

Jonah Year-Round Development Project Drilling and Fracing Noise Impact Analysis Report

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January 11, 2016

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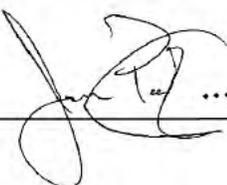
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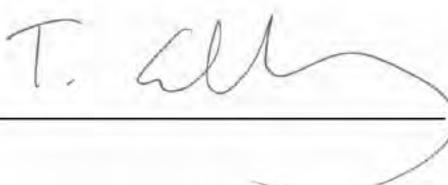
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1. Introduction

1.1 Study Purpose and Objectives

The purpose of this study is to assess the noise impact of planned drilling and fracing operations at the Sand Draw Reservoir and South Rocks greater sage-grouse leks at the proposed Jonah Year-Round Development (YRD) Project in Sublette County, Wyoming (see Figure 1-1). To assess the planned drilling and fracing noise impact, noise models representing the planned drilling and fracing operations were constructed and compared to allowable noise levels calculated from measured ambient noise levels at the two leks.

The drilling noise models were constructed with SoundPLAN 7.4 software and calibrated with field sound level measurements of Ensign Rig 157 and Unit Drilling Rig 326. Sound level data from a previously measured Haliburton frac operation was used to construct the fracing noise models.

The following is provided in this report:

- Documentation of measured ambient noise levels at the Sand Draw Reservoir and South Rocks greater sage-grouse leks within the Jonah YRD Project Area
- A review of the BLM Approved Resource Management Plan Amendment (ARMPA) and Wyoming Executive Order (EO) 2015-4
- Establishment of allowable drilling and fracing noise levels based on the measured ambient noise levels
- Analysis of the projected drilling and fracing noise levels at the SHB 77-04 pad
- Analysis of the projected drilling and fracing noise levels at the Cabrito 15-13 pad



Figure 1-1 Jonah YRD Project Location



1.2 Project Description

The Jonah YRD Project is located off of Highway 191 approximately 25 miles south of Pinedale in Sublette County Wyoming. The multi-year project consists of numerous drill pads that are being developed by Jonah Energy LLC (Jonah Energy) and LINN Operating, Inc (LINN Operating). Two pads planned for development in 2016, SHB 77-04 and Cabrito 15-13 were selected for noise impact analysis.

The SHB 77-04 well pad, located approximately 0.9 miles from the Sand Draw Reservoir greater sage-grouse lek, is being developed by Jonah Energy. Ensign Rig 157 is planned for use at the SHB 77-04 pad. The Cabrito 15-13 pad, located approximately 1.35 miles from the South Rocks greater sage-grouse lek, is being developed by LINN Operating. Unit Drilling Rig 326 is planned for use at the Cabrito 15-13 well pad. Figure 1-2 shows the Jonah YRD Project Area including the location of the two mentioned well pads and greater sage-grouse leks.

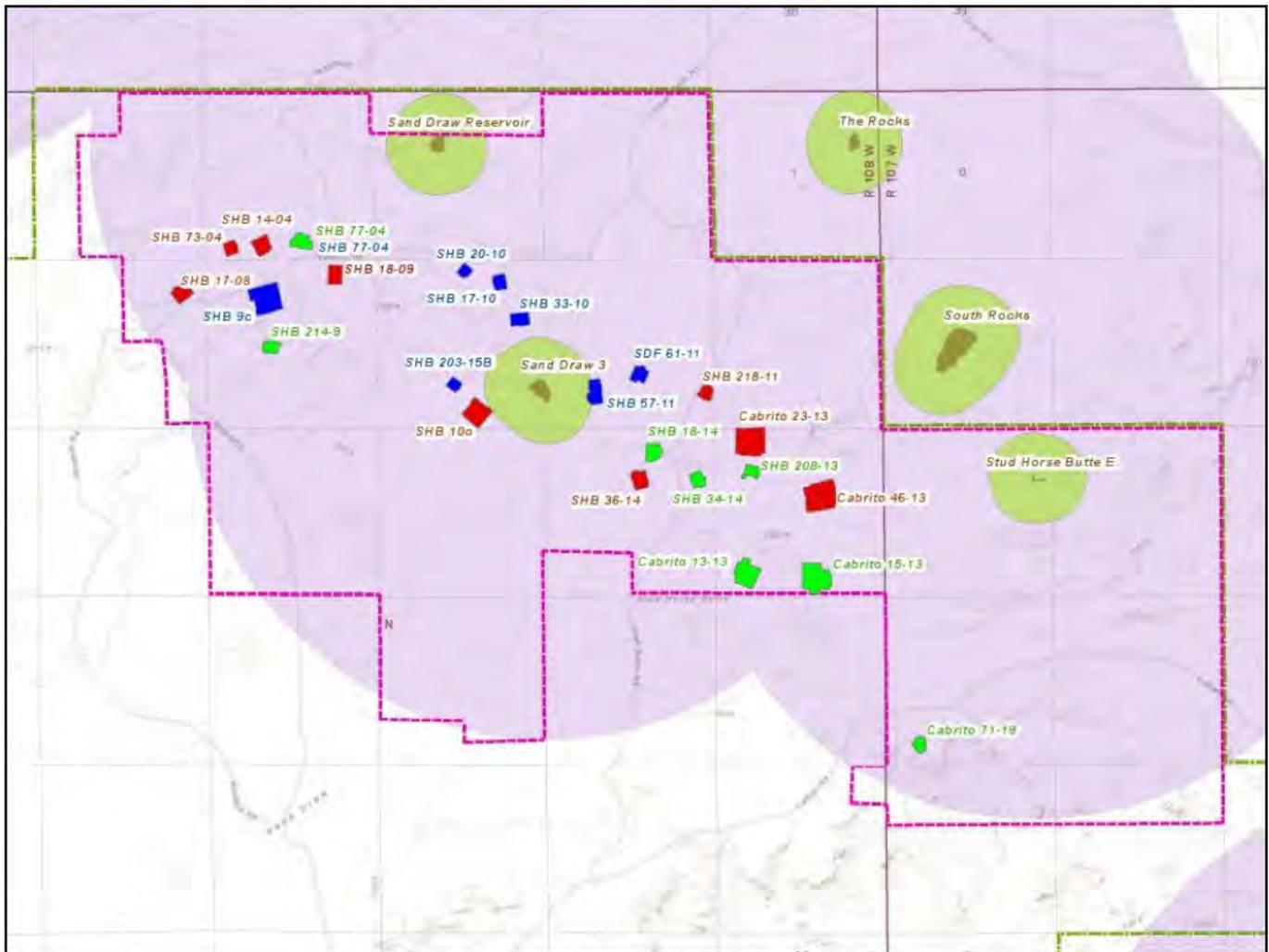


Figure 1-2 Project Development Area



2. Relevant Land Use Plan and Executive Order

The YRD Project is located in a rural area away from human habitation and as a result there are no relevant noise standards limiting possible human annoyance with the potential drilling and fracing noise. However, to protect the greater sage-grouse population in Wyoming, the BLM has recently approved an amendment to the Pinedale Field Office Resource Management Plan and the Governor of Wyoming has recently issued EO 2015-4.

