



**Kerr-McGee Oil & Gas Onshore LP**

**Noise Mitigation and Monitoring Plan**

**Paul Nelson 25-29HZ Well Pad and Facility  
NW/4 SE/4 Section 29, 5N 67W**

**Weld County, Colorado**

**September 2021**

# Paul Nelson Pad - Form 2A Noise Mitigation and Monitoring Plan

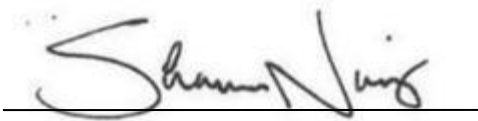
August 27, 2021

Prepared for:

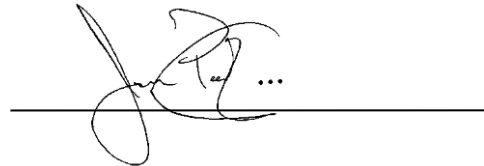
Kerr-McGee Oil & Gas Onshore, LP  
1099 18th Street  
Denver, CO 80202

Prepared by:

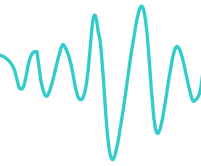
Behrens and Associates, Inc.  
9536 E. I-25 Frontage Rd.  
Longmont, CO 80504



Shaun Norris  
Staff Acoustical Engineer



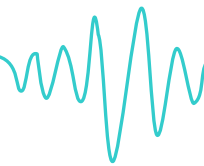
Jason Peetz  
Engineering Manager



## Table of Contents

---

1. Executive Summary .....	2
2. Introduction .....	4
3. Noise Fundamentals .....	6
4. Noise Standards.....	7
4.1 Colorado Oil and Gas Conservation Commission (COGCC) .....	7
4.2 Summary of COGCC Maximum Permissible Noise Levels .....	9
5. Ambient Sound Level Survey .....	10
5.1 Ambient Sound Level Survey Procedure .....	10
5.2 Ambient Sound Level Survey Results.....	10
5.3 Maximum Adjusted Noise Levels .....	11
6. Paul Nelson Pad Noise Modeling .....	16
6.1 Noise Modeling Methodology.....	16
6.2 Noise Sensitive Receptors .....	16
6.3 Unmitigated Drilling and Completions Noise Modeling Results.....	18
6.4 Drilling Mitigated Modeling Results .....	23
6.5 Completions Mitigated Modeling Results.....	27
7. Paul Nelson Pad Production Facility Noise Modeling.....	31
7.1 Unmitigated Production Facility Noise Modeling Results.....	31
8. Noise Points of Compliance and Continuous Noise Monitoring .....	38
8.1 Continuous Monitoring Procedure .....	38



## 1. Executive Summary

The following Form 2A Noise Mitigation and Monitoring Plan (2A NMP) was prepared by Behrens and Associates Environmental Noise Control (BAENC) for the planned operations associated with the proposed Paul Nelson pad operated by Kerr-McGee Oil & Gas Onshore, LP (KMOG). Predictive noise models representing the planned operations for the site were developed and assessed against the maximum permissible noise levels described in Rule 423 of the Colorado Oil and Gas Conservation Commission (COGCC) noise regulations. The following tasks were completed during development of the 2A NMP:

- Completion of a 3-location, 72-hour ambient sound level survey at the site
- Development of a site-specific drilling noise model representing the Precision 461 rig
- Development of a site-specific completions noise model representing a Haliburton Quiet Fleet crew
- Development of a site-specific production noise model

The ambient sound level survey was conducted to document the existing ambient sound levels at the site and determine if an increase in maximum permissible sound levels was appropriate per Rule 423.d.(2).

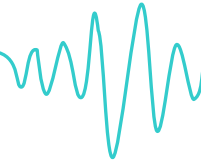
The site-specific noise models were developed to predict the future noise impact of the proposed operations and determine what noise mitigation measures, if any, would be required to demonstrate compliance with the COGCC maximum permissible noise levels. The noise modeling results were calculated utilizing the ISO 9613-2 standard and include the effects of local topography, buildings, barriers, and ground cover. Both A-weighted (dBA) and C-weighted (dBC) noise levels were measured during the ambient survey and considered during the noise modeling assessment.

The operator has the ability to utilize an equivalent drilling rig, completions fleet, and/or production equipment at the time operations commence as needed with substantially similarly equipment with an equal or less sound signature.

Additionally, the area surrounding the site was evaluated to establish noise points of compliance per Rule 423.a.(5). The need for continuous noise monitoring was also evaluated per Rule 423.c.(1). Table 1-1 below summarizes the analysis and mitigation findings in the Form 2A and presents them in the form of best management practices.

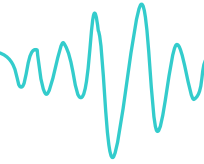
**Table 1-1 Site Mitigation and Best Management Practices**

<b>Task</b>	<b>Result of Analysis/ Action</b>
Ambient Survey	<ul style="list-style-type: none"><li>• Ambient survey conducted to document noise levels in area around the site (July 2021)</li><li>• Max permissible noise levels adjusted</li></ul>
Drilling Noise Model	<ul style="list-style-type: none"><li>• Developed noise model representing drilling to assess operational noise levels against COGCC allowable dBA and dBC noise levels</li><li>• Perimeter mitigation includes 32-foot-high sound wall with minimum STC-25 rating installed on north, south, and east sides of the pad</li></ul>



Completions Noise Model	<ul style="list-style-type: none"><li>• Developed noise model representing completions to assess operational noise levels against COGCC allowable dBA and dBC noise levels</li><li>• Perimeter mitigation includes 32-foot-high sound wall with minimum STC-25 rating installed on north, south, and east sides of the pad</li></ul>
Flowback Operations	<ul style="list-style-type: none"><li>• Flowback operations follow completions but utilize a fraction of similar pump trucks resulting in a smaller noise impact</li><li>• Completions mitigation will remain in place throughout the course of flowback operations</li></ul>
Production Noise Model	<ul style="list-style-type: none"><li>• Developed noise model representing production to assess operational noise levels against COGCC allowable dBA and dBC noise levels</li><li>• Noise mitigation not required</li></ul>
Land Use Evaluation	<ul style="list-style-type: none"><li>• Residential building units located within 2,000 ft</li><li>• Agricultural site zoning (Weld County)</li></ul>
Continuous Monitoring Evaluation	<ul style="list-style-type: none"><li>• Noise points of compliance proposed</li><li>• Continuous monitoring proposed at 4 locations</li></ul>

Based on the noise modeling analysis, with the implementation of the best management practices outlined in Table 1-1, the drilling, completions, and production operations are predicted to comply with the COGCC dBA and dBC noise limits.



## 2. Introduction

The following report provides a noise modeling assessment of the proposed activities at the Paul Nelson pad operated by Kerr-McGee Oil & Gas Onshore, LP (KMOG) in relation to the Colorado Oil and Gas Conservation Commission (COGCC) noise regulations. The assessment includes a modeling analysis of the Precision 461 production rig, Halliburton Quiet Fleet completion crew and Paul Nelson production facility. The Paul Nelson pad (40.368150, -104.915382) is located approximately 0.3 miles northeast of the intersection of County Road 15 ½ and County Road 52 as shown in Figure 2-1. The Weld County GIS portal indicates that the parcel in question, parcel # 095729000012, has been assigned a zoning designation of Agricultural by Weld County, and an image depicting the parcel as defined by Weld County is shown in Figure 2-2 below.

To assess the operational noise levels of the proposed Paul Nelson pad, file noise level data previously measured and typical of the Precision 461 production rig, and Halliburton Quiet Fleet completion crew and production facility equipment were utilized in the noise modeling. The noise models were developed using SoundPLAN 8.1 software.

PD 461 drilling operations are scheduled to occur for 90 days, Haliburton completions operations are scheduled to occur for 60 days, flowback operations are scheduled to occur for 30 days and production operations are scheduled to occur for 360 months.

The following is provided in this report:

- Documentation of ambient sound level survey results
- A review of applicable COGCC noise standards
- A discussion of noise modeling methodology
- An assessment of the predicted operational noise levels in relation to the COGCC noise limits
- Proposed continuous noise monitoring procedure



**Figure 2-1 Paul Nelson Pad Location**

# Behrens and Associates, Inc.

Environmental Noise Control

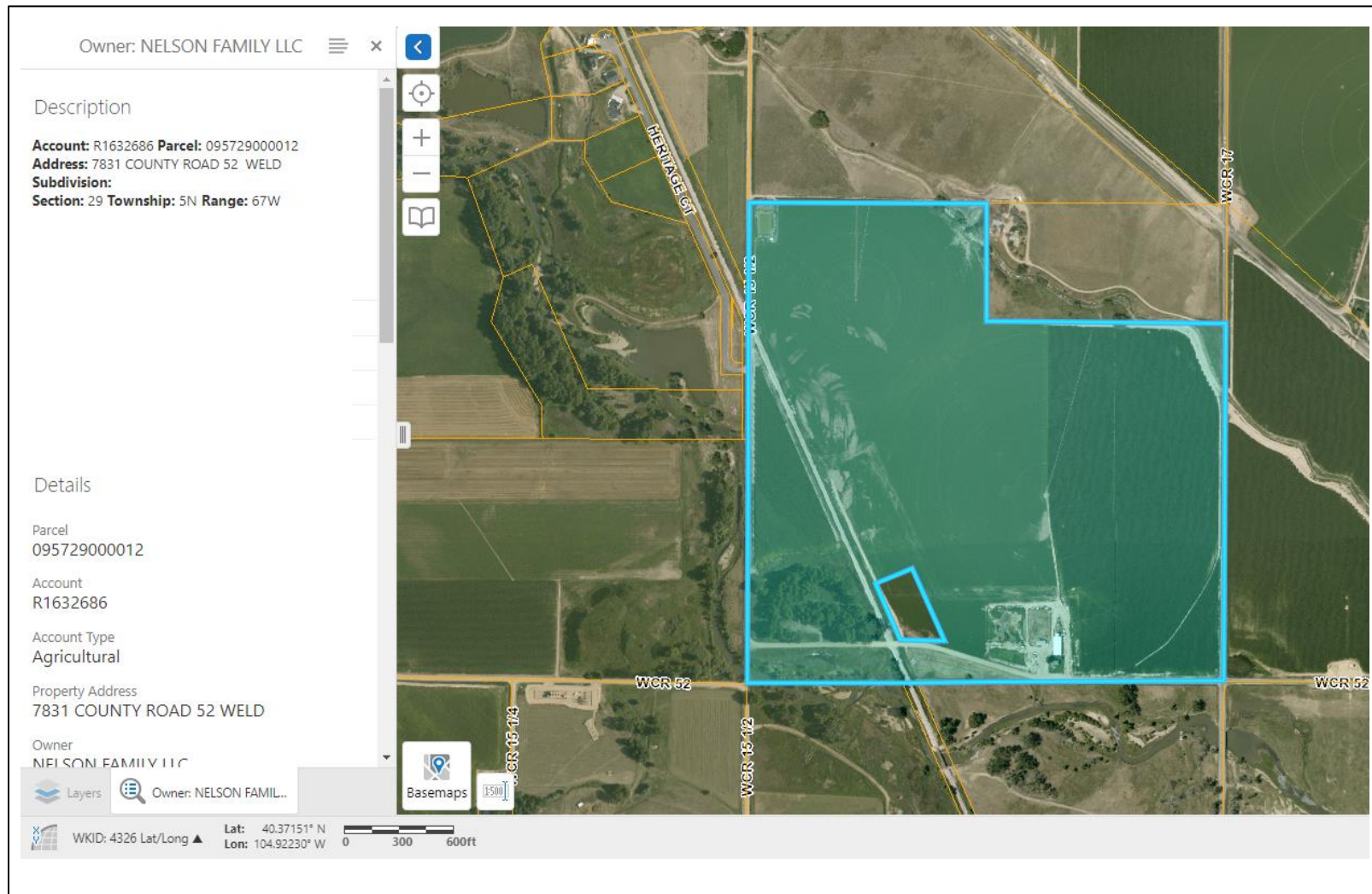
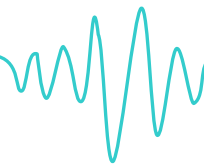


Figure 2-2 Weld County Geographic Information Systems (GIS) Parcel # 095729000012





## 3. Noise Fundamentals

Sound is most commonly experienced by people as pressure waves passing through air. These rapid fluctuations in air pressure are processed by the human auditory system to produce the sensation of sound. The rate at which sound pressure changes occur is called the frequency. Frequency is usually measured as the number of oscillations per second or Hertz (Hz). Frequencies that can be heard by a healthy human ear range from approximately 20 Hz to 20,000 Hz. Toward the lower end of this range are low-pitched sounds, including those that might be described as a “rumble” or “boom”. At the higher end of the range are high-pitched sounds that might be described as a “screech” or “hiss”.

Environmental noise generally derives, in part, from a combination of distant noise sources. Such sources may include common experiences such as distant traffic, wind in trees, and distant industrial or farming activities. These distant sources create a low-level “background noise” in which no particular individual source is identifiable. Background noise is often relatively constant from moment to moment but varies slowly from hour to hour as natural forces change or as human activity follows its daily cycle.

Superimposed on this low-level, slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. These events may include the passing of single-vehicles, aircraft flyovers, screeching of brakes, and other short-term events. The presence of these short-term events causes the noise level to fluctuate. Typical indoor and outdoor A-weighted sound levels are shown in Figure 3-1.

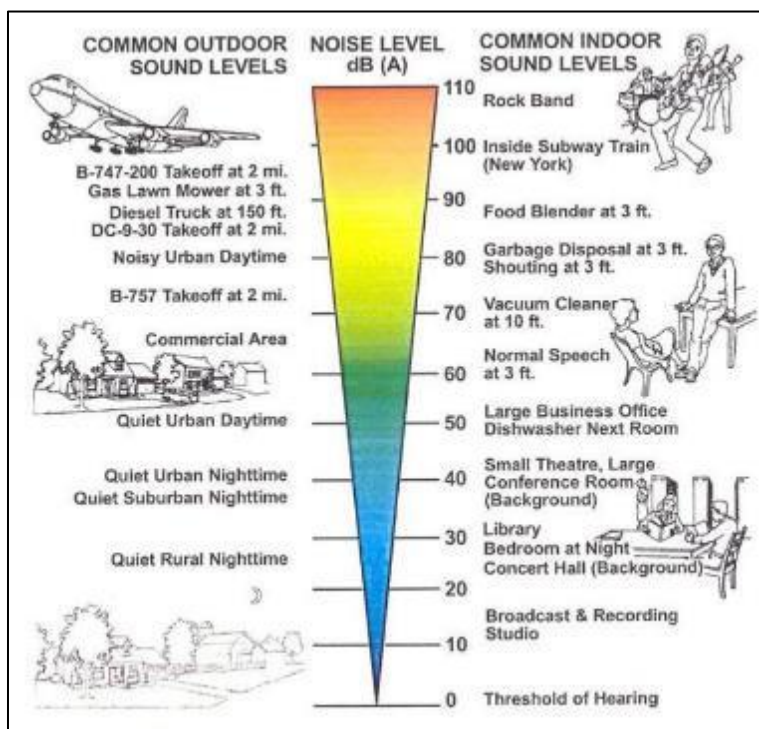
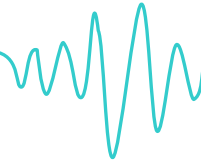


Figure 3-1 Typical Indoor and Outdoor A-Weighted Sound Levels





## 4. Noise Standards

The pad is located in Weld County in the state of Colorado and is subject to the regulations of the Colorado Oil and Gas Conservation Commission (COGCC). The COGCC publishes rules regulating oil and gas operations with rules relating to noise found in Rule 423. In addition to COGCC noise standards, the pad is subject to Weld County (WOGLA) noise standards and will comply with the NL-3 dBA standards.

