

# ELU A18-495 Pad - Form 2A Noise Mitigation and Monitoring Plan

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## 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 ELU A18-495 pad operated by Caerus Oil and Gas LLC. Predictive noise models representing the planned operations for the site were developed and assessed against the maximum permissible noise levels described in COAs of the Colorado Oil and Gas Conservation Commission (COGCC) noise regulations as well as guidance provided by National Environmental Policy Act (NEPA) and the Colorado Parks and Wildlife (CPW) division. The following tasks were completed during development of the 2A NMP:

- Development of a site-specific drilling noise model representing the Helmerich & Payne (H&P) 445 rig

The site-specific noise model was 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, and ground cover. 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>
Land Use Evaluation	<ul style="list-style-type: none"><li>• Per direction from Caerus, this evaluation is being conducted per a land use of Agricultural with additional considerations per CPW</li></ul>
Ambient Survey	<ul style="list-style-type: none"><li>• Ambient sound level survey may be conducted 60-90 days prior to pad construction at the Directors request</li></ul>
Drilling Noise Model	<ul style="list-style-type: none"><li>• Developed noise model representing drilling to assess operational noise levels against COGCC/CPW allowable dBA limits</li><li>• Noise mitigation not required</li></ul>
Completions Operations	<ul style="list-style-type: none"><li>• Completions is being performed remotely from the ELU G13 CDP location and is permitted separately and not part of this study.</li></ul>
Production Operations	<ul style="list-style-type: none"><li>• Production is being performed remotely from the ELU G13 CDP location and is permitted separately and not part of this study.</li></ul>
Continuous Monitoring Evaluation	<ul style="list-style-type: none"><li>• Continuous noise monitoring is not proposed at this time due to the absence of any RBU's within 2000-feet of drilling pad.</li></ul>

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



## 2. Introduction

The following report provides a noise modeling assessment of the proposed activities at the ELU A18-495 pad operated by Caerus Oil and Gas LLC in relation to the Colorado Oil and Gas Conservation Commission (COGCC) noise regulations. The assessment includes a modeling analysis of a Helmerich & Payne (H&P) production rig. The ELU A18-495 pad (39.709121°, -108.104744°) is located approximately 20 miles northwest of Rifle Colorado as shown in Figure 2-1.

To assess the operational noise levels of the proposed ELU A18-495 pad, file noise level data previously measured and typical of the H&P 445 production rig was utilized in the noise modeling, which is similar to the rig planned for use at the site. The noise model was developed using SoundPLAN 8.2 software.

The following is provided in this report:

- 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



Figure 2-1 ELU A18-495 Pad Location



## 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.

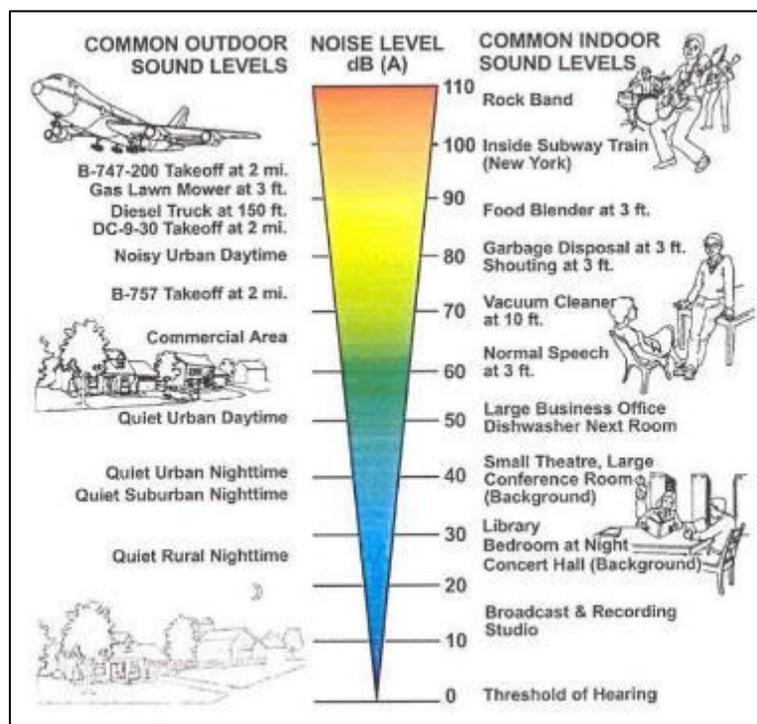


Figure 3-1 Typical Indoor and Outdoor A-Weighted Sound Levels



## 4. Noise Standards

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The pad is located 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.

