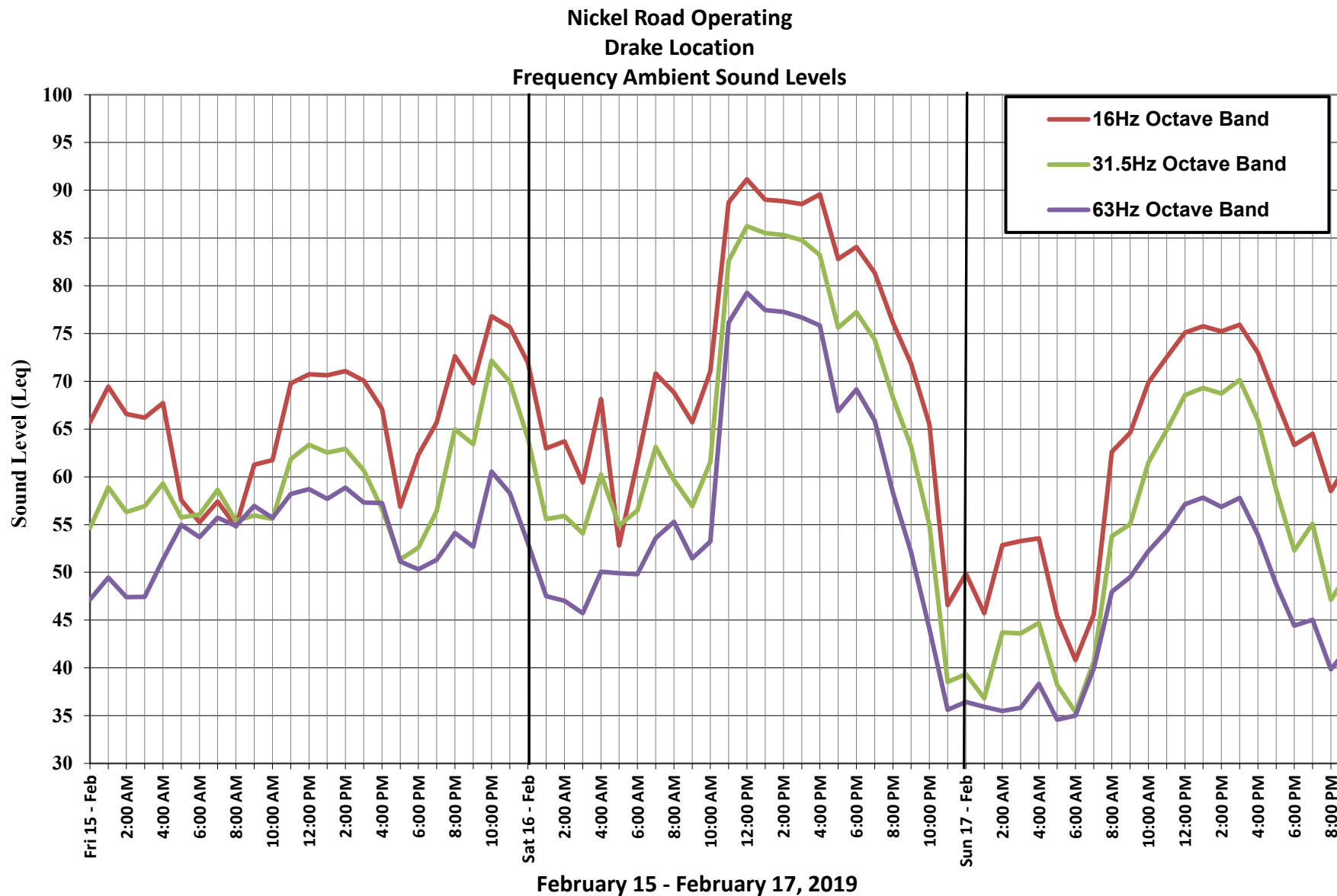


Figure 3.  
Drake Location – 72 Hour Average dBA & dBC



**Figure 4.**  
**Drake Location – Frequency Sound Levels**



Nickel Road - Drake Pad Site								
Time	LAeq	LCeq	Max Wind Speed		Time	LAeq	LCeq	Max Wind Speed
Fri 15 - Feb	34.4	63.9	11.2		1:00 PM	61.1	90.6	38.0
1:00 AM	35.1	67.7	13.2		2:00 PM	61.0	90.4	38.3
2:00 AM	34.7	64.9	12.8		3:00 PM	60.8	90.0	15.7
3:00 AM	33.5	64.8	12.8		4:00 PM	61.0	90.0	34.2
4:00 AM	39.7	66.6	14.1		5:00 PM	50.7	82.9	29.3
5:00 AM	41.3	61.2	9.4		6:00 PM	53.4	84.4	32.7
6:00 AM	44.9	61.5	6.3		7:00 PM	49.7	81.5	28.9
7:00 AM	44.8	63.1	7.4		8:00 PM	42.0	75.8	19.5
8:00 AM	43.1	61.5	7.4		9:00 PM	36.4	71.4	19.0
9:00 AM	44.6	63.8	11.0		10:00 PM	32.7	63.8	13.6
10:00 AM	42.3	63.3	11.6		11:00 PM	29.9	48.2	6.3
11:00 AM	44.6	69.6	15.0		Sun 17 - Feb	29.5	50.0	8.9
12:00 PM	43.6	70.7	16.1		1:00 AM	31.6	47.9	8.5
1:00 PM	43.4	70.4	14.8		2:00 AM	27.2	52.4	11.4
2:00 PM	44.6	70.8	15.4		3:00 AM	26.9	53.0	10.1