2.1 BLM Approved Resource Management Plan Amendment

The management of BLM public lands and resources encompassed by the Jonah YRD Project Area is directed and guided by the Pinedale Resource Management Plan (RMP) Record of Decision (ROD) (BLM, 2008) and the ARMPA (BLM, 2015). Management Decision (MD) SSS 12 in the ARMPA states:

“New project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L₅₀) above baseline noise at the perimeter of the lek from 6:00 pm to 8:00 am during the breeding season (March 1 to May 15). Specific noise protocols for measurement and implementation will be developed as additional research and information emerges.”

Required design features (RDFs) as set forth in Appendix C of the ARMPA are required for certain activities in greater sage-grouse habitat and include the following:

“Limit noise to less than 10 decibels above ambient measures (20-24 dBA) at sunrise at the perimeter of a lek during active lek season (Patricelli et al. 2010, Blickley et al. 2012).”

As well as:

“Require noise shields when drilling during the lek, nesting, brood-rearing, or wintering season.”

2.2 Wyoming Executive Order 2015-4

Wyoming EO 2015-4 relates “Wyoming’s strategy for the conservation of the Greater sage-grouse and their habitats.” The executive order establishes Greater Sage-Grouse Core Population Areas that are subject to general stipulations; however, the proposed YRD Project is not located in a core area. Page 8 of Attachment B of the EO states the following:

New project noise levels, either individual or cumulative, should not exceed 10 decibels (as measured by L₅₀) above baseline noise at the perimeter of a lek from 6:00 pm to 8:00 am during breeding season (March 1 to May 15). Specific noise protocols for measurement and stipulations for implementation will be developed as additional research and information emerges.

In the absence of any newly developed protocols, based on the language in the EO the ambient/baseline noise level is taken to be the measured L₅₀ sound level between the hours of 6:00 p.m. and 8:00 a.m. as measured without any nearby drilling activity. The value of the measured ambient sound level plus 10 dB is taken as the maximum allowable drilling sound level at the lek. Drilling or fracing noise levels above this calculated value would trigger the requirement of noise mitigation measures to be implemented at the well pad during drilling and/or fracing operations.



3. Ambient Noise Level Survey

An ambient sound level survey was performed at both the Sand Draw Reservoir and South Rocks greater sage-grouse leks adjacent to the YRD Project Area. The survey was conducted to measure and document ambient sound data at two locations on opposite sides of each lek. The following sections detail the measurement procedure and document the results of the ambient survey.

3.1 Ambient Survey Procedure

The Sand Draw Reservoir (42°30'50.39"N, 109°42'26.29"W) and South Rocks (42°29'46.30"N, 109°38'50.31"W) greater sage-grouse leks are located in a rural area with existing oil and gas related facilities nearby. At the time of the survey, no greater sage-grouse were observed in the area.

A total of four Type 1 Svantek 971 sound level meters were utilized for the ambient sound level survey. Two sound level meters were deployed on opposite sides of each lek at a height of five feet above ground level. All sound level meters were deployed with windscreens.

The sound level meters were calibrated with a Quest QC-10 calibrator and deployed in metal enclosures at the leks at approximately 4:00 p.m. on Monday, December 7, 2015 and retrieved at approximately noon on Monday, December 14, 2015 after a 7-day monitoring period. The meters were programmed to record A-weighted L_{eq} and L_{50} noise levels. One meter at each location recorded audio to aid in identifying any possible noise level spikes. Upon review of the measured data and audio recordings, there was no evidence of out of the ordinary activity at the leks during the survey. Table 3-1 summarizes the equipment used in the ambient survey and Figure 3-1 shows the measurement locations utilized for the ambient survey.

Table 3-1 Ambient Measurement Equipment

| Measurement Location | Instrument Type | Approximate Location |
|--------------------------------|-----------------|----------------------------------|
| Sand Draw Reservoir Location 1 | Svantek 971 | 42°30'52.74"N, 109°42'23.13"W |
| Sand Draw Reservoir Location 2 | Svantek 971 | 42°30'47.92"N, 109°42'27.55"W |
| South Rocks Location 1 | Svantek 971 | 42°29'49.51"N, 109°38'53.86"W |
| South Rocks Location 2 | Svantek 971 | 42°29'38.73"N, 109°38'54.99"W |

3.2 Ambient Sound Level Survey Results

Time-varying noise environments may be expressed in terms of the noise level that is exceeded for a certain percentage of the total measurement time. These statistical noise levels are denoted L_n , where n is the percent of time. For example, the L_{50} is the noise level exceeded for 50% of the time. For a 1-hour measurement period, the L_{50} would be the noise level exceeded for a cumulative period of 30 minutes in that hour. The measured data is presented as one-hour L_{50} (1-hr L_{50}) sound levels in Figure 3-2 for the Sand Draw Reservoir lek locations and in Figure 3-3 for the South Rocks lek locations.



Figure 3-1 Ambient Measurement Locations

The measured L₅₀ values between the hours of 6:00 p.m. and 8:00 a.m. for seven days over the monitoring period are shown in Table 3-2. The last column shows the average of the seven days for each locations.

Table 3-2 Measured L₅₀ Sound Levels from 6 p.m. to 8 a.m.

| Measurement Location | Dec 7- Dec 8 (dBA) | Dec 8- Dec 9 (dBA) | Dec 9- Dec 10 (dBA) | Dec 10- Dec 11 (dBA) | Dec 11- Dec 12 (dBA) | Dec 12- Dec 13 (dBA) | Dec 13- Dec 14 (dBA) | 7-Day Average (dBA) |
|--------------------------------|--------------------------|--------------------------|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|
| Sand Draw Reservoir Location 1 | 38.8 | 36.0 | 35.8 | 37.7 | 36.5 | 32.0 | 37.6 | 36.3 |
| Sand Draw Reservoir Location 2 | 40.1 | 37.5 | 37.1 | 39.2 | 36.9 | 33.8 | 37.1 | 37.4 |
| South Rocks Location 1 | 33.5 | 31.6 | 29.9 | 31.4 | 34.2 | 27.4 | 34.8 | 31.8 |
| South Rocks Location 2 | 32.7 | 30.0 | 29.0 | 28.8 | 30.2 | 26.0 | 33.1 | 30.0 |

In an effort to be conservative, the lowest measured 7-day average L₅₀ sound level from the two measurement locations at each lek will be used to represent the ambient sound level at each lek. Accordingly, adding 10 dB to the measured ambient noise level per the ARMPA and Wyoming EO 2015-4, the maximum allowable drilling and fracing noise level would be 46.3 dBA at the Sand Draw Reservoir lek (based on the ambient data collected at Sand Draw Reservoir Location 1) and 40.0 dBA at the South Rocks lek (based on the ambient data collected at South Rocks Location 2).