### 4.1 Colorado Oil and Gas Conservation Commission (COGCC)

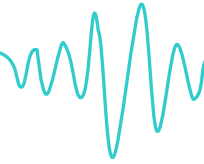
The COGCC Code lists noise limits for oil and gas operations. “All Oil and Gas Operations will comply with the following maximum permissible noise levels in Table 423-1 unless otherwise required by Rule 423.” The noise limits are provided in Table 4-1.

**Table 4-1 COGCC Table 423-1 – 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 / Rural / State Parks & State Wildlife Areas	55 dBA	50 dBA
Commercial / Agricultural	60 dBA	55 dBA
Light Industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA
All Zones	60 dBC	60 dBC

Exceptions to the noise limits above are given in Rule 423.b(2):

- (2) Unless otherwise required by Rule 423, drilling or completion operations, including Flowback:
  - A. In Residential/Rural or Commercial/Agricultural, maximum permissible noise levels will be 60 db(A) in the hours between 7:00 p.m. to 7:00 a.m. and 65 db(A) in the hours between 7:00 a.m. to 7:00 p.m.; and
  - B. In all zones maximum permissible noise levels will be 65 db(C) in the hours between 7:00 p.m. to 7:00 a.m. and 65 db(C) in the hours between 7:00 a.m. to 7:00 p.m.



To demonstrate compliance with the sound level limits, Rule 423.c.(2).A states:

A. In response to a complaint or at the Director's request, Operators will measure sound levels at 25 feet from the complainant's occupied structure towards the noise source for low frequency (dB<sub>C</sub>) indicated issues. For high frequency (dB<sub>A</sub>) measurement will be at the nearest point of compliance. For equipment installed at Oil and Gas Locations subject to a Form 2A approved prior to January 15, 2021, after the Commencement of Production Operations, no single piece of equipment will exceed the maximum permissible noise levels listed in Table 423-1 as measured at a point 350 feet from the equipment generating the noise in the direction from which the complaint was received.

Defining noise points of compliance, Rule 423.a.(5) states:

(5) For proposed Oil and Gas Locations with a Working Pad Surface within 2,000 feet of one or more Residential Building Units, at least one, and no more than six noise points of compliance where monitors will be located. Operators will identify noise points of compliance using the following criteria:

A. Provide one noise point of compliance in each direction in which a Residential Building Unit is located within 2,000 feet of the proposed Working Pad Surface.

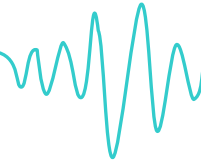
B. Noise points of compliance will be located at least 350 feet from the Working Pad Surface, and no less than 25 feet from the exterior wall of the Residential Building Unit that is closest to the Working Pad Surface. If a Surface Owner or tenant refuses to provide the Operator with access to install a noise monitor, then the noise point of compliance will be located at either the next-closest Residential Building Unit or an alternative location approximately the same distance and direction from the Working Pad Surface.

With regards to adjusting maximum permissible noise levels based on measured ambient sound levels, Rule 423.d. states:

d. Cumulative Noise. All noise measurements will be cumulative.

(1) Noise measurements taken at noise points of compliance designated pursuant to Rule 423.a.(5) will take into account ambient noise, rather than solely the incremental increase of noise from the facility targeted for measurement.

(2) At new or substantially modified Oil and Gas Locations where ambient noise levels at noise points of compliance designated pursuant to Rule 423.a.(5) already exceed the noise thresholds identified in Table 423-1, then Operators will be considered in compliance with Rule 423, unless at any time their individual noise contribution, measured pursuant to Rule 423.c, increases noise above ambient levels by greater than 5 dBC and 5 dBA between 7:00 p.m. and 7:00 a.m. or 7 dBC and 7 dBA between 7:00 a.m. and 7:00 p.m. This Rule 423.d.(2) does not allow Operators to increase noise above the maximum cumulative noise thresholds specified in Table 423-2 after the Commencement of Production Operations.



- (3) After the Commencement of Production Operations, if ambient noise levels already exceed the maximum permissible noise thresholds identified in Table 423-1, under no circumstances will new Oil and Gas Operations or a significant modification to an existing Oil and Gas Operations raise cumulative ambient noise above:

**Table 423-2 – Maximum Cumulative Noise Levels**

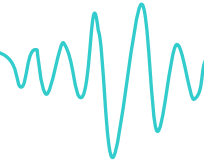
LAND USE	7:00 am to next 7:00 pm	7:00 pm to next 7:00 am
Residential /Rural/State Parks/State Wildlife Areas	65 db(A)	60 db(A)
Commercial/Agricultural	70 db(A)	65 db(A)
Light Industrial	80 db(A)	75 db(A)
Industrial	90 db(A)	85 db(A)
All Zones	75 db(C)	70 db(C)

## 4.2 Summary of COGCC Maximum Permissible Noise Levels

Notwithstanding any influence or adjustments due to ambient noise or maximum cumulative noise levels of Rule 423 – Table 423-2, based on COGCC Rule 423, the allowable noise level limits applicable to the site are as follows:

**Table 4-2 Unadjusted Maximum Permissible Noise Levels**

Operation	Applicable Zoning	Noise Limits (dBA)	Noise Limits (dBC)
Drilling	Agricultural/Commercial	65 day / 60 night	65 day and night
Completions & Flowback	Agricultural/Commercial	65 day / 60 night	65 day and night
Production	Agricultural/Commercial	60 day / 55 night	60 day and night



## 5. Ambient Sound Level Survey

### 5.1 Ambient Sound Level Survey Procedure

Three Type 1 SVANTEK SVAN 971 sound level meters were utilized to conduct an ambient sound level survey adjacent to the Paul Nelson pad. The sound level meters conform to Type 1 as per ANSI S1.4 Specification for Sound Level Meters. The sound level meters were calibrated prior to deployment. The sound level monitoring period began on Friday, July 23, 2021 with the meters programmed to continuously monitor and record A-weighted and C-weighted sound levels. The monitoring period ended on Monday, July 26, 2021. The locations of the sound level meters and weather station used to conduct the ambient sound level survey can be seen in Figure 5-1 below. Weather data was collected using a Larson Davis Technologies Vantage Vue Weather Station.

Per COGCC Rule 423.c.(2), the measurements were conducted at an approximate height of 5 feet. When calculating the ambient average sound levels shown in Table 5-1, the weather data collected during the survey was used to exclude periods from the calculation when winds exceeded 5 mph. The graphed ambient survey results show the measurement data before periods of wind above 5 mph were removed.

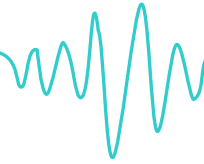
### 5.2 Ambient Sound Level Survey Results

The measured A-weighted and C-weighted hourly average  $L_{eq}$  for each monitoring location can be seen in Figure 5-2, Figure 5-3, and Figure 5-4. The measured A-weighted and C-weighted daytime and nighttime average sound levels for the Monitoring Locations are shown in Figure 5-1 below.

**Table 5-1 Ambient Sound Level Survey Results for Monitoring Locations 1, 2, & 3**

Day	Location 1				Location 2				Location 3			
	Daytime $L_{eq}$ Ambient Noise Levels		Nighttime $L_{eq}$ Ambient Noise Levels		Daytime $L_{eq}$ Ambient Noise Levels		Nighttime $L_{eq}$ Ambient Noise Levels		Daytime $L_{eq}$ Ambient Noise Levels		Nighttime $L_{eq}$ Ambient Noise Levels	
	dBA	dB(C)	dBA	dB(C)	dBA	dB(C)	dBA	dB(C)	dBA	dB(C)	dBA	dB(C)
1	56	80	53	70	56	81	42	63	54	82	41	59
2	52	70	54	70	40	63	42	61	45	60	42	56
3	46	68	45	59	39	64	40	60	43	68	44	64
4	62	64	-	-	50	59	-	-	56	61	-	-
Overall $L_{eq}$	56	72	52	68	48	71	41	61	51	72	43	61

Note: Day 1 Daytime is an  $L_{eq}$  from 1pm until 7pm, and Day 4 Daytime is an  $L_{eq}$  from 7am until 1pm.



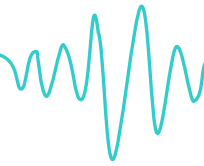
**Figure 5-1 Ambient Monitoring Locations**

## 5.3 Maximum Adjusted Noise Levels

The measured ambient sound levels already exceed the maximum permissible noise thresholds identified in COGCC Table 423-1. Based on COGCC Rule 423.d.(2), for drilling, completions, and production operations, the operational noise levels at the site will be limited to the measured ambient noise level plus 5 dBC during nighttime and 7 dBC during daytime. The following table presents the adjusted allowable noise levels for the site.

**Table 5-2 Adjusted Allowable Daytime and Nighttime Noise Level Limits for Drilling and Completions**

Noise Point of Compliance	Measured Ambient day/night	Adjusted Allowable Day/Night
<b>Location 1</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 1)	72/68 dBC	79/73 dBC



<b>Location 2</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 2)	71/61 dBC	78/65 dBC
<b>Location 3</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 3)	72/61 dBC	79/65 dBC

**Table 5-3 Adjusted Allowable Daytime and Nighttime Noise Level Limits for Production**

Noise Point of Compliance	Measured Ambient day/night	Adjusted Allowable Day/Night
<b>Location 1</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 1)	72/68 dBC	75/70 dBC
<b>Location 2</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 2)	71/61 dBC	75/66 dBC
<b>Location 3</b> (This adjusted allowable sound level applies to noise points of compliance in the direction of Monitoring Location 3)	72/61 dBC	75/66 dBC

Note: Maximum adjusted production cumulative noise levels capped at 75/70 day/night dBC

The drilling, completions, and production operations are planned to occur 24 hours a day, as such, the stricter nighttime allowable level will be utilized in the noise modeling analysis.