3:00 PM	43.4	69.2	13.9		4:00 AM	30.5	53.0	9.4
4:00 PM	45.1	66.4	11.6		5:00 AM	33.1	47.6	7.6
5:00 PM	48.7	60.3	8.3		6:00 AM	32.0	44.3	6.0
6:00 PM	46.9	62.1	11.6		7:00 AM	34.8	48.9	7.6
7:00 PM	43.9	64.7	14.3		8:00 AM	36.0	62.0	11.0
8:00 PM	43.1	71.9	15.0		9:00 AM	37.4	63.7	12.8
9:00 PM	40.8	69.4	14.5		10:00 AM	39.6	69.0	15.4
10:00 PM	45.6	77.5	16.8		11:00 AM	39.9	71.8	17.4
11:00 PM	43.3	75.7	16.8		12:00 PM	45.8	74.8	18.6
Sat 16 - Feb	39.3	71.0	13.6		1:00 PM	43.9	75.5	19.0
1:00 AM	37.7	62.2	9.6		2:00 PM	43.7	74.9	20.4
2:00 AM	36.9	62.7	9.4		3:00 PM	44.5	75.8	18.6
3:00 AM	34.7	59.2	9.4		4:00 PM	40.7	72.6	18.1
4:00 AM	40.9	67.3	13.9		5:00 PM	36.7	67.0	14.8
5:00 AM	42.7	58.3	7.2		6:00 PM	31.3	61.7	14.8
6:00 AM	43.1	62.0	10.5		7:00 PM	32.2	63.4	16.1
7:00 AM	46.8	70.3	13.6		8:00 PM	27.2	56.7	13.0
8:00 AM	43.6	67.8	12.3		9:00 PM	28.6	59.7	11.9
9:00 AM	41.6	65.1	13.4					
10:00 AM	41.9	69.9	14.1			LAeq	LCeq	
11:00 AM	63.2	89.5	37.6		72-Hour (3-day) Average:	52.3	80.4	
12:00 PM	65.7	92.3	39.1					