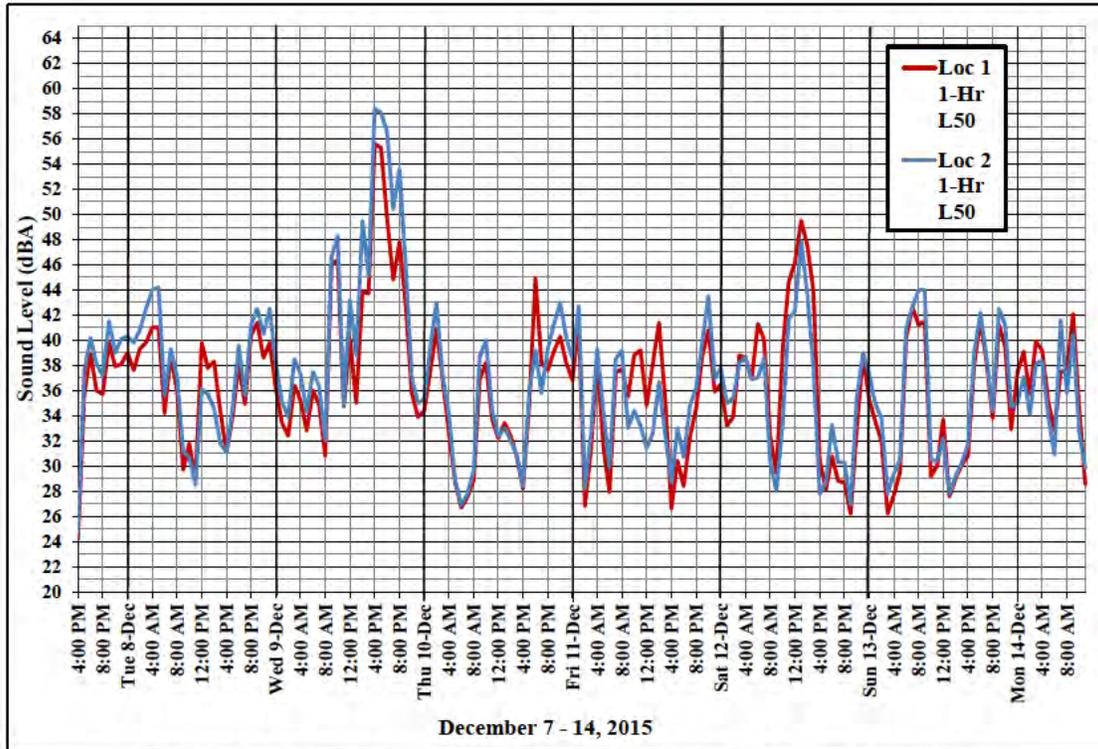
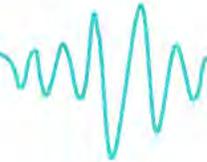


Figure 3-2 Sand Draw Reservoir Lek Ambient Survey Results

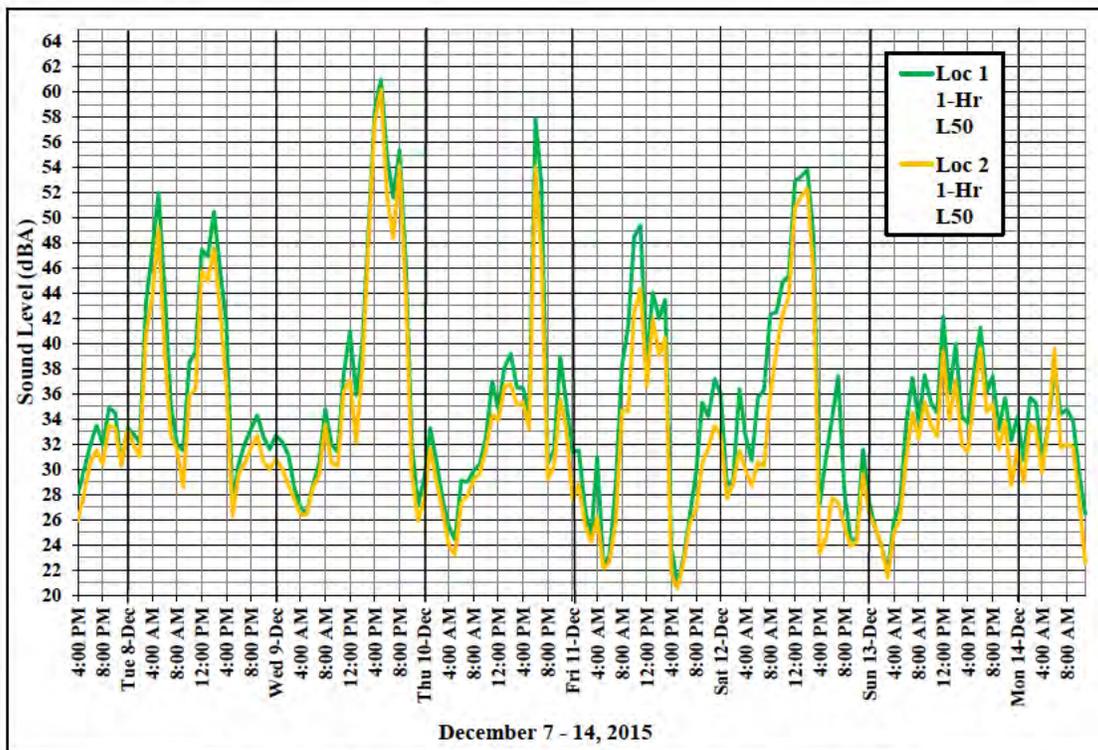


Figure 3-3 South Rocks Lek Ambient Survey Results



4. SHB 77-04 Pad Noise Modeling

The noise impact analysis was completed with use of three-dimensional computer noise impact modeling. All models in this report were developed with SoundPLAN 7.4 software using the ISO 9612-2 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. SoundPLAN software simulates light downwind conditions in all directions to ensure conservative assessments.