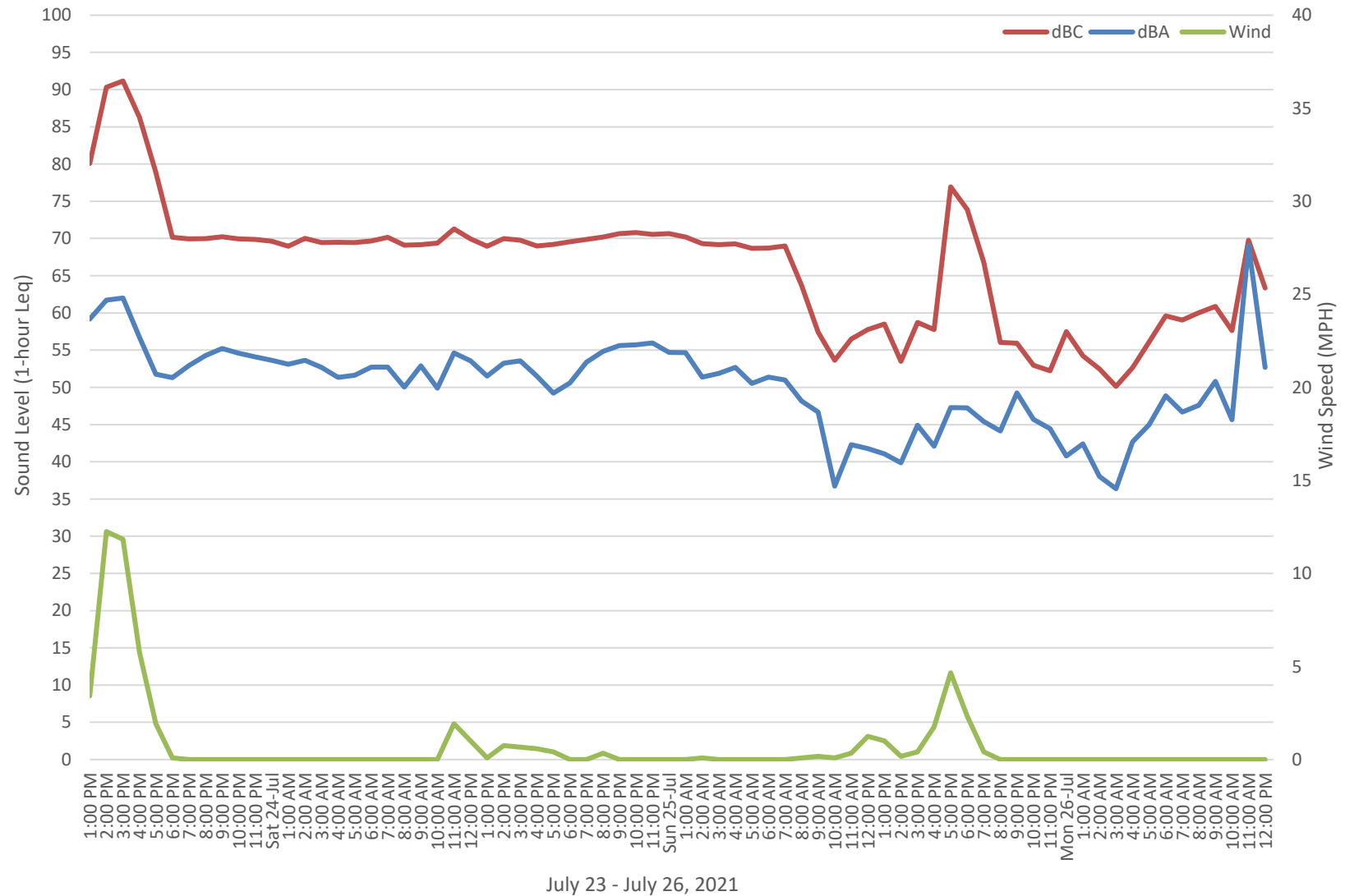


Figure 5-2 Ambient Sound Level Data for Measurement Location 1

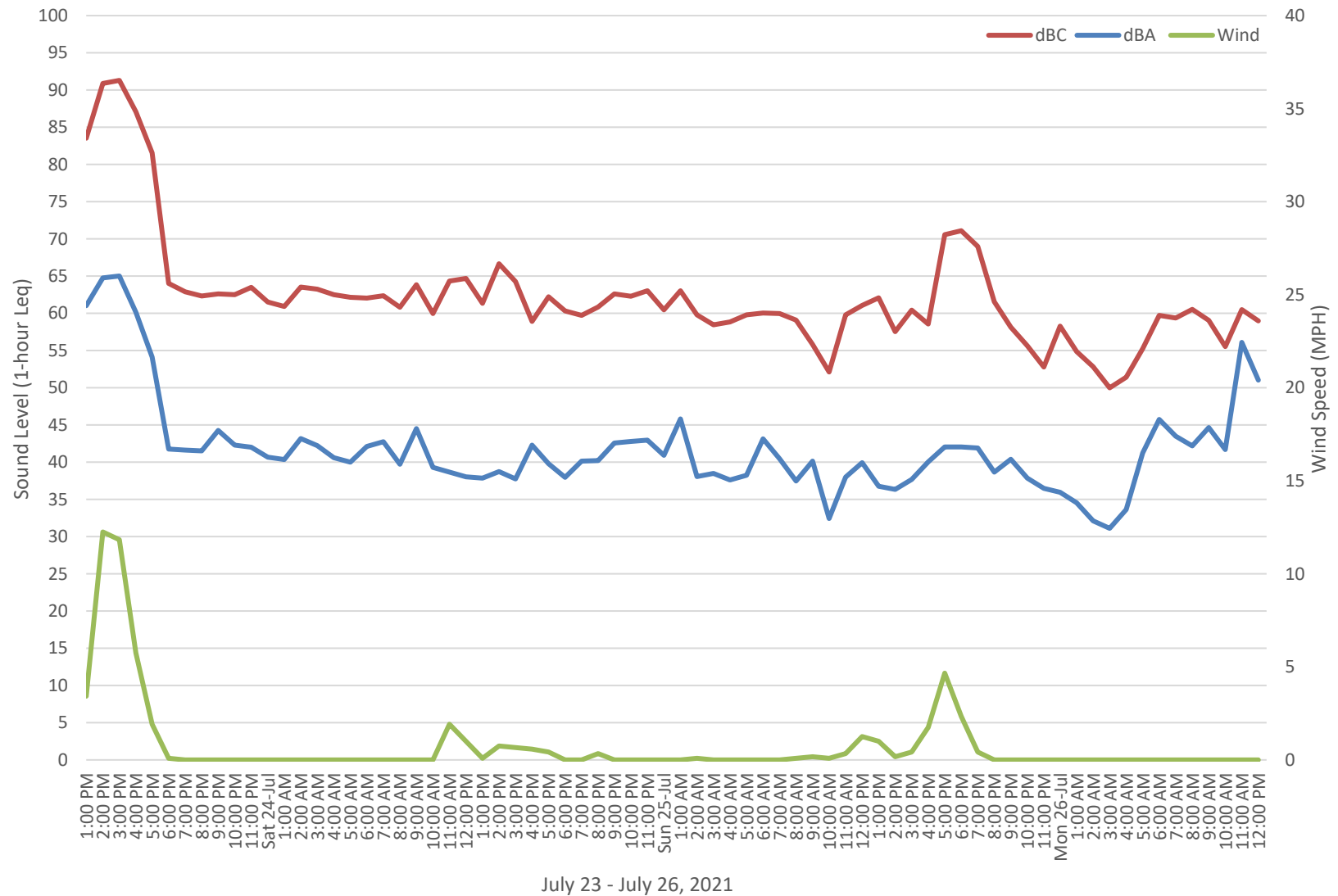
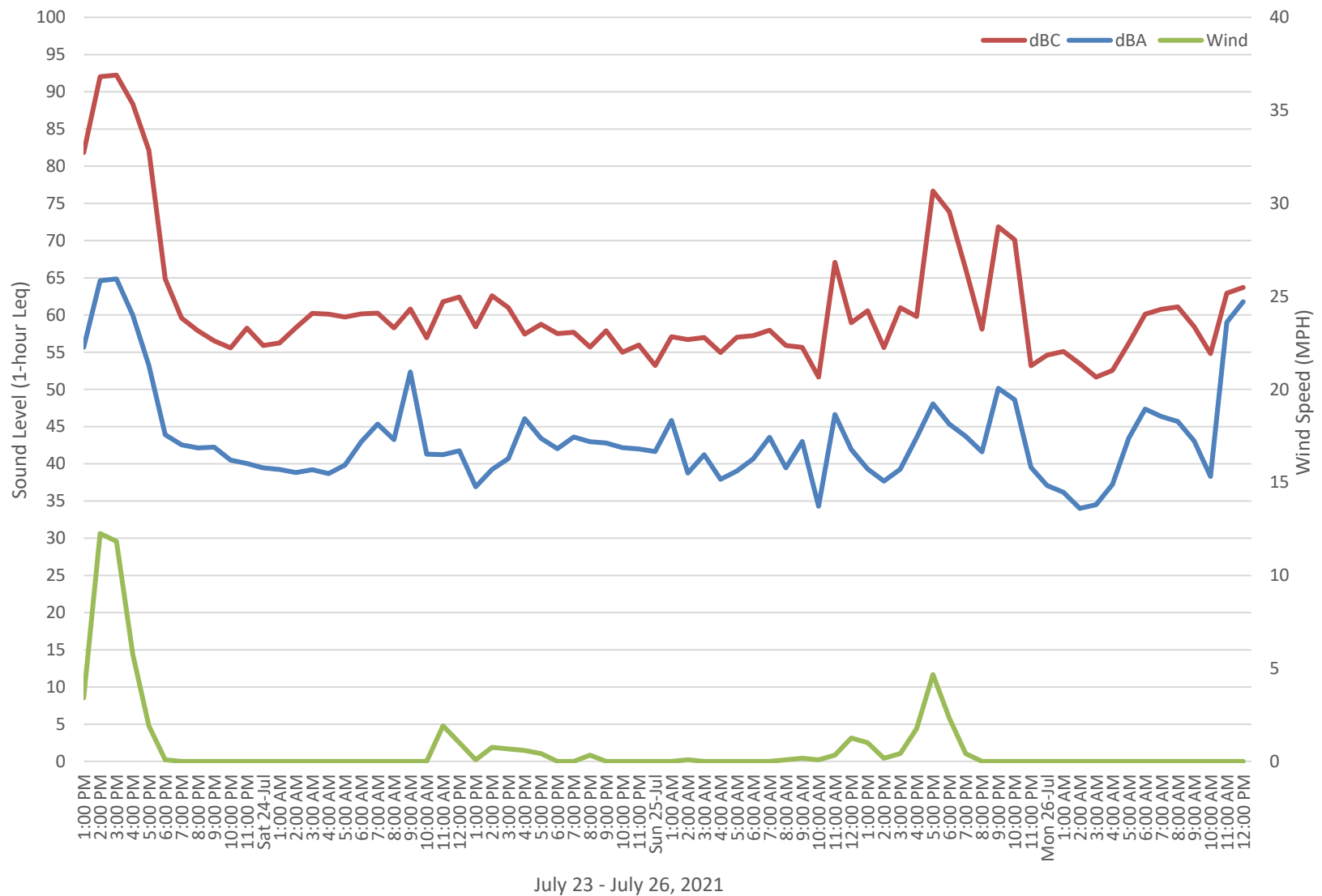
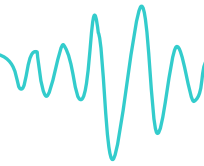


Figure 5-3 Ambient Sound Level Data for Measurement Location 2



**Figure 5-4 Ambient Sound Level Data for Measurement Location 3**



## 6. Paul Nelson Pad Noise Modeling

---

### 6.1 Noise Modeling Methodology

The noise modeling was completed with use of three-dimensional computer noise modeling software. All models in this report were developed with SoundPLAN 8.1 software using the ISO 9613-2 standard. Noise levels are predicted based on the locations, noise levels and frequency spectra of the noise sources, and the geometry and reflective properties of the local terrain, buildings and barriers. To ensure a conservative assessment and compliance with ISO 9613-2 standards, light to moderate winds are assumed to be blowing from the source to receptor. The predicted noise levels represent only the contribution of the drilling, completions and production facility equipment operations and do not include ambient noise or noise from other facilities. Actual field sound level measurements may vary from the modeled noise levels due to other noise sources such as traffic, other facilities, other human activity, or environmental factors.

Sound level data utilized in the surface drilling model was based on file data of the Precision 461 rig collected by BAENC. The V door faces south with the backyard equipment positioned to the east. Rig placement and orientation was coordinated with KMOG and oriented to minimize noise impact when possible. The predicted modeling results are dependent on equipment and mitigation orientation as indicated.

Sound level data utilized in the completions model was based on file data of the Halliburton Quiet Fleet completions crew collected by BAENC. The model consists of 12 completions trucks positioned south of the well heads. Completions equipment placement and orientation was coordinated with KMOG and oriented to minimize noise impact when possible. The predicted modeling results are dependent on equipment and mitigation orientation as indicated.

Flowback operations follow completions but utilize a fraction of similar pump trucks resulting in a smaller noise impact. Mitigation for completions, if required, will remain in place throughout flowback operations.

The operator has the ability to utilize an equivalent drilling rig, completions fleet, and/or production equipment at the time operations commence as needed with substantially similarly equipment with an equal or less sound signature.

### 6.2 Noise Sensitive Receptors

The noise sensitive receptors utilized in the drilling and completions modeling were positioned to be consistent with the requirements of the COGCC noise standards. The requirements state that dBA noise levels shall comply with the applicable noise limits as measured at 350 feet from the working pad surface and no less than 25 feet from the exterior wall of the Residential Building Unit that is within 2,000 ft. and closest to the drill pad surface. Receptor points used in the modeling can represent multiple closely located RBU's. The requirements state that dBC noise levels shall comply with the applicable noise limits as measured at 25 feet from the exterior wall of nearby residences or occupied structures. Figure 6-1 shows the dBA and dBC noise sensitive receptor locations.

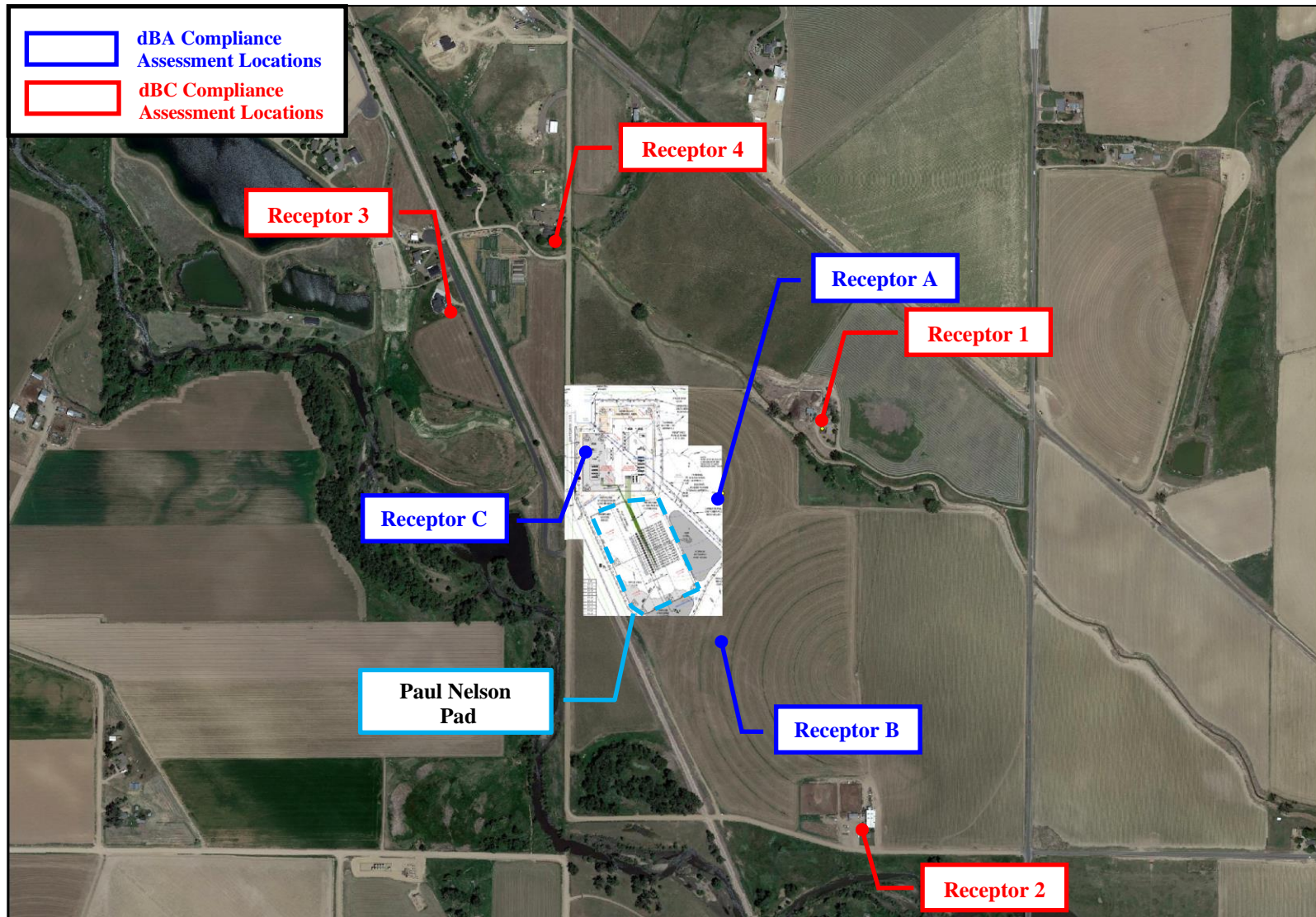
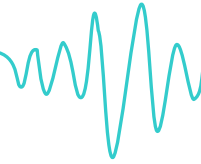


Figure 6-1 Noise Sensitive Receptor Locations



### 6.3 Unmitigated Drilling and Completions Noise Modeling Results

The unmitigated modeling is based off of current drilling and completions plans and does not include sound walls or other third-party acoustical mitigation measures. The results of the unmitigated drilling noise modeling are presented in Table 6-1 and Table 6-2. The locations in the tables correspond to the locations identified in Figure 6-1. The predicted noise levels represent only the contribution of the project operations and do not include ambient noise or noise from other facilities. Figure 6-2 and Figure 6-3 shows the Unmitigated PD 461 Noise Contour Map in dBA and dBC respectively. Figure 6-4 and Figure 6-5 shows the Unmitigated Halliburton Noise Contour Map in dBA and dBC respectively. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.