**Figure 5.**  
**Drake Location – Ambient Sound Level Data**

Sum Precipitation (in)	Average Wind Speed (mph)	Average Wind Direction	Average Temperature (°F)	Average Humidity (%)	Average Pressure (mb)	Maximum Wind Speed (mph)
0.0	6.4	E	25.7	64.4	834.3	11.2
0.0	7.8	E	24.8	63.9	833.3	13.2
0.0	6.7	E	24.3	61.4	832.9	12.8
0.0	6.7	ENE	23.1	63.1	833.1	12.8
0.0	6.7	ENE	22.1	66.4	833.0	14.1
0.0	3.3	NE	19.8	69.6	833.3	9.4
0.0	2.9	NNE	16.2	77.0	833.4	6.3
0.0	3.6	N	18.7	74.9	833.3	7.4
0.0	2.5	ESE	24.1	59.8	833.4	7.4
0.0	4.2	ENE	26.9	55.1	833.0	11.0
0.0	4.8	E	31.1	49.4	833.5	11.6
0.0	8.1	ESE	36.0	43.8	833.6	15.0
0.0	9.0	SE	40.4	39.4	833.4	16.1
0.0	8.7	ESE	44.7	35.3	832.9	14.8
0.0	9.0	ESE	47.9	32.0	832.9	15.4
0.0	8.3	E	50.3	29.1	832.9	13.9
0.0	7.2	ESE	50.4	28.3	832.9	11.6
0.0	4.7	ESE	43.8	38.4	833.3	8.3
0.0	5.6	ESE	39.4	45.9	833.6	11.6
0.0	6.6	ENE	36.2	53.0	833.7	14.3
0.0	10.0	NE	29.4	60.9	833.6	15.0
0.0	7.4	N	25.4	65.3	833.9	14.5
0.0	11.1	NNE	23.4	68.2	833.5	16.8
0.0	10.1	NNE	22.7	69.0	832.8	16.8

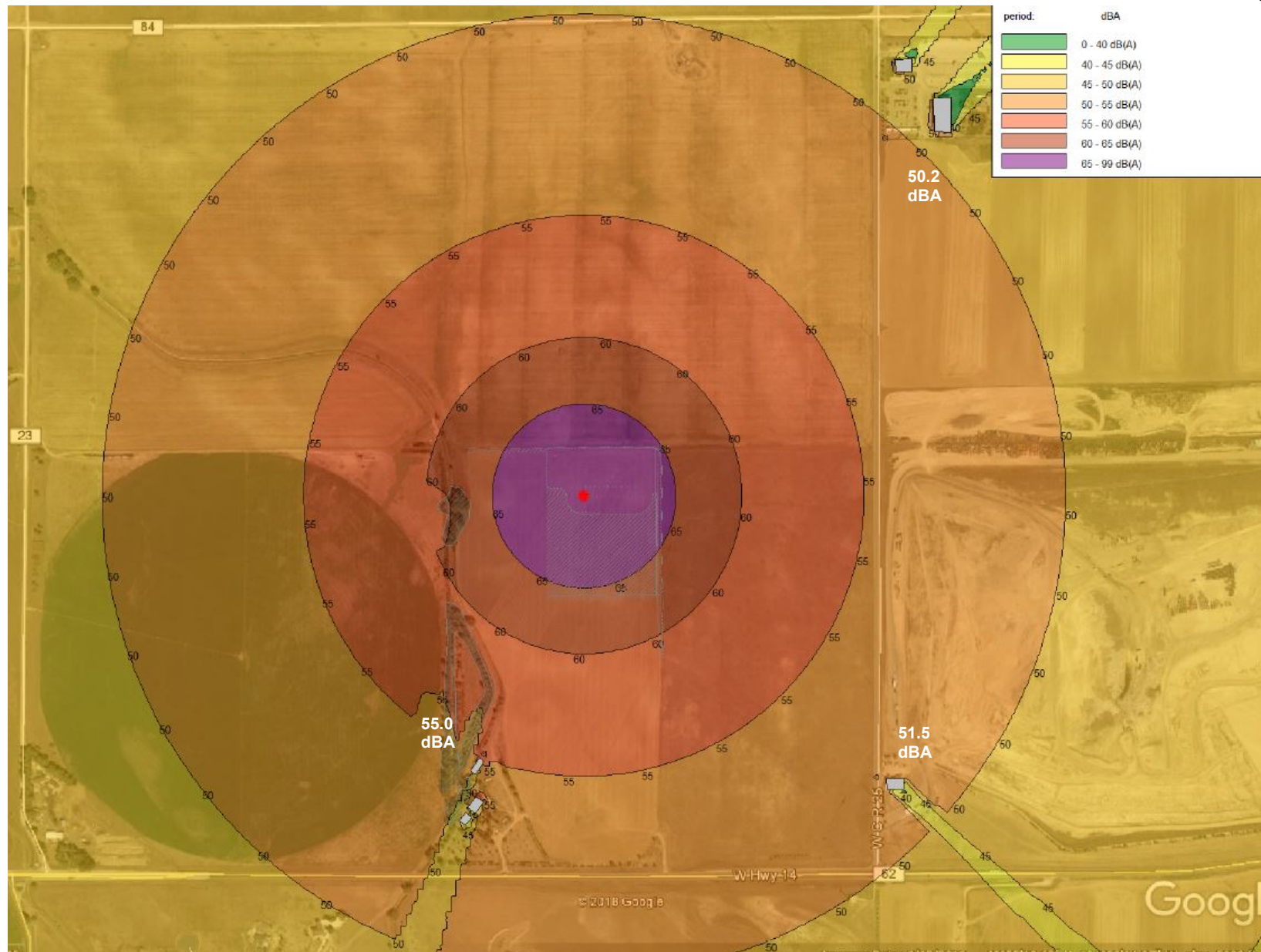
**Figure 6.**  
**Drake Location – Weather Data February 15, 2019**