A noise impact model was created for the planned drilling and fracing operations at the SHB 77-04 well pad to evaluate the impact at the Sand Draw Reservoir lek. The predicted noise levels were assessed against the proposed allowable noise levels of 46.3 dBA. One receiver point (Receiver 1) on the southern edge of the lek was utilized as an assessment point for the noise impact analysis (Figure 4-1). This point was selected because it is the closest point to the SHB 77-04 well pad and per Wyoming EO 2015-4, it is on the perimeter of the lek.

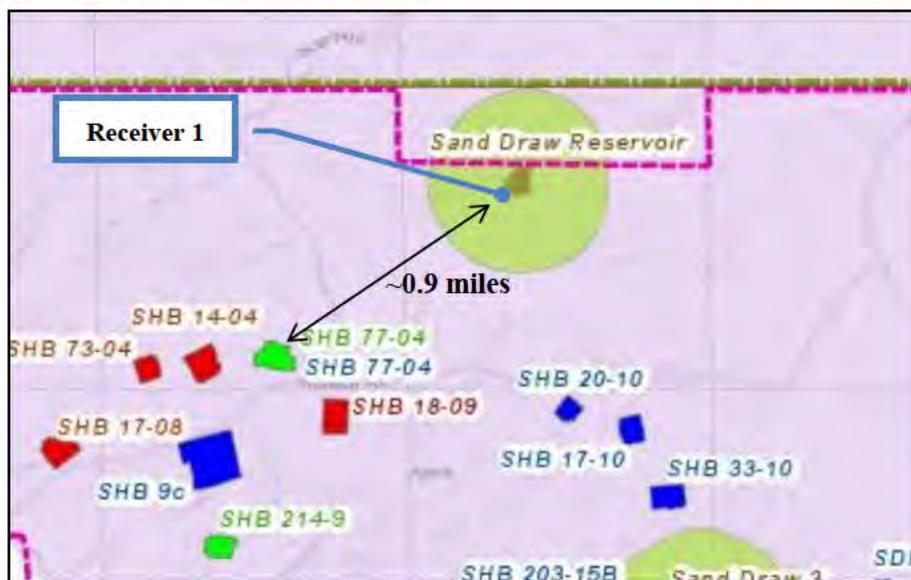


Figure 4-1 Sand Draw Reservoir Lek Noise Assessment Location

4.1 Unmitigated Drilling Noise Model

Ensign Rig 157 is planned to operate at the SHB 77-04 well pad 24-hours a day with no difference between daytime and nighttime activities. As such, a single drilling model was constructed to predict the constant, steady-state noise levels at the site.

A noise level survey was performed while Ensign Rig 157 was operating within the YRD Project Area on Monday, December 14, 2015. Sound measurements of the drilling equipment were conducted using a Type 1 Svantek 971 sound level meter calibrated with a Quest QC-10 calibrator. The sound level measurements were obtained adjacent to and at increasing distances from the noise emitting equipment to capture the noise signature of the rig. The measured noise levels were compared to and found to be in the range of data collected during numerous previous drill rig noise surveys at other sites.



The measured drilling rig data was used to calibrate the drilling noise model to ensure an accurate representation of the Ensign Rig 157 noise signature. The noise emitting drill rig components included in the modeling are shown in Table 4-1. The quantity of each component and the sound power level of each component are also shown in the table.

Table 4-1 Modeled Ensign Rig 157 Equipment

| Equipment | Quantity | Individual Component Sound Power Level (dBA) |
|-------------------------------|-----------------|---|
| Drawworks Enclosure | 1 | 108.3 |
| Generator Fan | 3 | 106.8 |
| Generator Enclosure Rear Vent | 3 | 99.1 |
| Shaker | 2 | 100.2 |

The results of the unmitigated noise modeling are presented as a noise contour map in Figure 4-2. The modeled noise levels represent only the contribution of the drilling rig noise and do not include ambient noise. Actual field sound level measurements may vary from the modeled noise levels due to existing non-drilling related noise sources such as traffic, other human activity, or environmental factors.