**Table 6-1 Unmitigated Noise Modeling Results (dBA)**

<b>Receptor</b>	<b>Location Description</b>	<b>Precision 461</b>	<b>Halliburton Quiet Fleet</b>
Location A	350 Feet Northeast	61	63
Location B	350 Feet Southeast	56	60
Location C	350 Feet Northwest	57	63
<b>COGCC Noise Limit</b>	<b>350 ft. from the working pad surface</b>	<b>65 Day / 60 Night</b>	<b>65 Day / 60 Night</b>

**Table 6-2 Unmitigated Noise Modeling Results (dBC)**

<b>Receptor</b>	<b>Location Description</b>	<b>Precision 461</b>	<b>Halliburton Quiet Fleet</b>
Location 1	25377 County Road 17	67	67
Location 2	7831 County Road 52	59	62
Location 3*	25341 Heritage Court	62	62
Location 4*	25671 County Road 15 ½	61	63
<b>COGCC Noise Limit</b>	<b>25 ft. from the exterior wall of a residence or occupied structure towards the noise source</b>	<b>65</b>	<b>65</b>

\*Location 3 & 4 are subject to adjusted allowable limits of 79 day/73 night dBC for drilling and completions

The results of the unmitigated noise modeling indicate that the drilling and completions operations will exceed the COGCC A-weighted and C-weighted noise level limits. Therefore, mitigation will be utilized for drilling and completions operations.



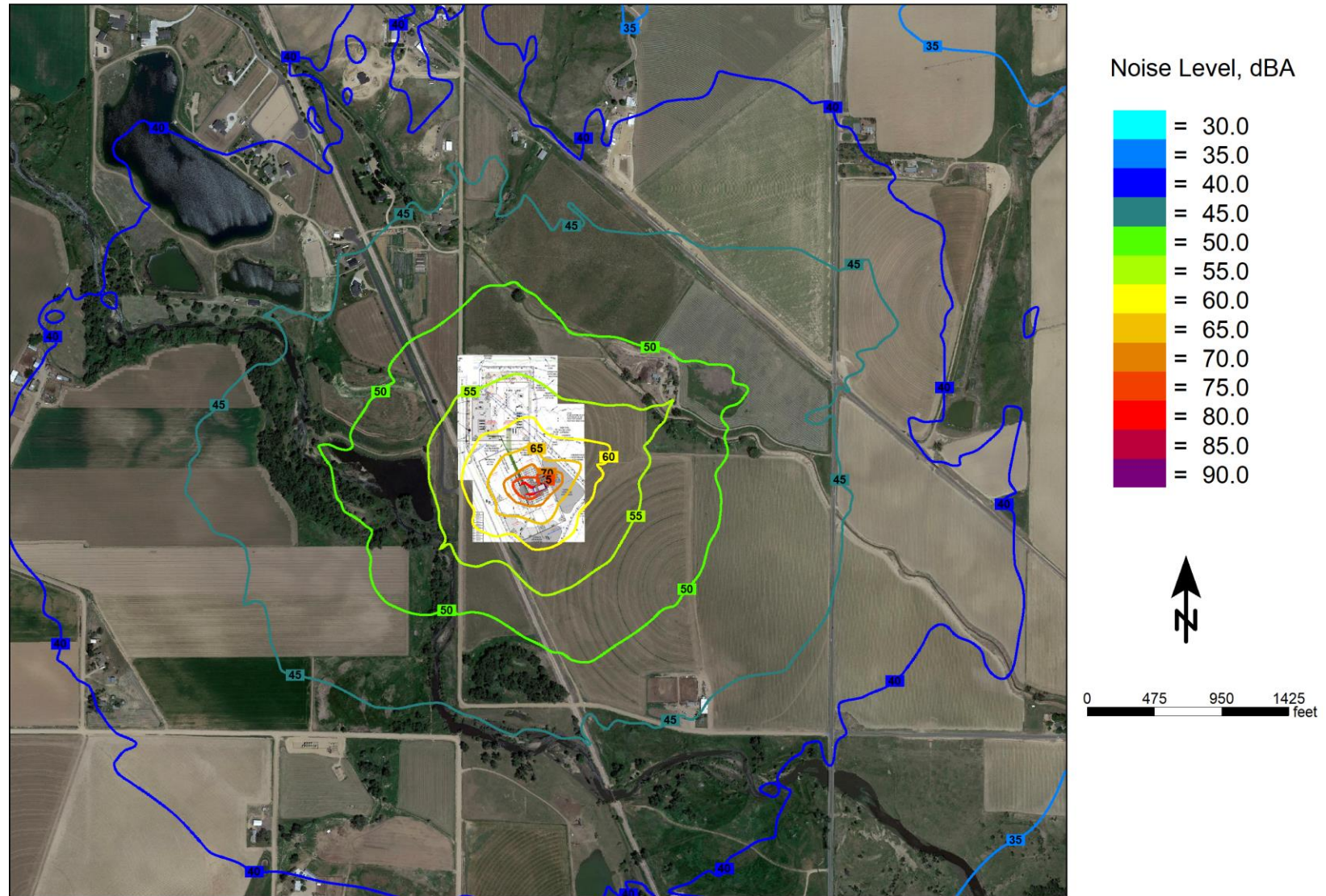


Figure 6-2 PD 461 Unmitigated Noise Contour Map (dBA)



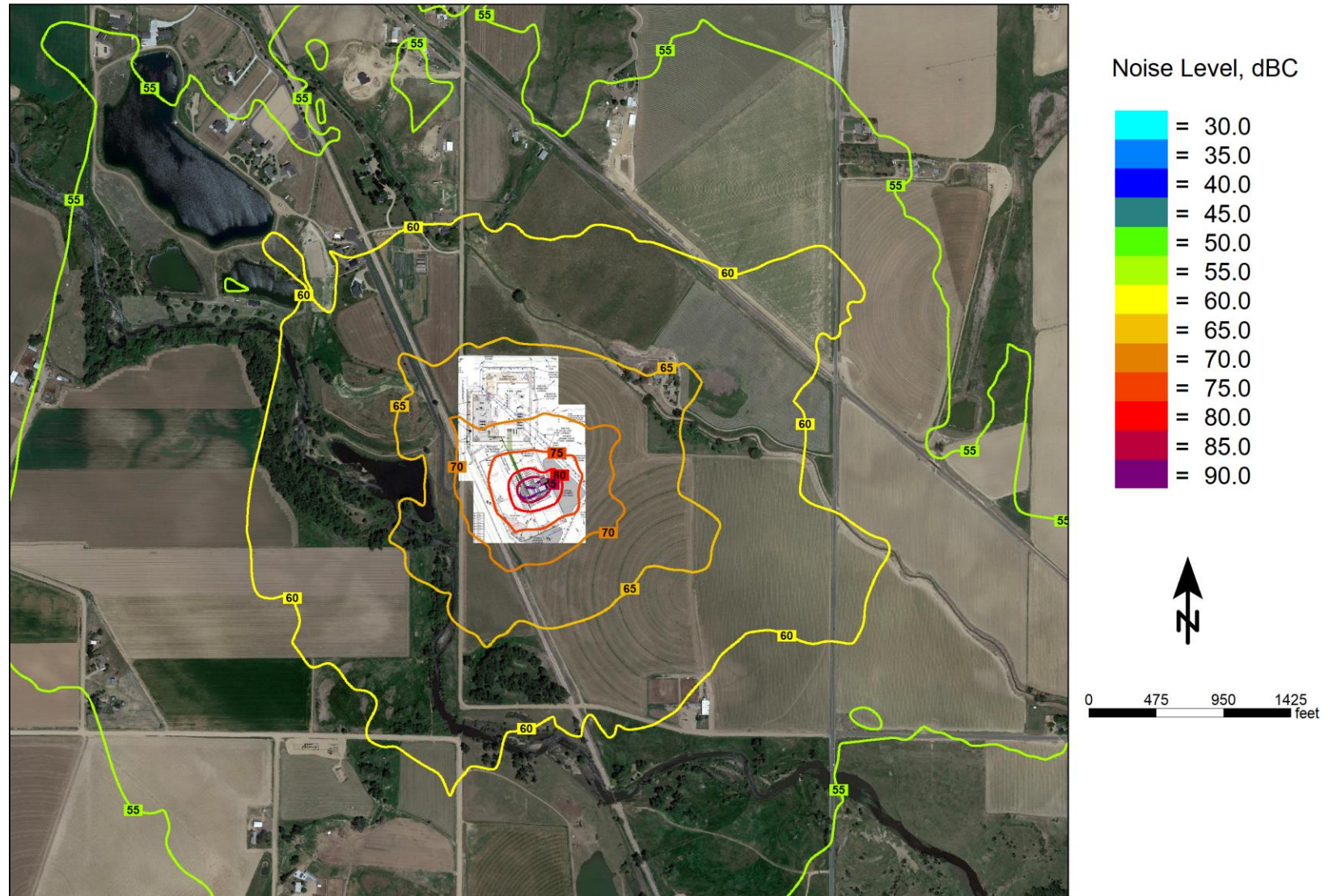


Figure 6-3 PD 461 Unmitigated Noise Contour Map (dBC)



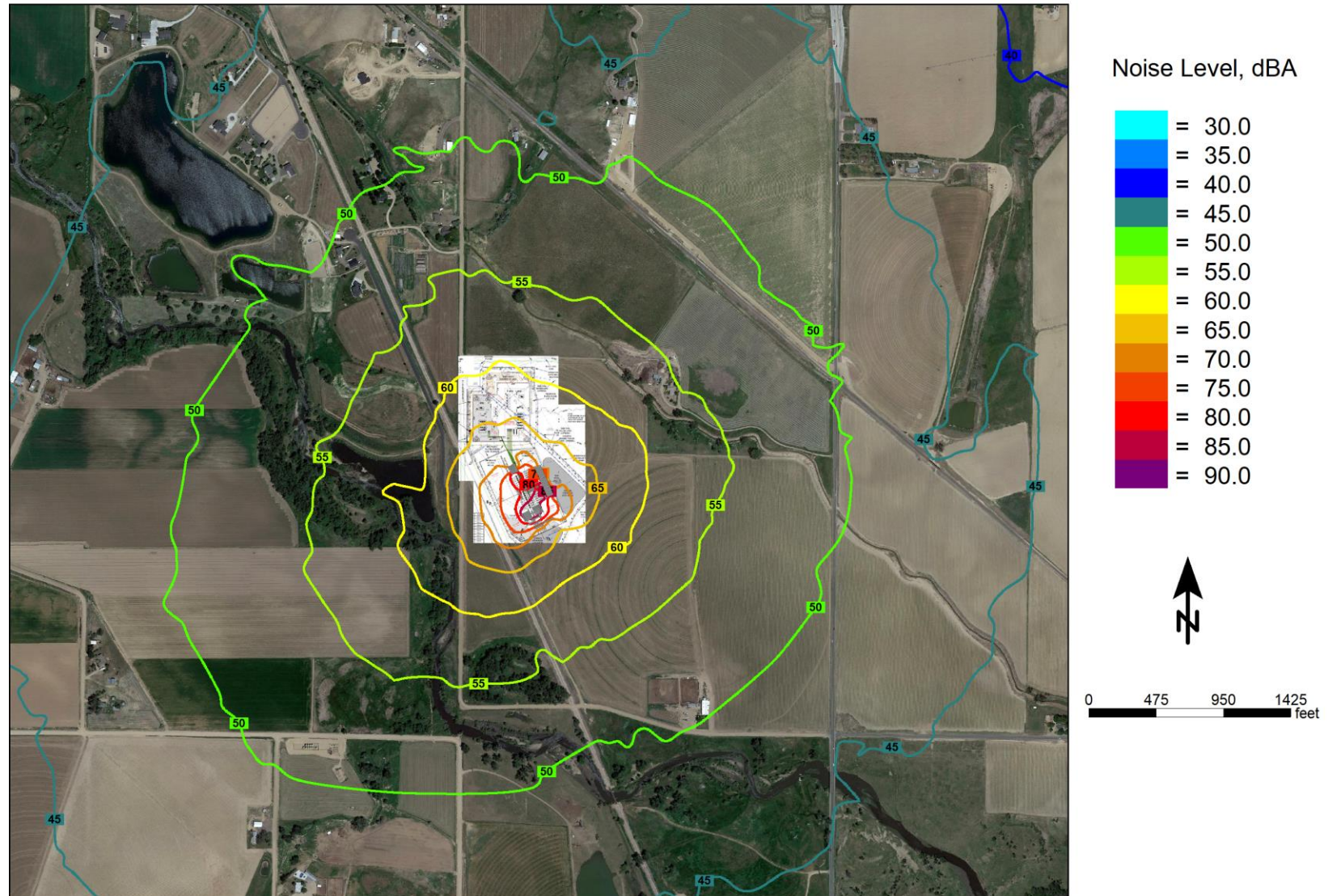


Figure 6-4 Halliburton Unmitigated Noise Contour Map (dBA)



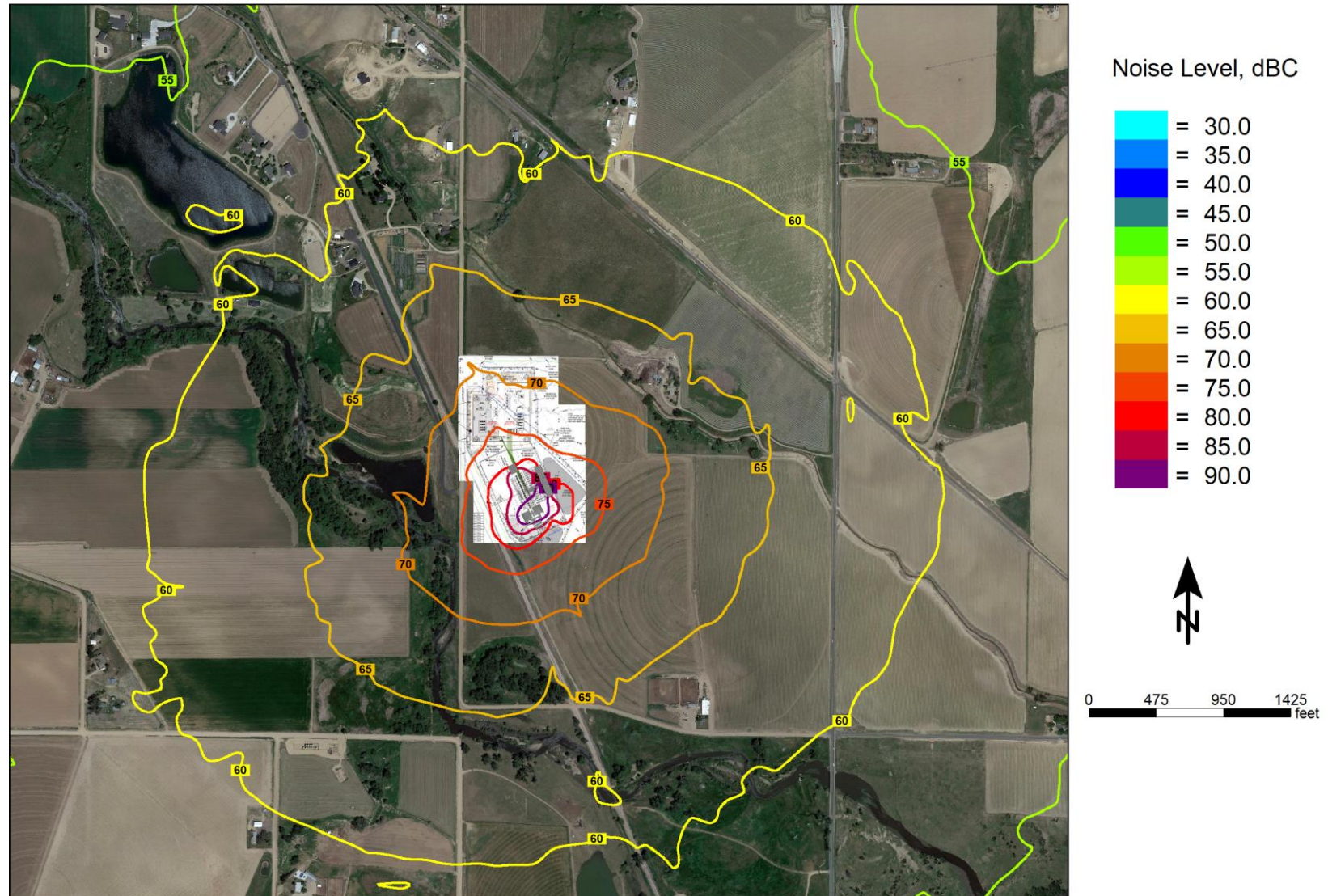
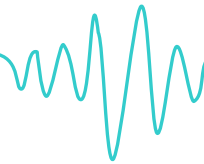