Sum Precipitation (in)	Average Wind Speed (mph)	Average Wind Direction	Average Temperature (°F)	Average Humidity (%)	Average Pressure (mb)	Maximum Wind Speed (mph)
0.0	7.9	NNE	21.0	72.3	832.3	13.6
0.0	5.0	NNE	19.3	75.2	831.8	9.6
0.0	5.2	N	18.8	75.5	830.9	9.4
0.0	3.1	NNE	17.5	76.5	830.2	9.4
0.0	5.4	NE	16.2	78.5	829.1	13.9
0.0	2.3	E	16.3	78.1	828.8	7.2
0.0	5.1	ENE	16.5	79.1	828.5	10.5
0.0	7.5	NE	17.6	80.8	828.4	13.6
0.0	7.3	ENE	20.4	78.8	828.2	12.3
0.0	6.3	ENE	26.8	67.4	827.5	13.4
0.0	8.7	E	33.9	53.7	827.3	14.1
0.0	17.1	NNW	41.2	33.1	827.0	37.6
0.0	25.6	NW	39.9	28.7	826.8	39.1
0.0	24.2	NW	36.6	28.6	827.6	38.0
0.0	16.4	NW	36.0	26.8	828.8	38.3
0.0	5.9	NNW	36.4	24.0	829.8	15.7
0.0	20.6	SW	34.9	25.9	830.6	34.2
0.0	15.5	SW	33.0	27.3	831.2	29.3
0.0	16.4	SW	31.7	29.7	831.9	32.7
0.0	14.6	SSW	30.3	31.5	832.5	28.9
0.0	11.5	SW	28.5	33.0	832.9	19.5
0.0	9.6	SW	27.3	33.7	833.8	19.0
0.0	5.7	W	23.0	39.4	834.1	13.6
0.0	3.6	WNW	19.2	45.2	834.1	6.3