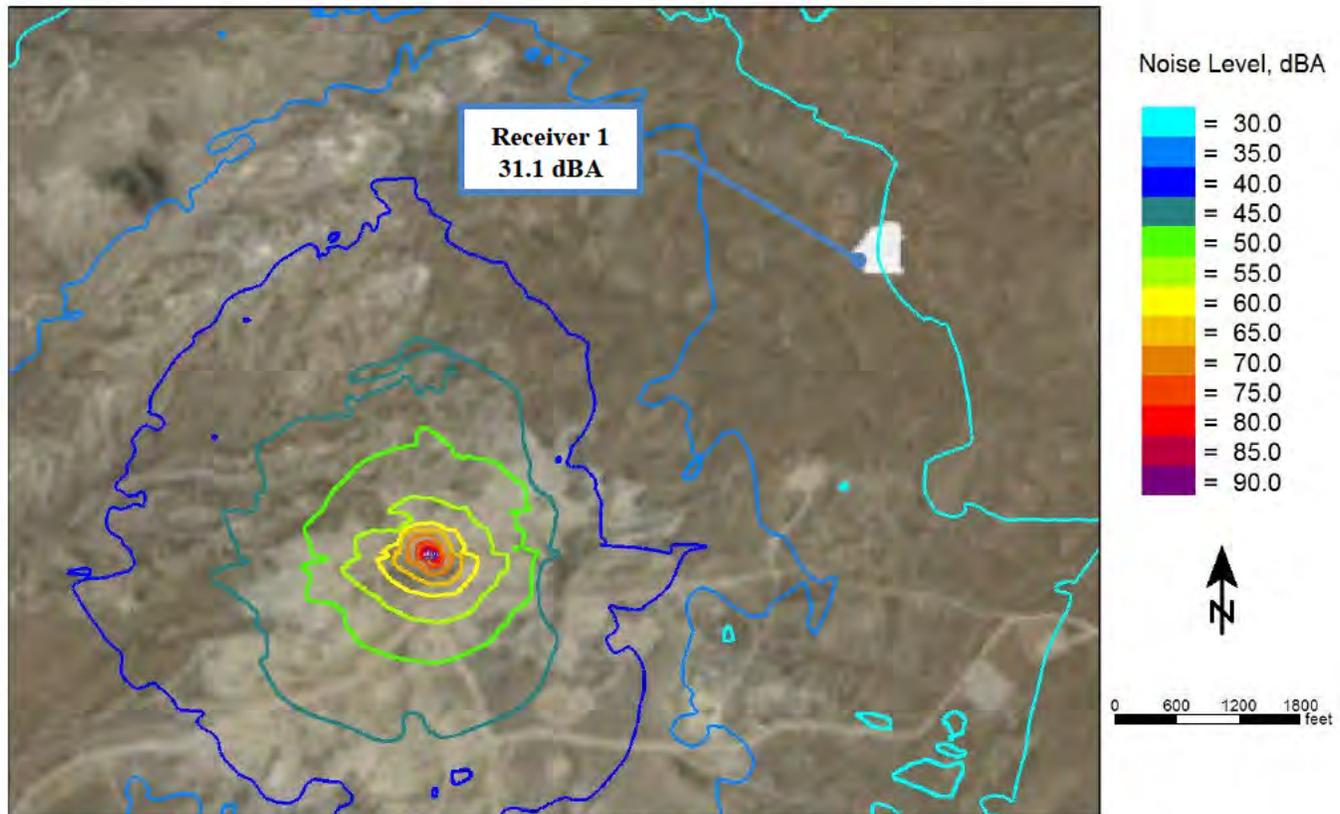


Figure 4-2 SHB 77-04 Well Pad Unmitigated Drilling Noise Contour Map



The predicted drilling noise level of 31.1 dBA at Receiver 1 is 15.2 dBA lower than 10 dBA above baseline (46.3 dBA). As a result, based on the ARMPA and Wyoming EO 2015-4, noise mitigation is not recommended at the SHB 77-04 well pad during drilling operations.

4.2 Unmitigated Fracing Noise Model

A single fracing model was constructed to predict the constant, steady-state noise levels at the SHB 77-04 well pad. File data from a previously measured Halliburton frac job was used to construct and calibrate the fracing model at the SHB 77-04 well pad. The noise emitting components included in the modeling are shown in Table 4-2. The quantity of each component and the sound power level of each component are also shown in the table.

Table 4-2 Modeled Fracing Equipment

| Equipment | Quantity | Individual Component Sound Power Level (dBA) |
|------------------------|-----------------|---|
| Halliburton Frac Truck | 12 | 118.1 |
| Wireline Crane | 1 | 98.4 |
| Wireline Truck | 1 | 104.4 |
| Wireline Truck Engine | 1 | 95.8 |
| Wireline Truck Rear | 1 | 91.1 |

The results of the unmitigated noise modeling are presented as a noise contour map in Figure 4-3. The modeled noise levels represent only the contribution of the fracing noise and do not include ambient noise. Actual field sound level measurements may vary from the modeled noise levels due to existing non-fracing related noise sources such as traffic, other human activity, or environmental factors.

The predicted fracing noise level of 44.2 dBA at Receiver 1 is 2.1 dBA lower than 10 dBA above baseline (46.3 dBA). As a result, based on the ARMPA and Wyoming EO 2015-4, noise mitigation is not recommended at the SHB 77-04 well pad during fracing operations.

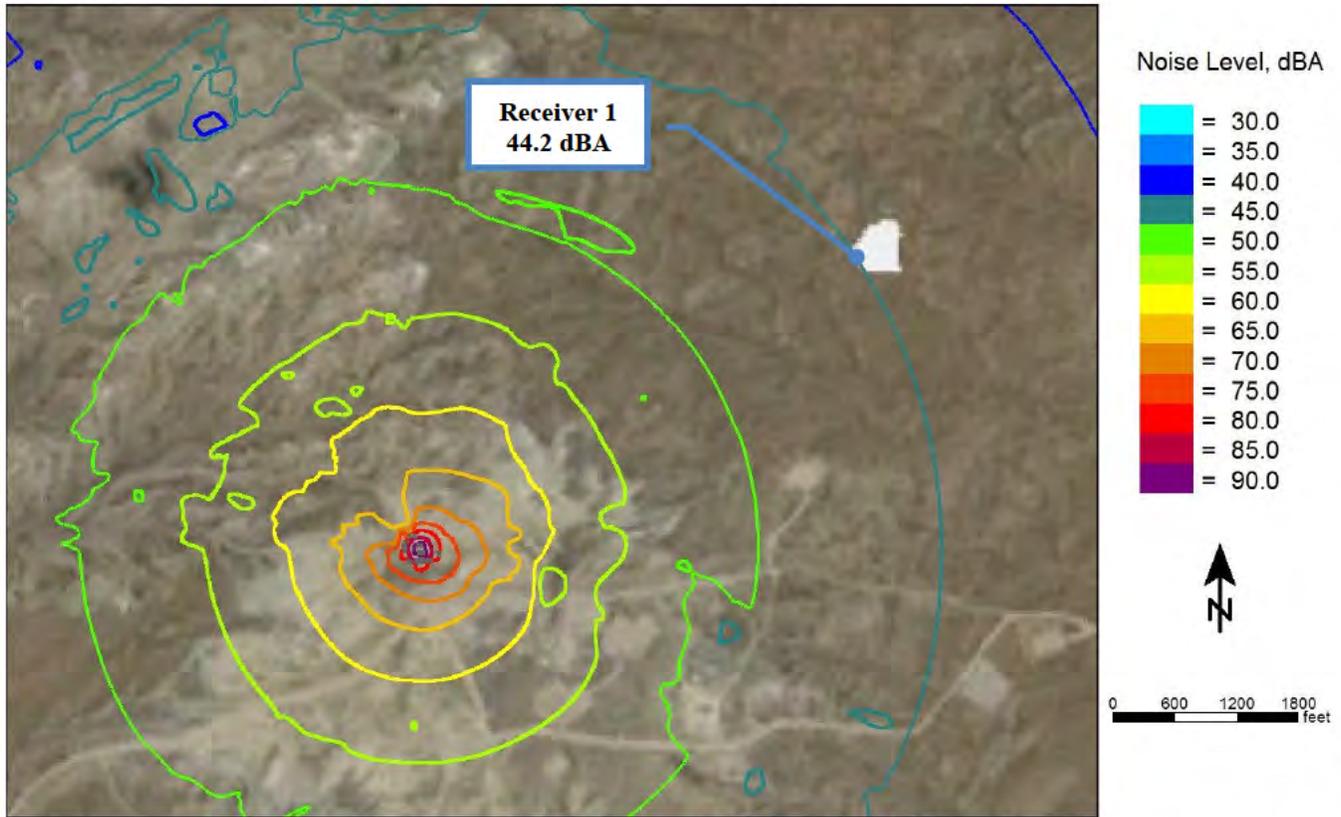


Figure 4-3 SHB 77-04 Well Pad Unmitigated Fracing Noise Contour Map



5. Cabrito 15-13 Pad Noise Modeling

The noise impact analysis was completed with use of three-dimensional computer noise impact modeling. All models in this report were developed with SoundPLAN 7.4 software using the ISO 9612-2 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. SoundPLAN software simulates light downwind conditions in all directions to ensure conservative assessments.

A noise impact model was created for the planned drilling and fracing operations at the Cabrito 15-13 well pad to evaluate the noise impact at the South Rocks lek. The predicted noise levels were assessed against the proposed allowable noise levels of 40.0 dBA. One receiver point (Receiver 1) on the southern edge of the lek was utilized as an assessment point for the noise impact analysis (Figure 5-1). This point was selected because it is the closest point to the drilling pad and per Wyoming EO 2015-4, it is on the perimeter of the lek.