Figure 6-5 Halliburton Unmitigated Noise Contour Map (dBC)



## 6.4 Drilling Mitigated Modeling Results

Noise mitigation for drilling operations has been included in the modeling to reduce noise levels in the surrounding environment. The noise mitigation included in the modeling is described below:

- Approximately 1,060 total linear feet of 32-foot-high, Sound Transmission Class (STC) 25 acoustical wall installed on the north, south, and east perimeter of the site.

The layout for the modeled mitigation scenario is shown in Figure 6-6.

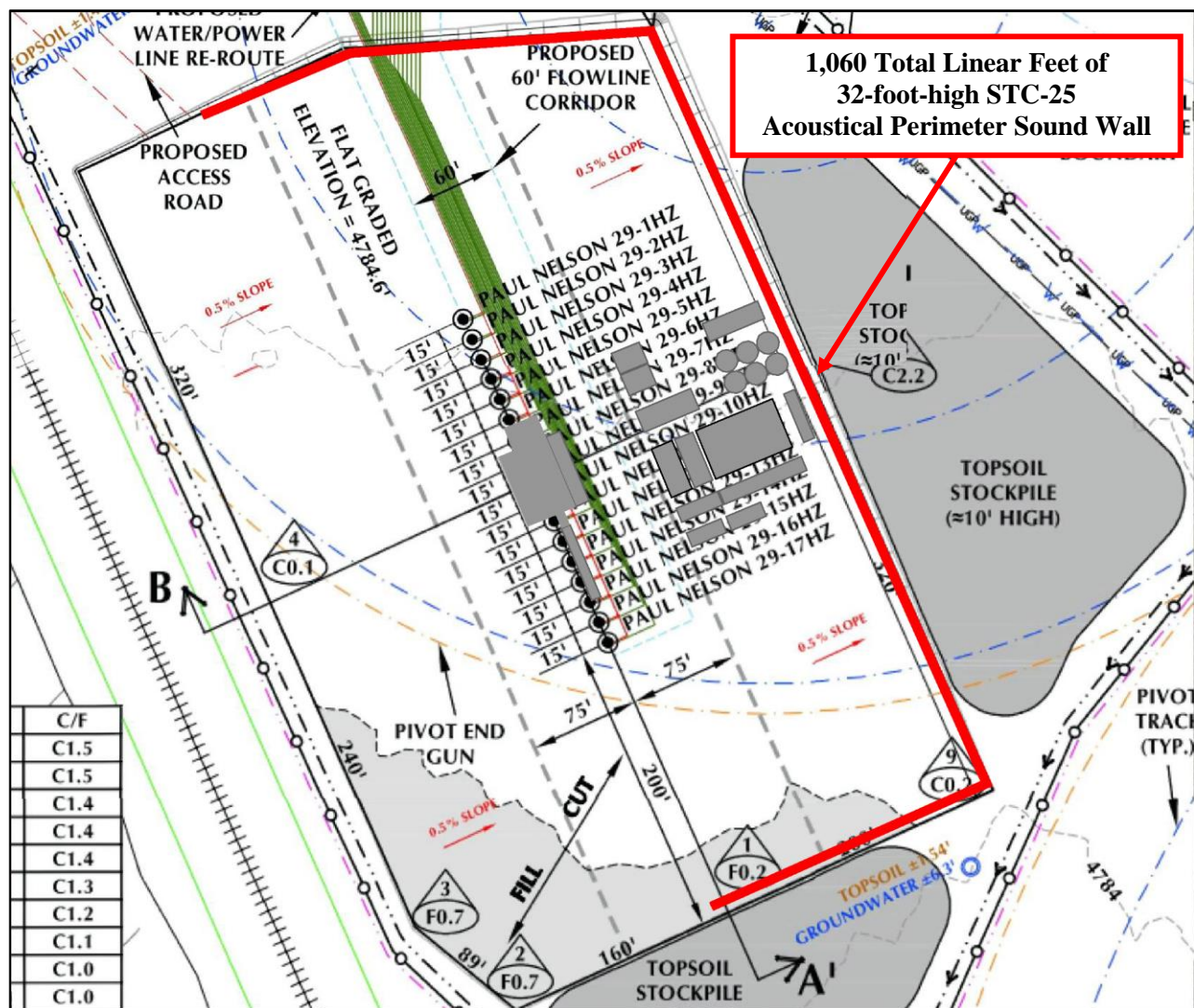
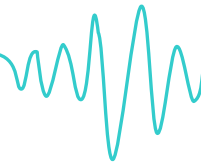


Figure 6-6 Mitigation Layout





The mitigated modeling includes the acoustical mitigation shown in Figure 6-6. The results of the mitigated noise modeling are presented in Table 6-3 and Table 6-4. The locations in the tables correspond to the locations identified in Figure 6-1. The predicted noise levels represent only the contribution of the drilling operations and do not include ambient noise or noise from other facilities. Actual field sound level measurements may vary from the modeled noise levels due to other noise sources such as traffic, other facilities, other human activity, or environmental factors.

**Table 6-3 Mitigated Noise Modeling Results (dBA)**

<b>Receptor</b>	<b>Location Description</b>	<b>Precision 461</b>
Location A	350 Feet Northeast	51
Location B	350 Feet Southeast	48
Location C	350 Feet Northwest	50
<b>COGCC Noise Limit</b>	<b>350 ft. from the working pad surface</b>	<b>65 Day / 60 Night</b>

**Table 6-4 Mitigated Noise Modeling Results (dBC)**

<b>Receptor</b>	<b>Location Description</b>	<b>Precision 461</b>
Location 1	25377 County Road 17	61
Location 2	7831 County Road 52	58
Location 3*	25341 Heritage Court	59
Location 4*	25671 County Road 15 ½	58
<b>COGCC Noise Limit</b>	<b>25 ft. from the exterior wall of a residence or occupied structure towards the noise source</b>	<b>65</b>

\*Location 3 & 4 are subject to adjusted allowable limits of 79 day/73 night dBC for drilling and completions

The results of the mitigated noise modeling indicate that with the implementation of the mitigation the proposed drilling operations are predicted to comply with the allowable COGCC A-weighted and C-weighted noise limits. The results of the mitigated noise modeling are also shown as noise contour maps. Figure 6-7 shows the Mitigated PD 461 Noise Contour Map in the A-weighted scale and Figure 6-8 shows the Mitigated PD461 Noise Contour Map in the C-weighted scale.



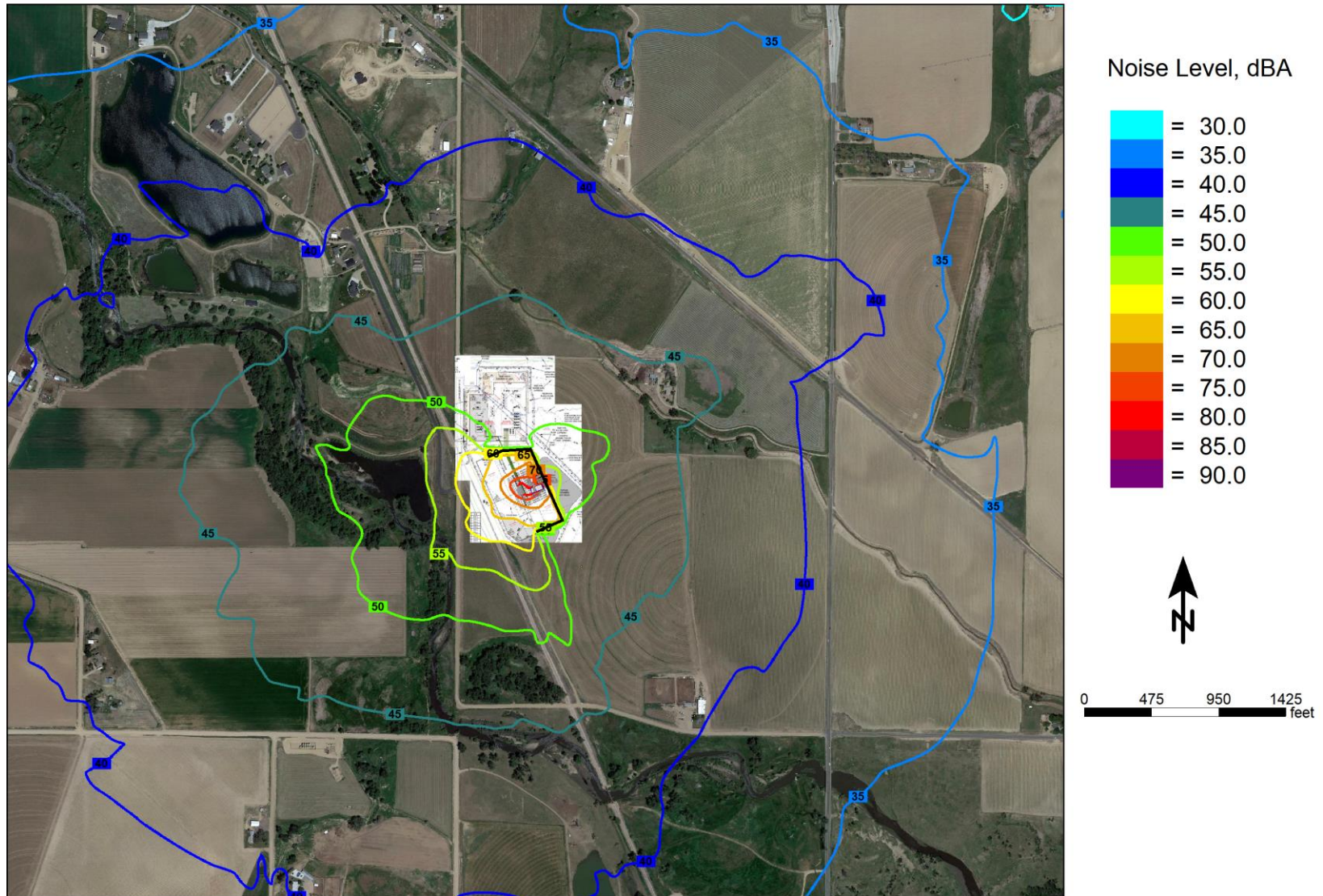
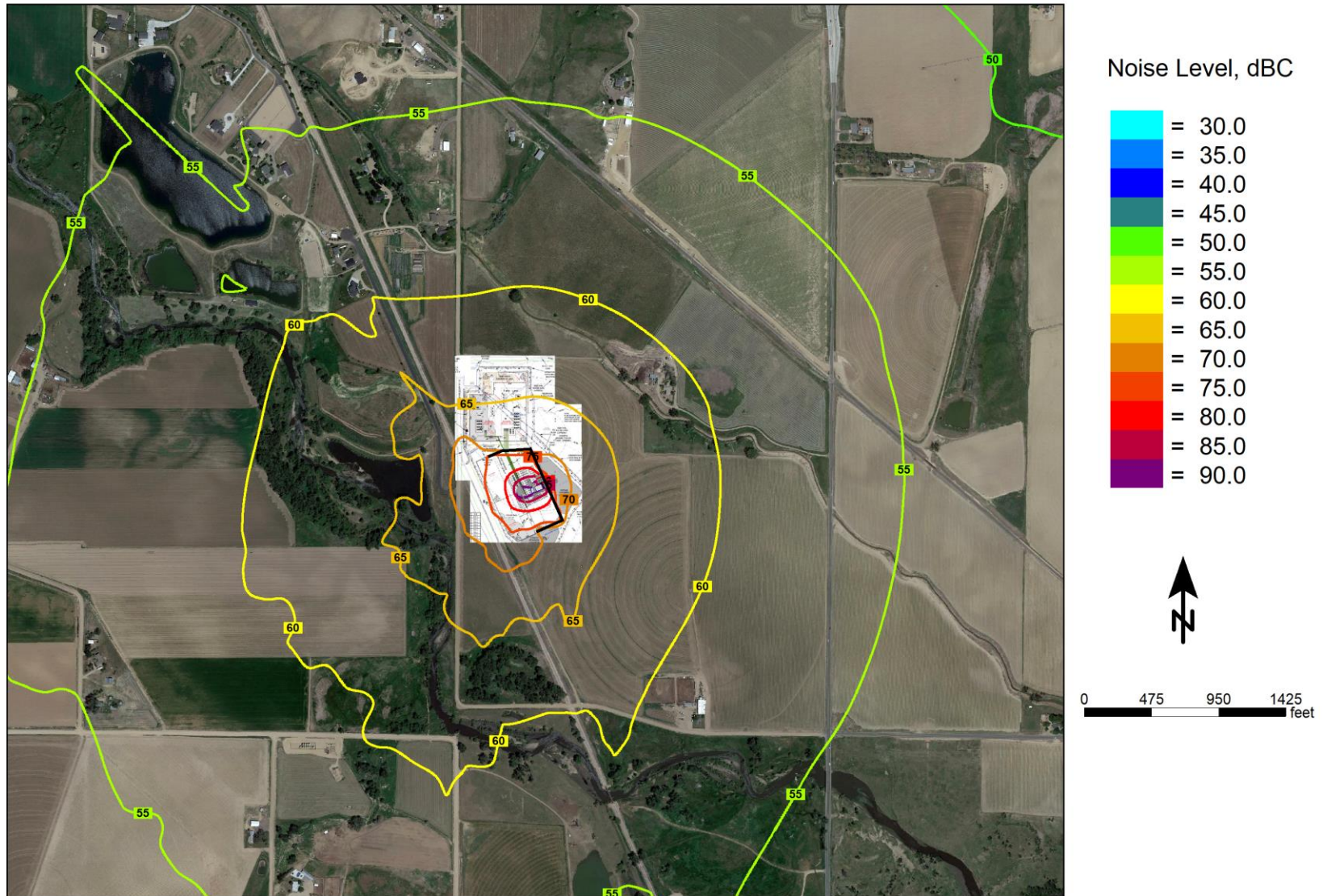
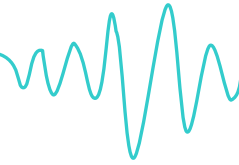
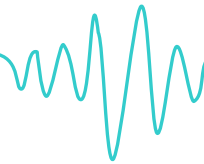


Figure 6-7 Mitigated PD 461 Noise Contour Map (dBA)





**Figure 6-8 Mitigated PD 461 Noise Contour Map (dBC)**



## 6.5 Completions Mitigated Modeling Results

Noise mitigation for completions operations has been included in the modeling to reduce noise levels in the surrounding environment. Flowback operations follow completions but utilize a fraction of similar pump trucks resulting in a smaller noise impact. The noise mitigation included in the modeling is described below:

- Approximately 1,060 total linear feet of 32-foot-high, Sound Transmission Class (STC) 25 acoustical wall installed on the north, south, and east perimeter of the site.