### 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.

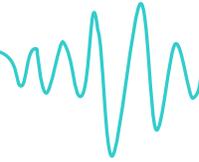
B. Noise points of compliance will be located at least 350 feet from the Working Pad Surface, and no less than 25 feet from the exterior wall of the Residential Building Unit that is closest to the Working Pad Surface. If a Surface Owner or tenant refuses to provide the Operator with access to install 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 dB<sub>C</sub> and 5 dB<sub>A</sub> between 7:00 p.m. and 7:00 a.m. or 7 dB<sub>C</sub> and 7 dB<sub>A</sub> 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**

<b>LAND USE</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	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**

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

**4.3 Summary of Maximum Permissible Noise Levels**

Caerus Oil and Gas LLC received direction from NEPA to evaluate noise in relation to sage grouse limits. CPW reviewed this language and agreed to the (Conditions of Approval) COA’s imposed. To comply with these COA’s, the operator must limits noise from drilling activities to no greater than 70 dBA at 350 ft. from a noise source. Receptor locations are placed in the modeling to reflect these COA’s and evaluate compliance.



## 5. ELU A18-495 Pad Noise Modeling

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### 5.1 Noise Modeling Methodology

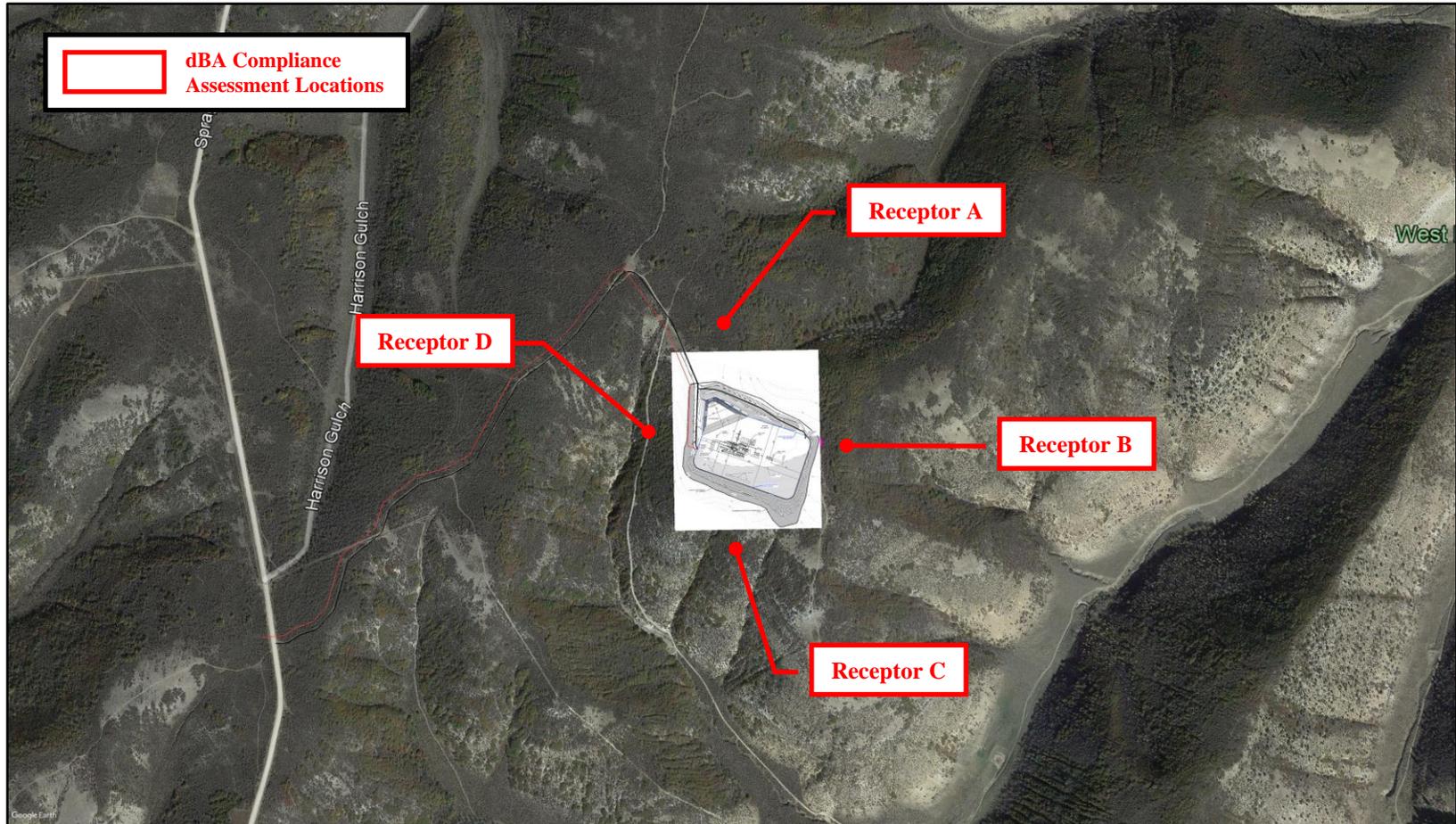
The noise modeling was completed with use of three-dimensional computer noise modeling software. All models in this report were developed with SoundPLAN 8.2 software using the ISO 9613-2 standard. Noise levels are predicted based on the locations, noise levels and frequency spectra of the noise sources, 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 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 drilling model was based on file data of the H&P 445 rig collected by BAENC. The V door faces north with the backyard equipment positioned to the south. Rig placement and orientation was coordinated with Caerus and oriented to minimize the noise impact when possible. The predicted modeling results are dependent on equipment and mitigation orientation as indicated.

### 5.2 Noise Sensitive Receptors

The noise sensitive receptors utilized in the drilling 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. 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. There are no RBU's within 2,000 ft. of the pad so no COGCC dBA receptors have been included in this study. The nearest RBU is several miles away and therefore no COGCC dBC receptors have been included in this study.

Per the conditions of approval (COA's) directed by NEPA and CPW, dBA receptor locations have been placed at 350 ft. from the noise source in all four cardinal directions. Figure 5-1 shows the dBA noise sensitive receptor locations.