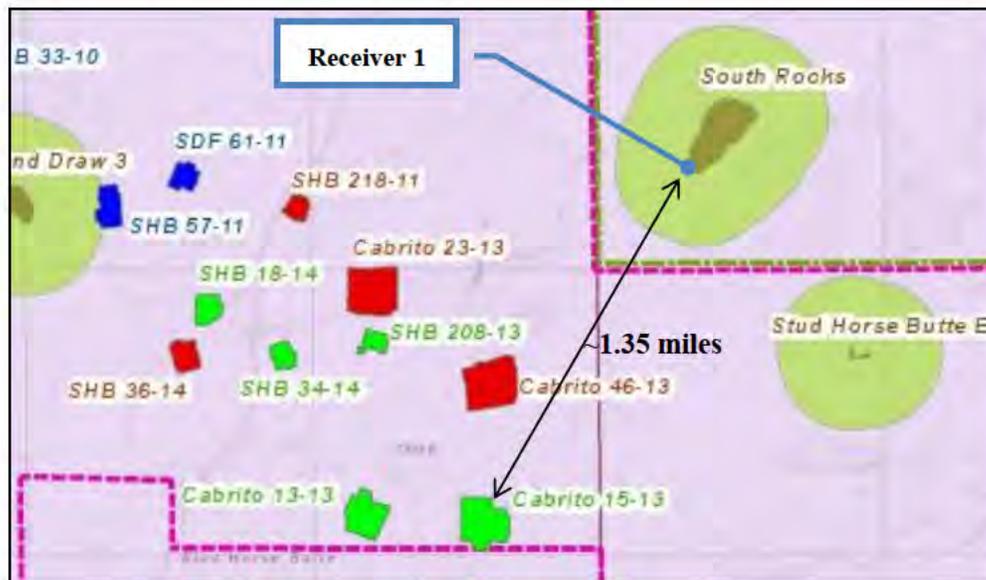


Figure 5-1 South Rocks Lek Noise Assessment Location

5.1 Unmitigated Drilling Noise Model

Unit Drilling Rig 326 is planned to operate at the Cabrito 15-13 pad 24-hours a day with no difference between daytime and nighttime activities. As such, a single drilling model was constructed to predict the constant, steady-state noise levels at the site.

A noise level survey was performed while the Unit Drilling Rig 326 was operating at the YRD Project site on Monday, December 8, 2015. Sound measurements of the drilling equipment were conducted using a Type 1 Svantek 971 sound level meter calibrated with a Quest QC-10 calibrator. The sound level measurements were obtained adjacent to and at increasing distances from the noise emitting equipment to capture the noise signature of the rig. The measured noise levels were compared to and found to be in the range of data collected during numerous previous drill rig noise surveys at other sites.



The measured drilling rig data was used to calibrate the drilling noise model to ensure an accurate representation of the Unit Drilling Rig 326 noise signature. The noise emitting drill rig components included in the modeling are shown in Table 5-1. The quantity of each component and the sound power level of each component are also shown in the table.

Table 5-1 Modeled Unit Drilling Rig 326 Equipment

| Equipment | Quantity | Individual Component Sound Power Level (dBA) |
|-------------------------------|-----------------|---|
| Drawworks Engine | 1 | 108.0 |
| Generator Fan | 3 | 110.0 |
| Mud Pump Enclosure Front/Back | 2 | 91.4 |
| Mud Pump Enclosure Sides | 2 | 90.5 |
| Shakers | 4 | 105.0 |

The results of the unmitigated noise modeling are presented as a noise contour map in Figure 5-2. The modeled noise levels represent only the contribution of the drilling noise and do not include ambient noise. Actual field sound level measurements may vary from the modeled noise levels due to existing non-drilling related noise sources such as traffic, other human activity, or environmental factors.