The layout for the modeled mitigation scenario is shown in Figure 6-9.

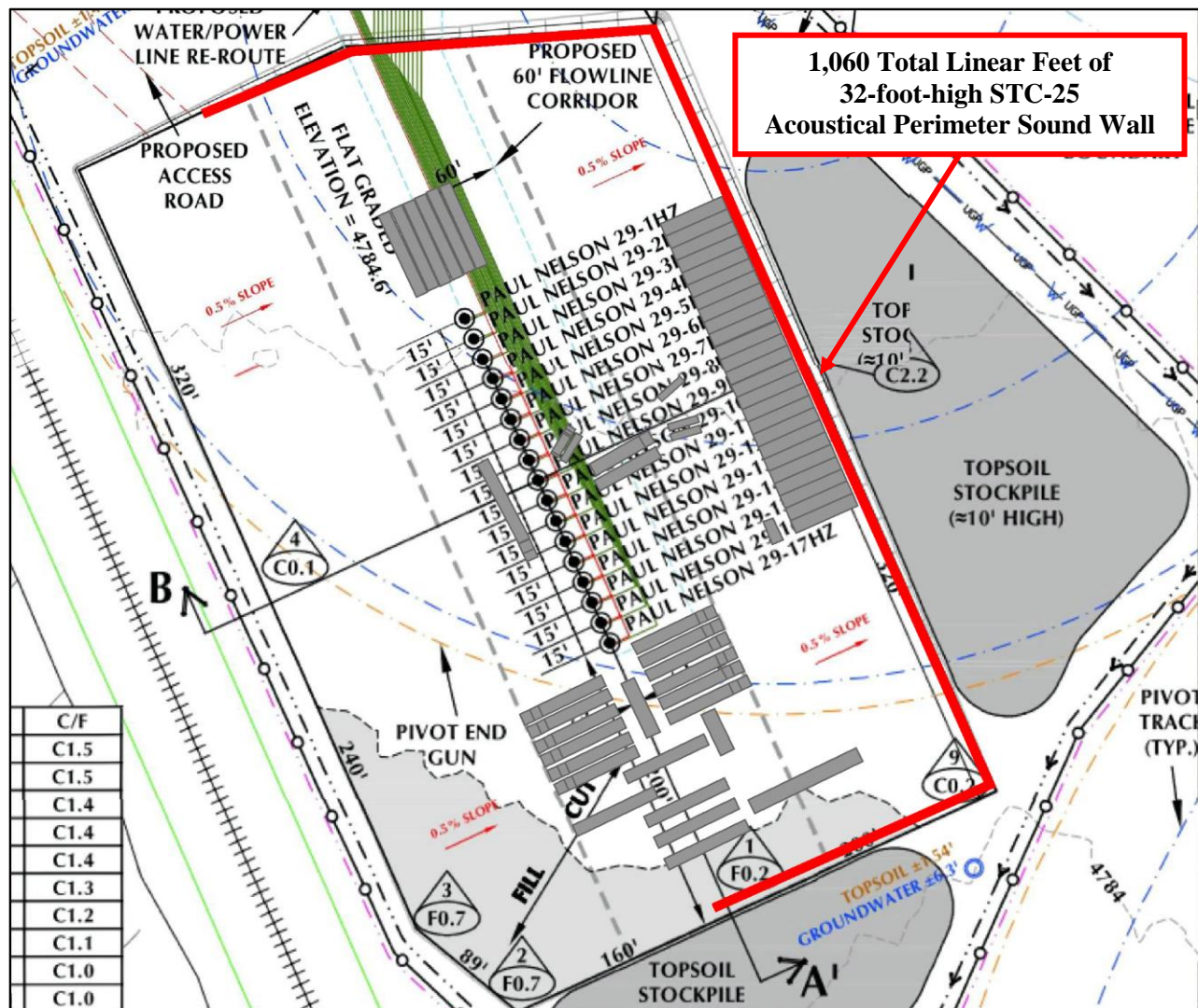
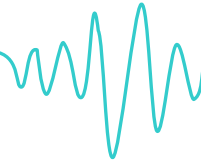


Figure 6-9 Mitigation Layout





The mitigated modeling includes the acoustical mitigation shown in Figure 6-9. The results of the mitigated noise modeling are presented in Table 6-5 and Table 6-6. The locations in the tables correspond to the locations identified in Figure 6-1. The predicted noise levels represent only the contribution of the completions operations and do not include ambient noise or noise from other facilities. Actual field sound level measurements may vary from the modeled noise levels due to other noise sources such as traffic, other facilities, other human activity, or environmental factors.

**Table 6-5 Mitigated Noise Modeling Results (dBA)**

<b>Receptor</b>	<b>Location Description</b>	<b>Halliburton Quiet Fleet</b>
Location A	350 Feet Northeast	56
Location B	350 Feet Southeast	55
Location C	350 Feet Northwest	57
<b>COGCC Noise Limit</b>	<b>350 ft. from the working pad surface</b>	<b>65 Day / 60 Night</b>

**Table 6-6 Mitigated Noise Modeling Results (dBC)**

<b>Receptor</b>	<b>Location Description</b>	<b>Halliburton Quiet Fleet</b>
Location 1	25377 County Road 17	64
Location 2	7831 County Road 52	61
Location 3*	25341 Heritage Court	62
Location 4*	25671 County Road 15 ½	61
<b>COGCC Noise Limit</b>	<b>25 ft. from the exterior wall of a residence or occupied structure towards the noise source</b>	<b>65</b>

\*Location 3 & 4 are subject to adjusted allowable limits of 79 day/73 night dBC for drilling and completions

The results of the mitigated noise modeling indicate that with the implementation of the mitigation the proposed completions operations are predicted to comply with the allowable COGCC A-weighted and C-weighted noise limits. The mitigation required for completions will also result in flowback operations being in compliance. The results of the mitigated noise modeling are also shown as noise contour maps. Figure 6-10 shows the Mitigated Halliburton Noise Contour Map in the A-weighted scale Figure 6-11 shows the Mitigated Halliburton Noise Contour Map in the C-weighted scale.

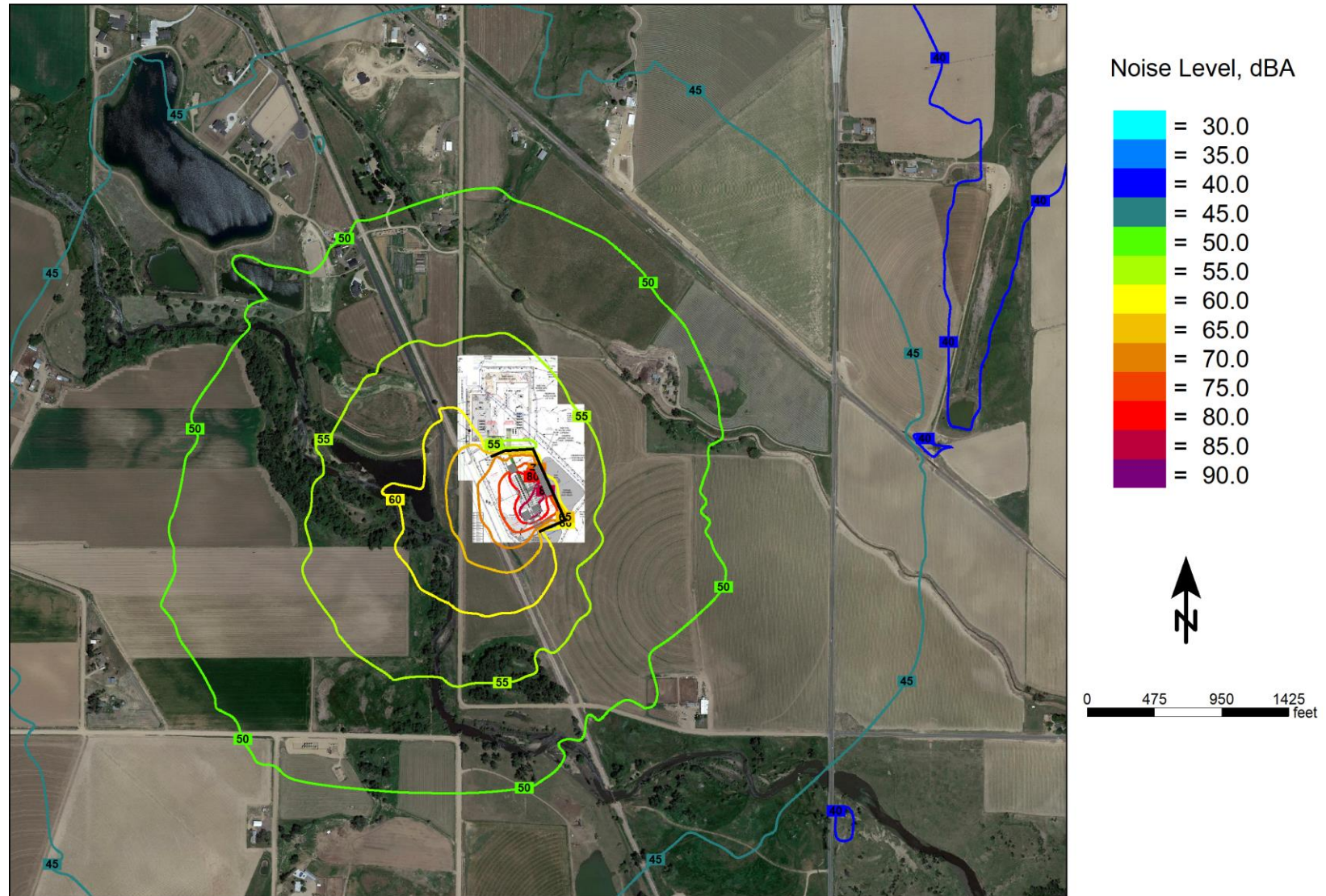
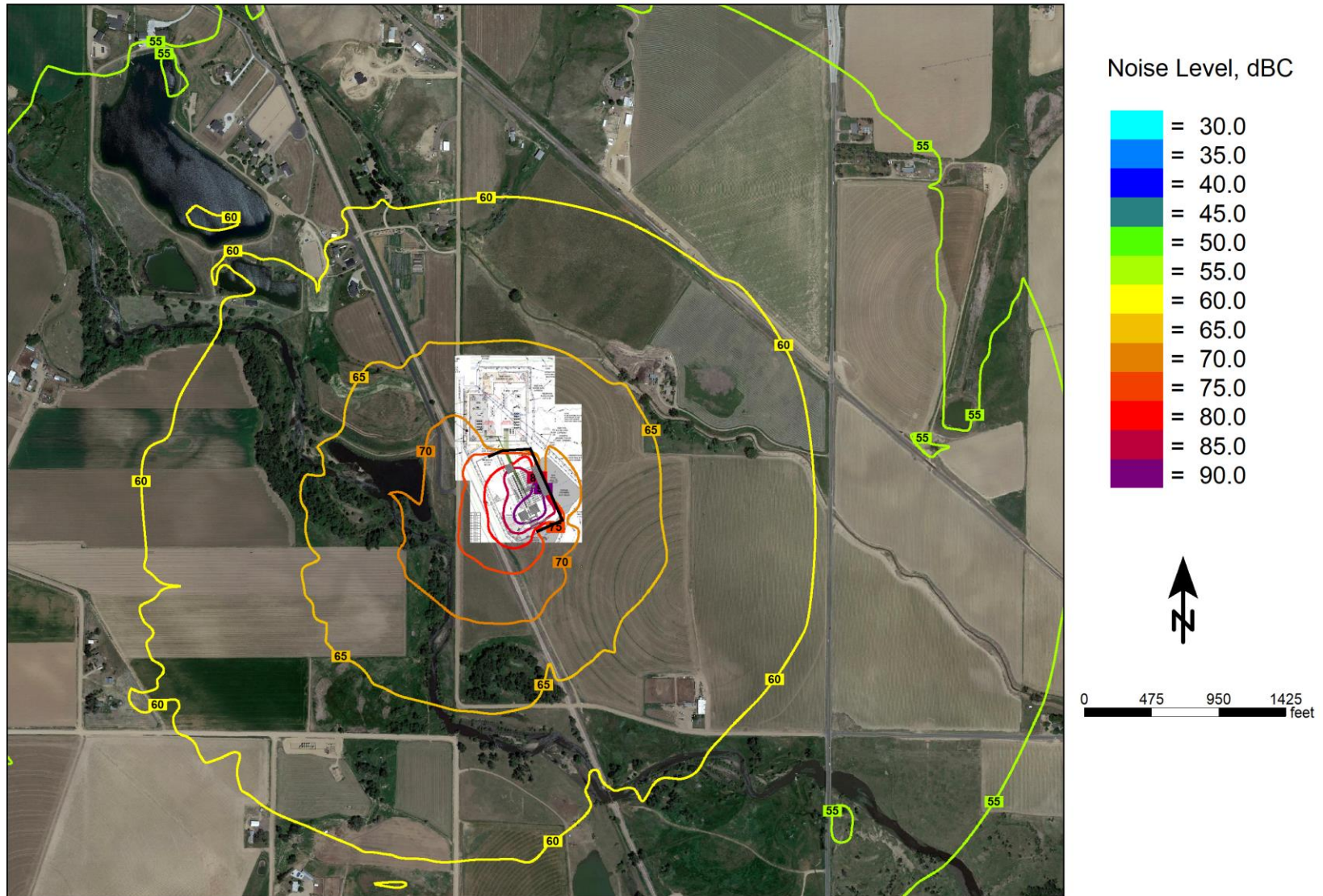
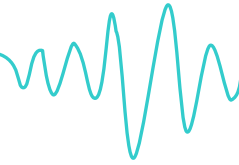