**Figure 5-1 Noise Sensitive Receptor Locations**



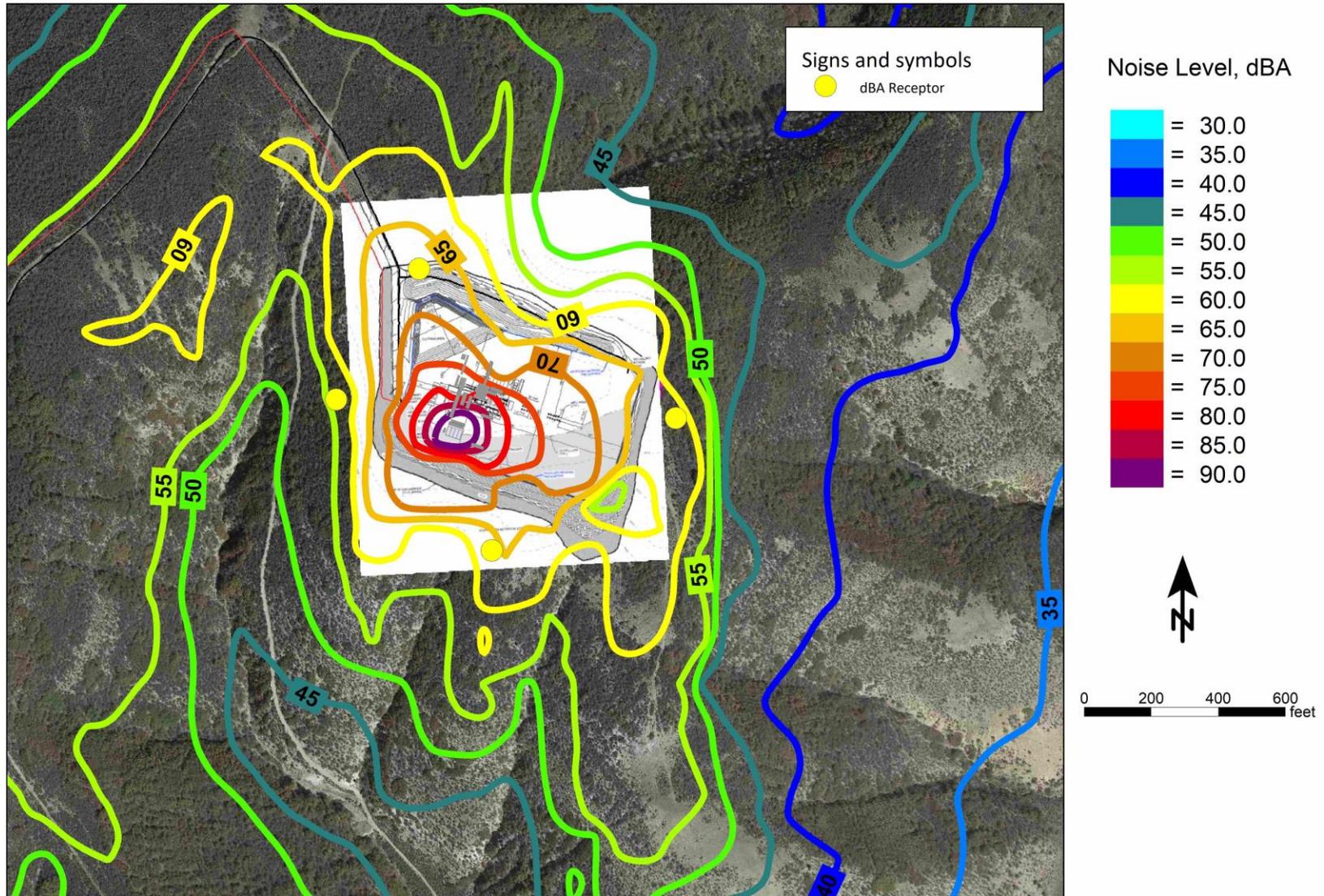
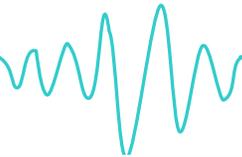
### 5.3 Unmitigated Drilling Noise Modeling Results

The unmitigated modeling is based off current drilling 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 5-1. The locations in the tables correspond to the locations identified in Figure 5-1. The predicted noise levels represent only the contribution of the project operations and do not include ambient noise or noise from other facilities. Figure 5-2 shows the Unmitigated H&P 445 Noise Contour Map in dBA. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.

**Table 5-1 Unmitigated Noise Modeling Results (dBA)**

<b>Receptor</b>	<b>Location Description</b>	<b>H&amp;P 445</b>
Location A	North of ELU A18-498 Equipment by 350'	68
Location B	East of ELU A18-498 Equipment by 350'	61
Location C	South of ELU A18-498 Equipment by 350'	63
Location D	West of ELU A18-498 Equipment by 350'	55
<b>CPW Noise Limit</b>	<b>350' Away from ELU A18-498 Equipment</b>	<b>70 dB</b>

The results of the unmitigated noise modeling indicate that the drilling operations will comply with the COGCC / CPW A-weighted noise level limits. Therefore, mitigation will not be required for drilling operations.



**Figure 5-2 H&P 445 Unmitigated Noise Contour Map (dBA)**