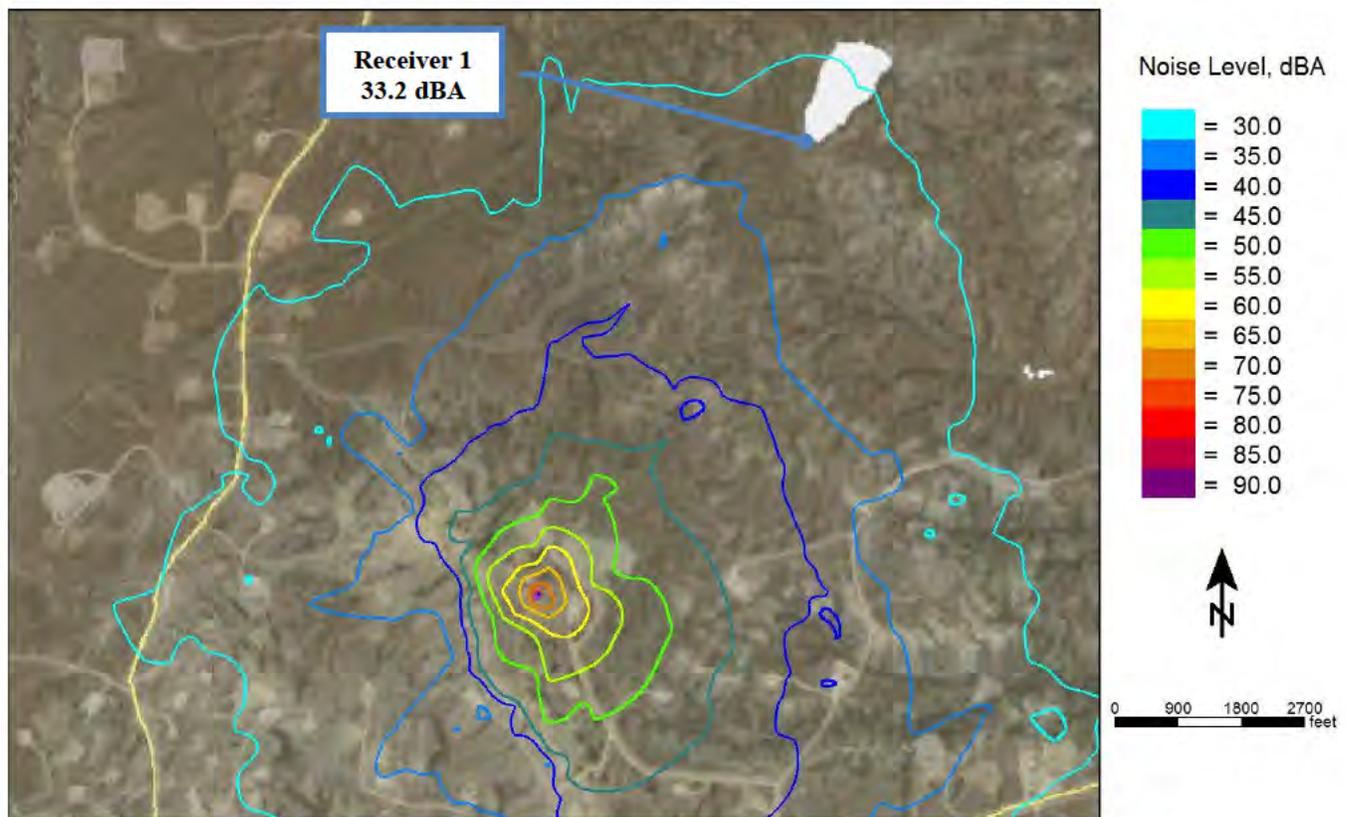


Figure 5-2 Cabrito 15-13 Well Pad Unmitigated Drilling Noise Contour Map



The predicted drilling noise level of 33.2 dBA at Receiver 1 is 6.8 dBA less than 10 dBA above baseline (40.0 dBA). As a result, based on the ARMPA and Wyoming EO 2015-4, noise mitigation is not recommended at the Cabrito 15-13 well pad during drilling operations.

5.2 Unmitigated Fracing Noise Model

A single fracing model was constructed to predict the constant, steady-state noise levels at the Cabrito 15-13 well pad. File data from a previously measured Halliburton frac job was used to construct and calibrate the fracing model at the Cabrito 15-13 well pad. The noise emitting components included in the modeling are shown in Table 5-2. The quantity of each component and the sound power level of each component are also shown in the table.

Table 5-2 Modeled Fracing Equipment

| Equipment | Quantity | Individual Component Sound Power Level (dBA) |
|------------------------|-----------------|---|
| Halliburton Frac Truck | 12 | 118.1 |
| Wireline Crane | 1 | 98.4 |
| Wireline Truck | 1 | 104.4 |
| Wireline Truck Engine | 1 | 95.8 |
| Wireline Truck Rear | 1 | 91.1 |

The results of the unmitigated noise modeling are presented as a noise contour map in Figure 5-3. The modeled noise levels represent only the contribution of the fracing noise and do not include ambient noise. Actual field sound level measurements may vary from the modeled noise levels due to existing non-fracing related noise sources such as traffic, other human activity, or environmental factors.

The predicted fracing noise level of 41.5 dBA at Receiver 1 is 1.5 dBA more than 10 dBA above baseline (40.0 dBA). As a result, based on the ARMPA and Wyoming EO 2015-4, noise mitigation is recommended at the Cabrito 15-13 well pad during fracing operations.

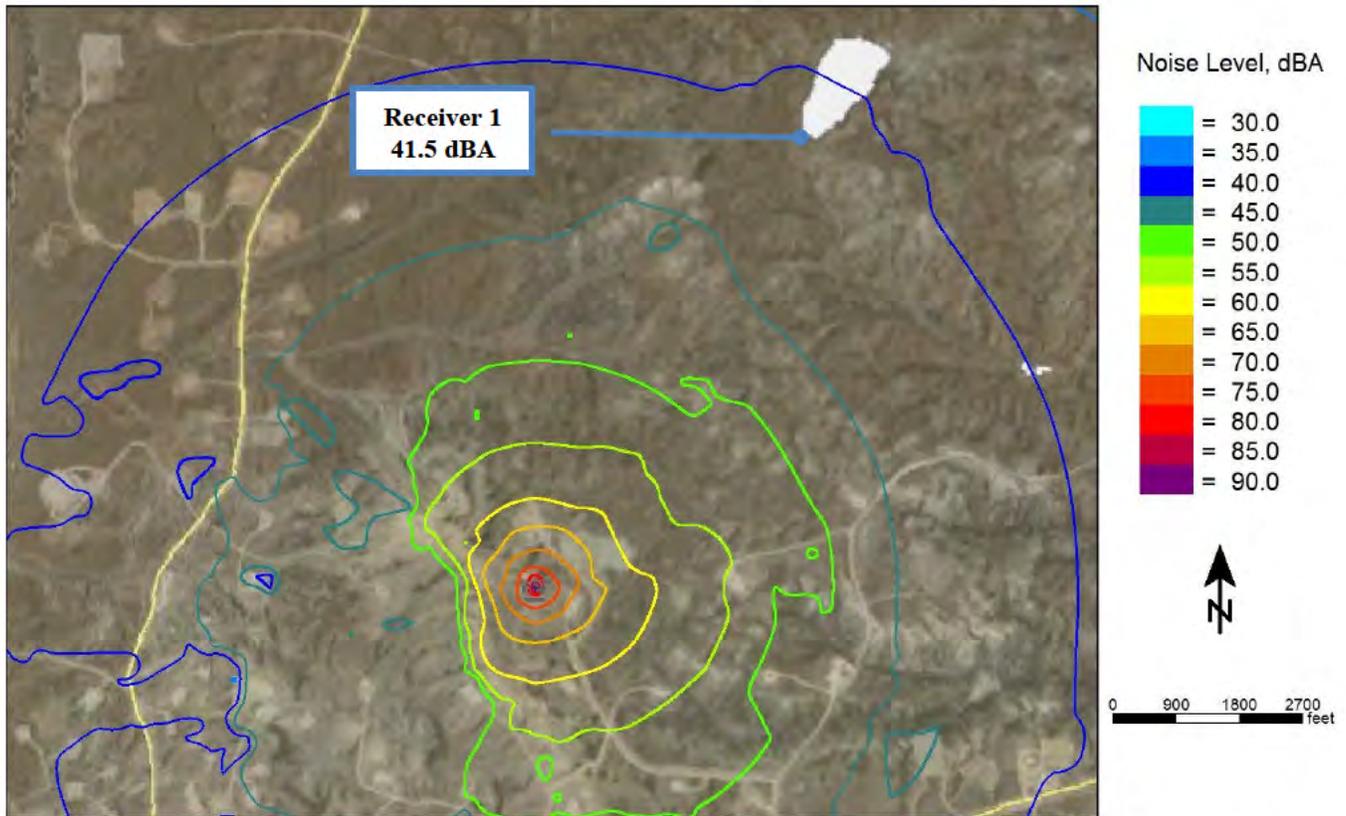


Figure 5-3 Cabrito 15-13 Well Pad Unmitigated Fracing Noise Contour Map



6. Drilling and Fracing on other Pads

The planned operations on the SHB 77-04 well pad and the Cabrito 15-13 pad were modeled with site specific topography. To assess the noise impact potential from operations at the other YRD Project pads, Ensign Rig 157, Unit Drilling Rig 326, and the Halliburton fracing operations were modeled on flat terrain. The operational noise levels from the flat terrain models were recorded up to 15,000 feet from the modeled operations and compared to the distances between the remaining pads and the two leks. Table 6-1 lists well pads proposed by Jonah Energy, distance from the pads to the two leks, and the projected noise levels at the two leks based on the flat terrain modeling.