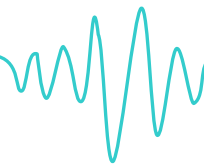
Figure 6-10 Mitigated Halliburton Noise Contour Map (dBA)





**Figure 6-11 Mitigated Halliburton Noise Contour Map (dBC)**

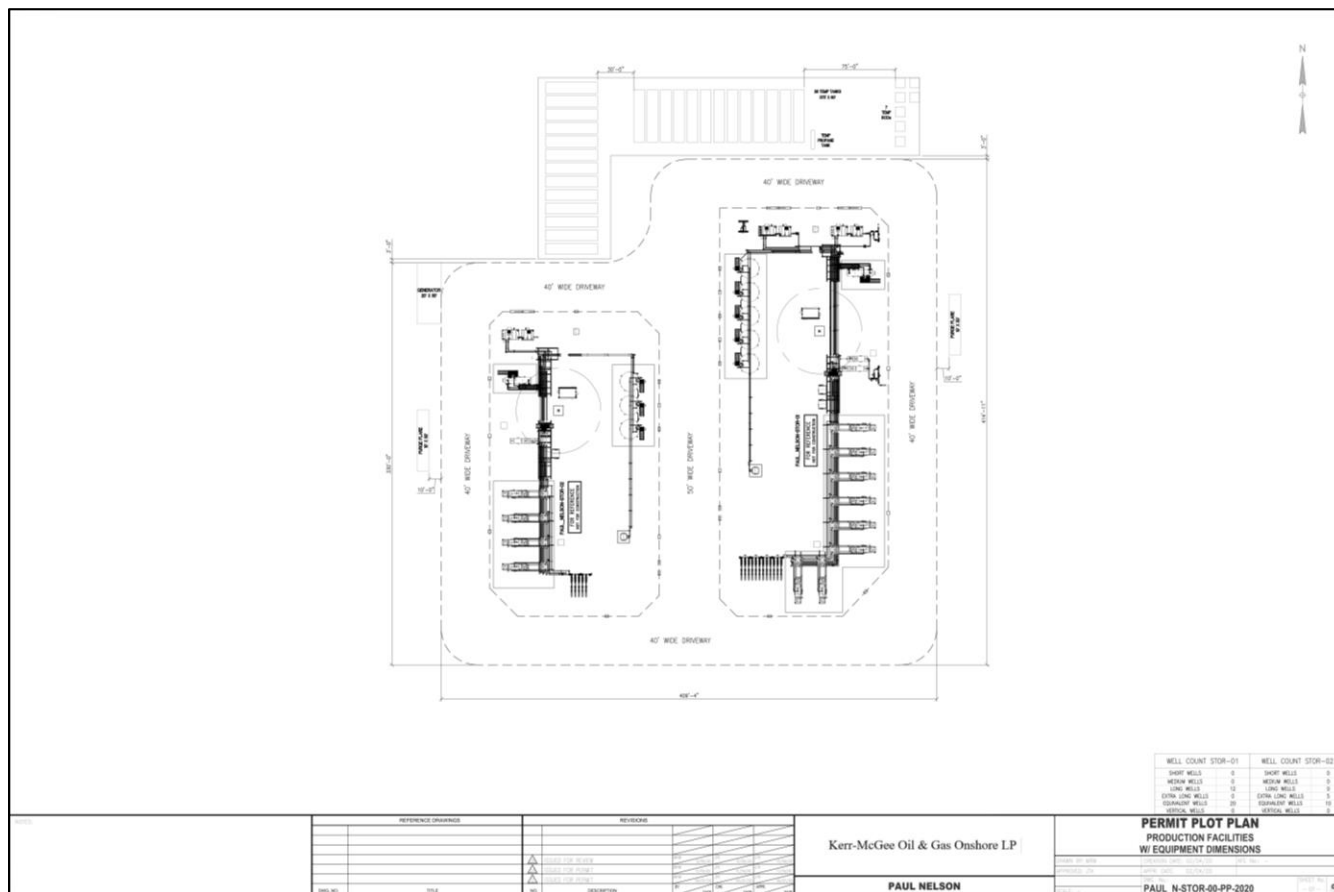




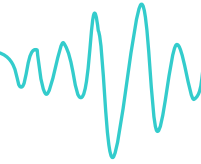
## 7. Paul Nelson Pad Production Facility Noise Modeling

### 7.1 Unmitigated Production Facility Noise Modeling Results

The unmitigated modeling is based off of current production site plans and does not include sound walls or other third-party acoustical mitigation measures. The production facility operational noise model was created to predict the constant, steady-state noise levels at the Paul Nelson pad and adjacent surroundings. The production facility was modeled assuming all listed equipment was operating simultaneously to represent the loudest operating scenario. Sound level data utilized in the production model was based on file data previously collected by BAENC at a KMOG production facility with similar equipment. The production facility equipment list and equipment orientation were supplied by KMOG and can be seen Figure 7-1. The predicted modeling results are dependent on equipment and orientation as indicated.



**Figure 7-1 Modeled Paul Nelson Production Facility Layout**  
(DWG # PAUL\_N-STOR-00-PP-2020, 02/04/2020)



The equipment list and layout were scrutinized to determine the major noise emitting sources planned for the site. These major noise sources, listed in Table 7-1, were included in the production modeling. Other auxiliary/temporary equipment or smaller equipment not anticipated to generate significant noise was not included in the production model.

The noise sensitive receptors utilized in the production modeling were positioned to be consistent with the requirements of the COGCC noise standards. The requirements state that dBA noise levels shall comply with the applicable noise limits as measured at 350 feet from the working pad surface and no less than 25 feet from the exterior wall of the Residential Building Unit that is within 2,000 ft. and closest to the production pad surface. The requirements state that dBC noise levels shall comply with the applicable noise limits as measured at 25 feet from the exterior wall of nearby residences or occupied structures. Figure 7-2 shows the dBA and dBC noise sensitive receptor locations.

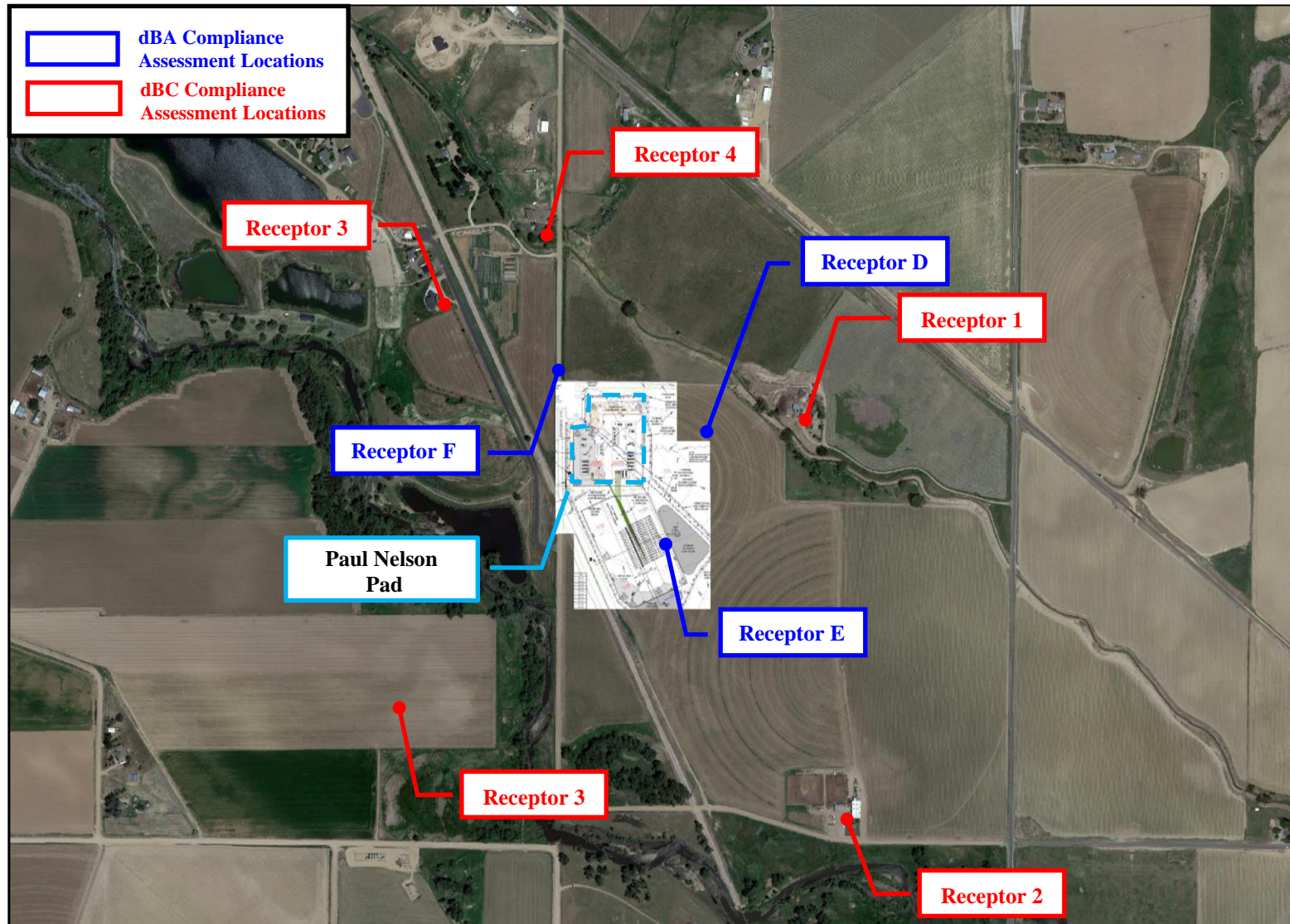
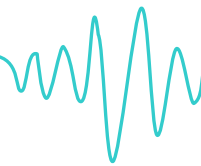


Figure 7-2 Noise Sensitive Receptor Location



The predicted modeling results are dependent on equipment and mitigation orientation as indicated and are only inclusive of the equipment listed in Table 7-1.

**Table 7-1 Production Facility Major Noise Emitting Equipment Included in Model**

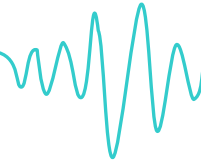
<b>Equipment</b>	<b>Quantity</b>
Air Compressor	3
Electrical Panel/Box	3
LACT Building	3
Fisher 4-inch ET Series Whisper I	2
Trim Globe Control Valve	2
Separator	12
Bulk Separator	2
Three Phase Separator Burner	14
VOC Combustor	2

The results of the unmitigated production facility noise modeling are presented in Table 7-2 and Table 7-3. The locations in the tables correspond to the locations identified in Figure 7-2. The predicted noise levels represent only the contribution of the production operations and do not include ambient noise or noise from other facilities. Figure 7-3 and Figure 7-4 shows the Unmitigated Production Facility Noise Contour Map in dBA and dBC respectively. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.

The results of the unmitigated noise modeling indicate that the production operations will comply with the COGCC A-weighted and C-weighted noise level limits.

**Table 7-2 Unmitigated Noise Modeling Results (dBA)**

<b>Receptor</b>	<b>Location Description</b>	<b>Production Facility</b>
Location D	350 Feet Northeast	45
Location E	350 Feet Southeast	45
Location F	350 Feet Northwest	45
<b>COGCC Noise Limit</b>	<b>350 ft. from the working pad surface</b>	<b>60 Day / 55 Night</b>

**Table 7-3 Unmitigated Noise Modeling Results (dBC)**

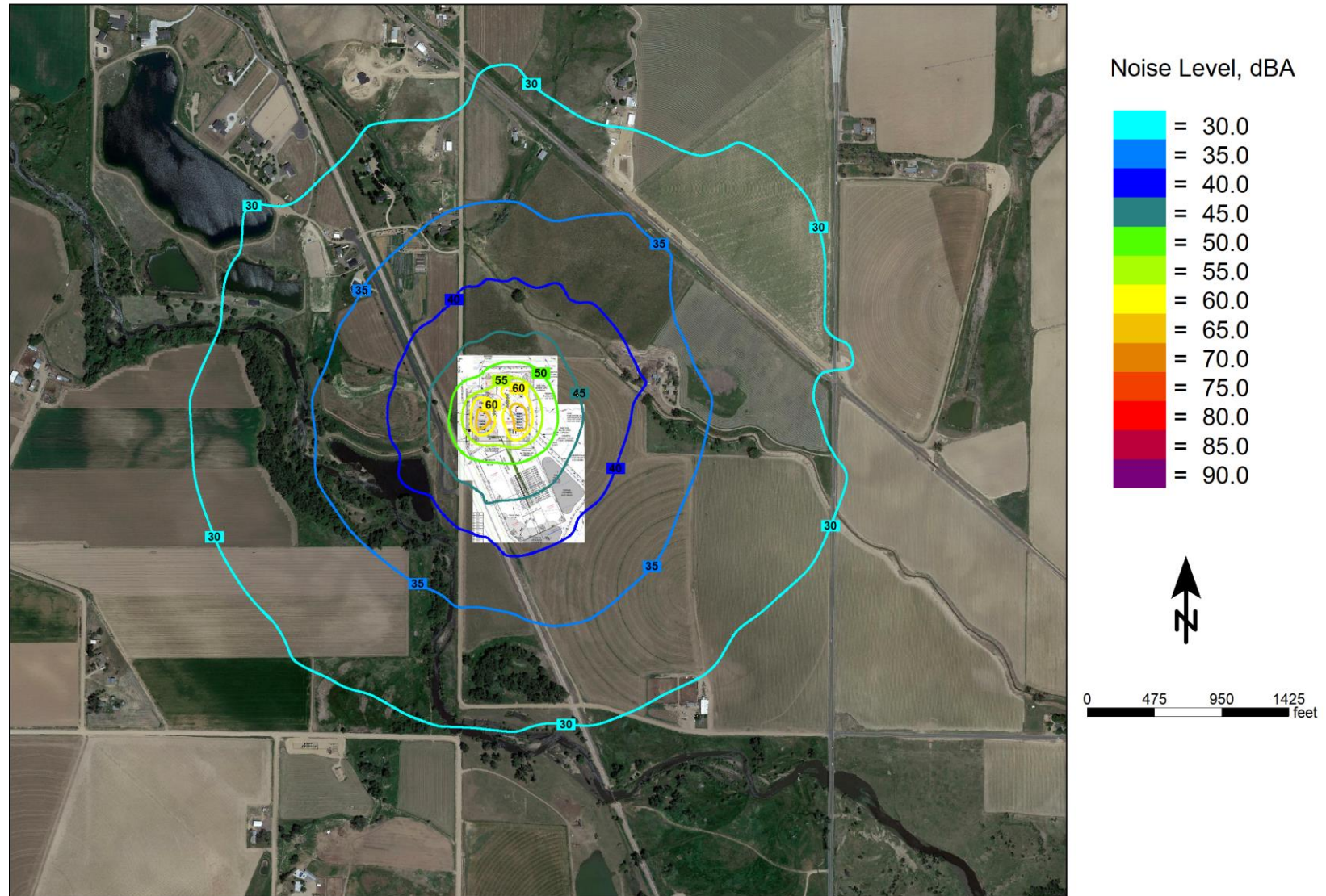
<b>Receptor</b>	<b>Location Description</b>	<b>Production Facility</b>
Location 1	25377 County Road 17	58
Location 2	7831 County Road 52	47
Location 3*	25341 Heritage Court	50
Location 4*	25671 County Road 15 ½	53
<b>COGCC Noise Limit</b>	<b>25 ft. from the exterior wall of a residence or occupied structure towards the noise source</b>	<b>60</b>