**Figure 7.**  
**Drake Location – Weather Data February 16, 2019**

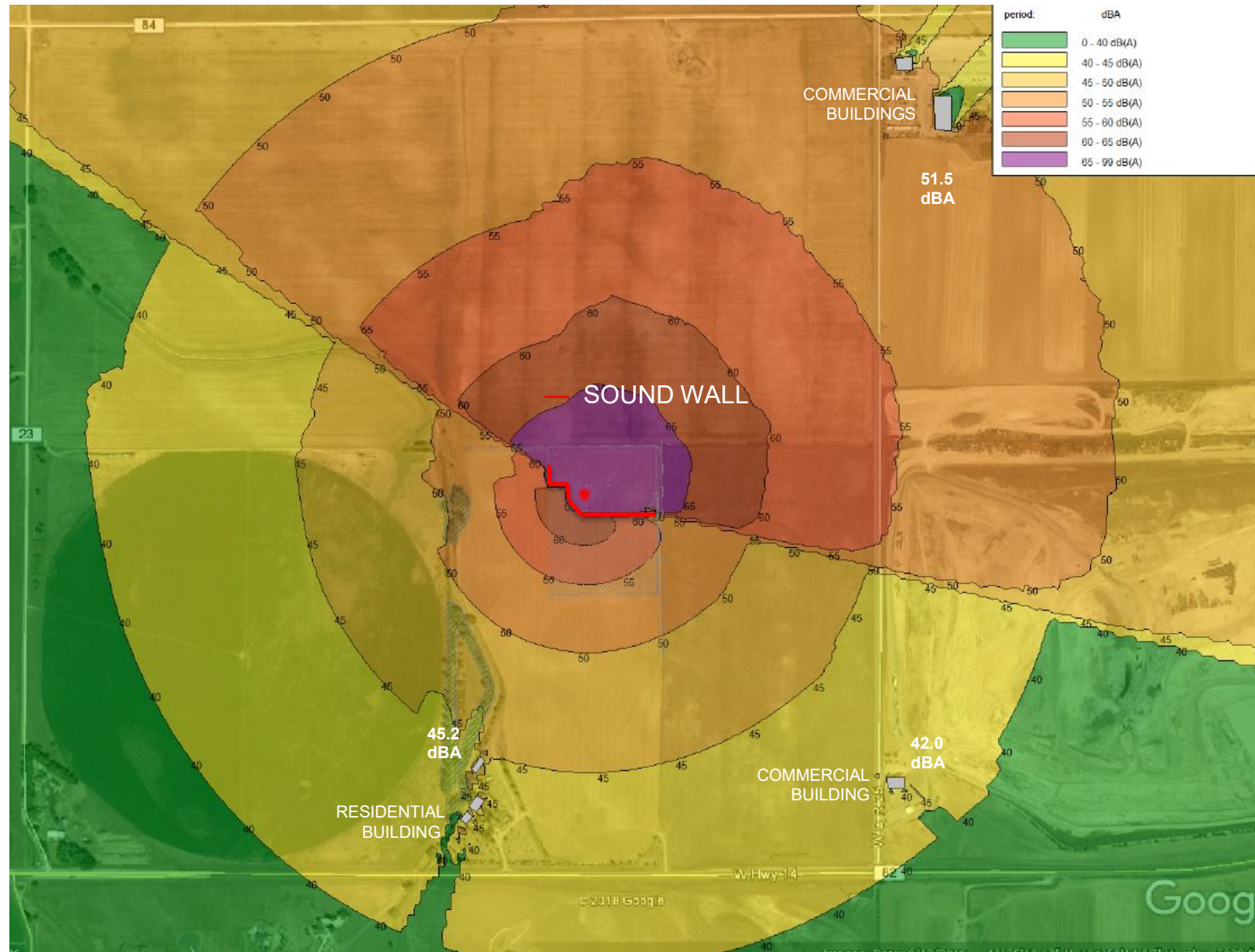
Sum Precipitation (in)	Average Wind Speed (mph)	Average Wind Direction	Average Temperature (°F)	Average Humidity (%)	Average Pressure (mb)	Maximum Wind Speed (mph)
0.0	3.6	WSW	20.3	43.2	834.4	8.9
0.0	3.1	WNW	20.2	42.7	834.6	8.5
0.0	2.9	SW	18.3	45.5	834.7	11.4
0.0	3.7	WNW	19.8	44.9	834.9	10.1
0.0	5.0	NE	16.5	57.4	835.4	9.4
0.0	4.3	NNW	12.5	63.1	835.9	7.6
0.0	2.4	NNW	11.2	63.7	836.2	6.0
0.0	2.9	NW	13.4	64.2	836.9	7.6
0.0	5.8	NNE	18.8	53.6	837.7	11.0
0.0	6.1	N	24.2	50.0	837.9	12.8
0.0	8.1	N	29.0	42.7	838.1	15.4
0.0	9.2	N	30.9	39.2	838.2	17.4
0.0	10.7	NNW	29.5	41.2	838.2	18.6
0.0	11.4	NNW	26.5	45.5	838.7	19.0
0.0	11.9	NW	24.3	47.6	839.3	20.4
0.0	12.6	NW	21.9	55.4	840.1	18.6
0.0	11.5	NW	20.2	58.2	840.9	18.1
0.0	9.3	NW	18.0	62.6	841.6	14.8
0.0	8.3	NW	17.4	66.1	842.9	14.8
0.0	9.0	NNW	16.8	66.7	843.7	16.1
0.0	6.9	NNW	16.0	69.7	844.2	13.0
0.0	7.4	NNW	14.7	65.7	844.6	11.9
0.0	6.2	NNW	12.5	63.1	845.0	11.4
0.0	7.5	N	12.0	62.0	845.3	13.0