Table 6-1 Estimated Operational Noise Levels at Leks due to Drilling and Fracing at Individual Well Pads Proposed by Jonah Energy

| Pad | Distance to Sand Draw Reservoir Lek (ft) | Ensign 157 Rig Noise Level at Sand Draw Reservoir Lek (dBA) | Haliburton Fracing Noise Level at Sand Draw Reservoir Lek (dBA) | Distance to South Rocks Lek (ft) | Ensign 157 Rig Noise Level at South Rocks Lek (dBA) | Haliburton Fracing Noise Level at South Rocks Lek (dBA) |
|---------------|--|---|---|----------------------------------|---|---|
| SHB 17-08 | 8,835 | 36 | 42 | 23,458 | <25 | <33 |
| SHB 73-04 | 6,133 | 39 | 46 | 21,539 | <25 | <33 |
| SHB 77-04 | 4,675 | 31.1* | 44.2* | 19,950 | <25 | <33 |
| SHB 14-04 | 5,397 | 41 | 47 | 20,853 | <25 | <33 |
| SHB 218-11 | 10,959 | 32 | 38 | 6,993 | 38 | 44 |
| SHB 57-11 | 8,675 | 35 | 42 | 10,272 | 33 | 39 |
| Cabrito 71-19 | 23,613 | <25 | <33 | 11,435 | 31 | 37 |
| SHB 36-14 | 11,805 | 31 | 37 | 9,634 | 34 | 40 |
| SHB 34-14 | 12,741 | 29 | 35 | 7,979 | 37 | 42 |
| SHB 18-14 | 10,903 | 32 | 38 | 8,615 | 35 | 42 |
| SHB 20-10 | 3,553 | 46 | 52 | 14,778 | 26 | 33 |
| SHB 17-10 | 4,195 | 44 | 50 | 13,622 | 28 | 34 |
| SHB 33-10 | 5,498 | 41 | 47 | 12,774 | 29 | 35 |
| SHB 18-09 | 4,664 | 43 | 49 | 18,681 | <25 | <33 |
| SHB 214-09 | 7,684 | 37 | 43 | 20,573 | <25 | <33 |
| SHB 203-15B | 7,037 | 38 | 44 | 14,819 | 25 | 33 |
| SHB 208-13 | 13,753 | 28 | 34 | 6,375 | 39 | 45 |

*Results taken from site specific modeling in previous chapter



Table 6-2 and Table 6-3 list the well pads proposed by LINN Operating and the projected noise levels at the two leks based on the flat terrain modeling. As LINN Operating may drill and frac simultaneously, a column in each chart shows the resulting noise level if both operations were to occur at the same time (simultaneous operations or SIMOPs).

Table 6-2 Estimated Operational Noise Levels at Sand Draw Reservoir Lek due to Drilling and Fracing at Individual Well Pads Proposed by LINN Operating

| Pad | Distance to Sand Draw Reservoir Lek (ft) | Unit 326 Rig Noise Level at Sand Draw Reservoir Lek (dBA) | Haliburton Fracing Noise Level at Sand Draw Reservoir Lek (dBA) | Combined Noise Level at Sand Draw Reservoir Lek (dBA) |
|---------------|--|---|---|---|
| Cabrito 13-13 | 15,808 | <23 | <33 | <33 |
| SHB 9c | 6,330 | 38 | 45 | 46 |
| SHB 10o | 7,776 | 34 | 43 | 44 |
| SDF 61-11 | 8,618 | 32 | 42 | 42 |
| Cabrito 15-13 | 17,314 | <23 | <33 | <33 |
| Cabrito 23-13 | 12,611 | 26 | 36 | 36 |
| Cabrito 46-13 | 15,428 | <23 | <33 | <33 |

Table 6-3 Estimated Operational Noise Levels at South Rocks Lek due to Drilling and Fracing at Well Pads Proposed by LINN Operating

| Pad | Distance to South Rocks Lek (ft) | Unit 326 Rig Noise Level at South Rocks Lek (dBA) | Haliburton Fracing Noise Level at South Rocks Lek (dBA) | Combined Noise Level at South Rocks Lek (dBA) |
|---------------|----------------------------------|---|---|---|
| Cabrito 13-13 | 8,287 | 33 | 42 | 43 |
| SHB 9c | 20,452 | <23 | <33 | <33 |
| SHB 10o | 13,871 | 26 | 34 | 35 |
| SDF 61-11 | 8,567 | 33 | 42 | 43 |
| Cabrito 15-13 | 7,028 | 33.2* | 41.5* | 42.1* |
| Cabrito 23-13 | 5,637 | 39 | 46 | 47 |
| Cabrito 46-13 | 4,710 | 41 | 47 | 48 |

*Results taken from site specific modeling in previous chapter

It should be noted that the predicted noise levels in Table 6-1, Table 6-2 and Table 6-3 are based on flat terrain modeling and represent a very conservative estimate of the operational noise levels at the leks. Hills or other obstructions that provide noise attenuation were not considered in the flat terrain modeling. Additional site-specific noise modeling would most likely show lower noise levels at the leks.



7. Conclusion

An ambient noise level survey was conducted at the Sand Draw Reservoir lek and South Rocks lek within and adjacent to the Jonah YRD Project Area to document the existing ambient levels and establish allowable drilling and fracing noise levels at the leks. Calculations based on the ARMPA and Wyoming EO 2015-4 (10 dBA above baseline) resulted in allowable levels of 46.3 dBA at the Sand Draw Reservoir lek and 40.0 dBA at the South Rocks lek.

Drilling and fracing noise models were constructed for the SHB 77-04 well pad and the Cabrito 15-13 well pad which are planned for development in 2016. The unmitigated drilling and fracing noise models demonstrated that the planned operations at the SHB 77-04 well pad will be less than 10 dBA above measured ambient levels at the Sand Draw Reservoir lek. Also, the unmitigated drilling noise model of the Cabrito 15-13 well pad demonstrated that the planned drilling operations will be less than 10 dBA above measured ambient levels at the South Rocks lek. As a result, noise mitigation is not recommended at the above sites for the mentioned operations.

However, the fracing noise model of the Cabrito 15-13 well pad revealed that the planned fracing operations will be more than 10 dBA above measured ambient levels at the South Rocks lek, triggering a recommendation of noise mitigation at the Cabrito 15-13 well pad during fracing operations.