\*Location 1 is subject to adjusted allowable limits of 75 day/66 night dBC for production

\*\*Location 2 is subject to adjusted allowable limits of 75 day/66 night dBC for production

\*\*\*Location 3 & 4 are subject to adjusted allowable limits of 75 day/70 night dBC for production



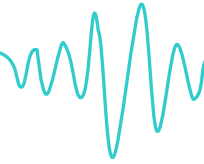


**Figure 7-3 Production Facility Unmitigated Noise Contour Map (dBA)**





**Figure 7-4 Production Facility Unmitigated Noise Contour Map (dBC)**



## **8. Noise Points of Compliance and Continuous Noise Monitoring**

### **8.1 Continuous Monitoring Procedure**

The following continuous monitoring procedures are proposed to ensure compliance with the monitoring procedures outlined in COGCC Rule 423.c.(2). To demonstrate compliance with COGCC noise regulations, pre-production activities and ongoing operations lasting longer than 24 consecutive hours will require continuous monitoring measurements from each noise point of compliance designated. According to Section 423. Noise (c), to demonstrate compliance with Tables 423-1 and 423-2 Operators will measure sound levels according to the following standards:

- (1) During pre-production activities and ongoing operations lasting longer than 24 consecutive hours such as drilling, completion, recompletion, Stimulation, and Well maintenance, in areas zoned residential or within 2,000 feet of a Building Unit, Operators will take continuous sound measurements from each noise point of compliance designated pursuant to Rule 423.a.(5).

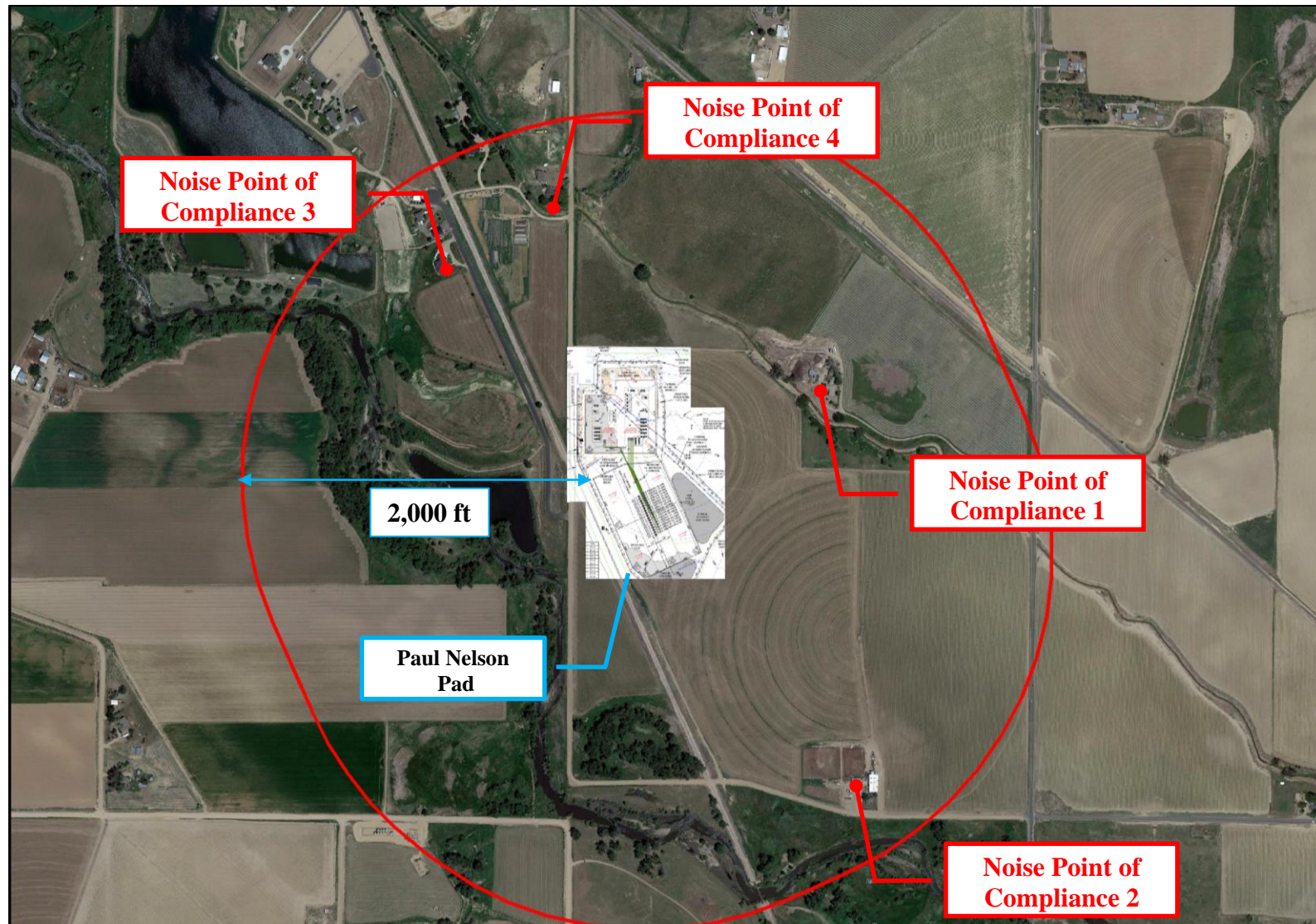
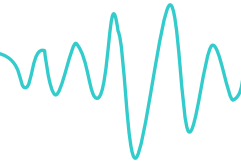
Figure 8-1 shows an aerial view of the proposed pad with an approximate 2,000 ft. radius from the working pad surface. There are numerous Residential Building Units (RBU) within the 2,000 ft. radius. Proposed noise points of compliance are detailed in Table 8-1. The noise points of compliance were selected to represent RBU's in multiple directions from the pad.

Residential Building Units (RBU) may be exempt to continuous monitoring due to rule 423.b.(5) if an agreement is made between the surface owner and operator and subsequently accepted by the COGCC.

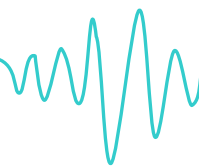
**Table 8-1 Proposed Continuous Monitoring Locations**

<b>Location</b>	<b>Description</b>	<b>Notes</b>
Noise Point of Compliance 1	25 feet from exterior of RBU	• Located on private land, measurement location can be adjusted if access is not granted
Noise Point of Compliance 2	25 feet from exterior of RBU	• Located on private land, measurement location can be adjusted if access is not granted
Noise Point of Compliance 3	25 feet from exterior of RBU	• Located on private land, measurement location can be adjusted if access is not granted
Noise Point of Compliance 4	25 feet from exterior of RBU	• Located on private land, measurement location can be adjusted if access is not granted





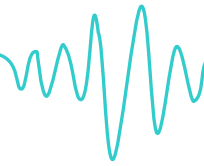
**Figure 8-1 Proposed Continuous Monitoring Locations**



---

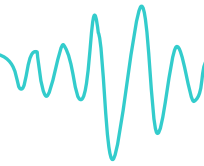
## **Appendix A - Ambient Data**

---



**Table A-8-2 Recorded Hourly Average Ambient Sound Levels Location 1 (1-hr dBA  $L_{eq}$ )**

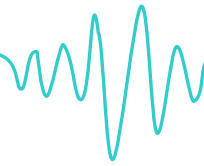
Location 1 - Hourly Leq					
Time	dBA	dB	Time	dBA	dB
1:00 PM	59	80	1:00 AM	55	70
2:00 PM	62	90	2:00 AM	51	69
3:00 PM	62	91	3:00 AM	52	69
4:00 PM	57	86	4:00 AM	53	69
5:00 PM	52	79	5:00 AM	51	69
6:00 PM	51	70	6:00 AM	51	69
7:00 PM	53	70	7:00 AM	51	69
8:00 PM	54	70	8:00 AM	48	64
9:00 PM	55	70	9:00 AM	47	57
10:00 PM	55	70	10:00 AM	37	54
11:00 PM	54	70	11:00 AM	42	57
Sat 24-Jul	54	70	12:00 PM	42	58
1:00 AM	53	69	1:00 PM	41	59
2:00 AM	54	70	2:00 PM	40	54
3:00 AM	53	69	3:00 PM	45	59
4:00 AM	51	69	4:00 PM	42	58
5:00 AM	52	69	5:00 PM	47	77
6:00 AM	53	70	6:00 PM	47	74
7:00 AM	53	70	7:00 PM	45	67
8:00 AM	50	69	8:00 PM	44	56
9:00 AM	53	69	9:00 PM	49	56
10:00 AM	50	69	10:00 PM	46	53
11:00 AM	55	71	11:00 PM	44	52
12:00 PM	54	70	Mon 26-Jul	41	58
1:00 PM	52	69	1:00 AM	42	54
2:00 PM	53	70	2:00 AM	38	52
3:00 PM	54	70	3:00 AM	36	50
4:00 PM	52	69	4:00 AM	43	53
5:00 PM	49	69	5:00 AM	45	56
6:00 PM	51	70	6:00 AM	49	60
7:00 PM	53	70	7:00 AM	47	59
8:00 PM	55	70	8:00 AM	48	60
9:00 PM	56	71	9:00 AM	51	61
10:00 PM	56	71	10:00 AM	46	58
11:00 PM	56	71	11:00 AM	69	70
Sun 25-Jul	55	71	12:00 PM	53	63



**Table A-8-3 Recorded Hourly Average Ambient Sound Levels Location 2 (1-hr dBA  $L_{eq}$ )**

Location 2 - Hourly Leq					
Time	dBA	dB	Time	dBA	dB
1:00 PM	61	84	1:00 AM	46	63
2:00 PM	65	91	2:00 AM	38	60
3:00 PM	65	91	3:00 AM	38	58
4:00 PM	60	87	4:00 AM	38	59
5:00 PM	54	82	5:00 AM	38	60
6:00 PM	42	64	6:00 AM	43	60
7:00 PM	42	63	7:00 AM	40	60
8:00 PM	42	62	8:00 AM	37	59
9:00 PM	44	63	9:00 AM	40	56
10:00 PM	42	63	10:00 AM	32	52
11:00 PM	42	63	11:00 AM	38	60
Sat 24-Jul	41	62	12:00 PM	40	61
1:00 AM	40	61	1:00 PM	37	62
2:00 AM	43	64	2:00 PM	36	58
3:00 AM	42	63	3:00 PM	38	60
4:00 AM	41	63	4:00 PM	40	59
5:00 AM	40	62	5:00 PM	42	71
6:00 AM	42	62	6:00 PM	42	71
7:00 AM	43	62	7:00 PM	42	69
8:00 AM	40	61	8:00 PM	39	62
9:00 AM	45	64	9:00 PM	40	58
10:00 AM	39	60	10:00 PM	38	56
11:00 AM	39	64	11:00 PM	36	53
12:00 PM	38	65	Mon 26-Jul	36	58
1:00 PM	38	61	1:00 AM	35	55
2:00 PM	39	67	2:00 AM	32	53
3:00 PM	38	64	3:00 AM	31	50
4:00 PM	42	59	4:00 AM	34	51
5:00 PM	40	62	5:00 AM	41	55
6:00 PM	38	60	6:00 AM	46	60
7:00 PM	40	60	7:00 AM	43	59
8:00 PM	40	61	8:00 AM	42	61
9:00 PM	43	63	9:00 AM	45	59
10:00 PM	43	62	10:00 AM	42	56
11:00 PM	43	63	11:00 AM	56	61
Sun 25-Jul	41	60	12:00 PM	51	59





**Table A-8-4 Recorded Hourly Average Ambient Sound Levels Location 3 (1-hr dBA  $L_{eq}$ )**

Location 3 - Hourly Leq					
Time	dBA	dB	Time	dBA	dB
1:00 PM	56	82	1:00 AM	46	57
2:00 PM	65	92	2:00 AM	39	57
3:00 PM	65	92	3:00 AM	41	57
4:00 PM	60	88	4:00 AM	38	55
5:00 PM	53	82	5:00 AM	39	57
6:00 PM	44	65	6:00 AM	41	57
7:00 PM	43	60	7:00 AM	44	58
8:00 PM	42	58	8:00 AM	39	56
9:00 PM	42	57	9:00 AM	43	56
10:00 PM	40	56	10:00 AM	34	52
11:00 PM	40	58	11:00 AM	47	67
Sat 24-Jul	39	56	12:00 PM	42	59
1:00 AM	39	56	1:00 PM	39	61
2:00 AM	39	58	2:00 PM	38	56
3:00 AM	39	60	3:00 PM	39	61
4:00 AM	39	60	4:00 PM	44	60
5:00 AM	40	60	5:00 PM	48	77
6:00 AM	43	60	6:00 PM	45	74
7:00 AM	45	60	7:00 PM	44	66
8:00 AM	43	58	8:00 PM	42	58
9:00 AM	52	61	9:00 PM	50	72
10:00 AM	41	57	10:00 PM	49	70
11:00 AM	41	62	11:00 PM	40	53
12:00 PM	42	62	Mon 26-Jul	37	55
1:00 PM	37	58	1:00 AM	36	55
2:00 PM	39	63	2:00 AM	34	53
3:00 PM	41	61	3:00 AM	35	52
4:00 PM	46	57	4:00 AM	37	53
5:00 PM	43	59	5:00 AM	43	56
6:00 PM	42	58	6:00 AM	47	60
7:00 PM	44	58	7:00 AM	46	61
8:00 PM	43	56	8:00 AM	46	61
9:00 PM	43	58	9:00 AM	43	58
10:00 PM	42	55	10:00 AM	38	55
11:00 PM	42	56	11:00 AM	59	63
Sun 25-Jul	42	53	12:00 PM	62	64