**Figure 8.**  
**Drake Location – Weather Data February 17, 2019**



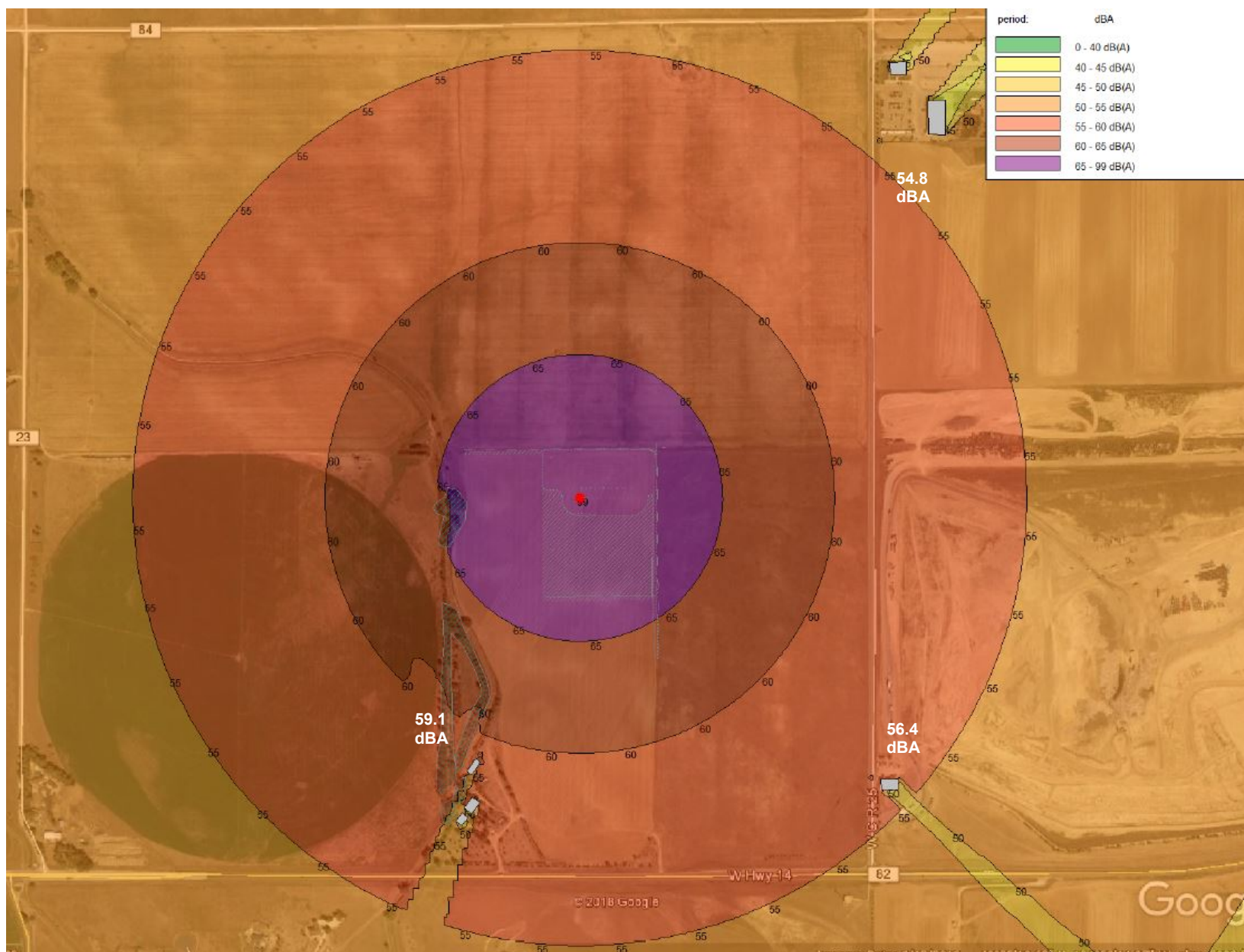
**Figure 9.**  
**Drake Location – Unmitigated Drilling Operations**



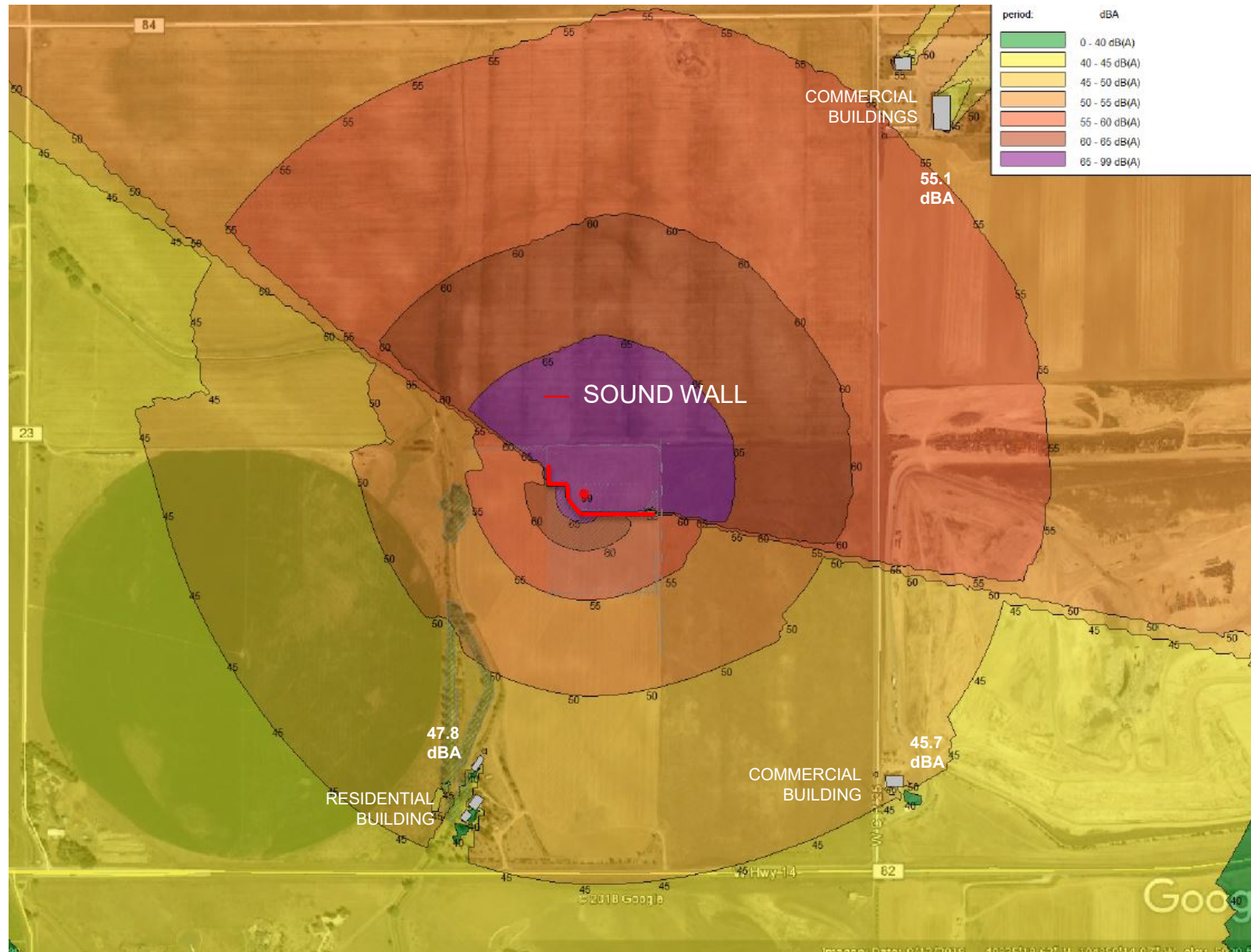


**Figure 10.**  
**Drake Location – Mitigated Drilling Operations**





**Figure 12.**  
**Drake Location – Unmitigated Facing Operations**



**Figure 13.**  
**Drake Location – Mitigated Facing Operations**