

4 August 2022

Mr. Doug Wilson
10515 Lucas Avenue
Franktown, Colorado, 80116

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Voice: 970.389.4620

RE: Noise Impact Review, of Noise Report for
Cherry Creek Events Center
EDI Job # C-4385

Dear Mr. Wilson:

Please find below Engineering Dynamics' review of the Cherry Creek Event Center noise impact report by Cerjan Consulting. See attached.

This peer review addresses some assumptions, regarding event center operations, made in the Cerjan report, which EDI finds to be unrealistic.

1.0 Background

1.1 Site Location

The Cherry Creek Event Center site is located adjacent to State Highway 83, as shown in Figure 1.1. The location of the event center is also shown in the Cerjan report, which, shows extents of the Event Center Parcel.

1.2 Applicable Ordinance

Douglas County Zoning Resolution, Use by Special Review, Section 2107.14 Event Center. See Section 3.0 of Cerjan report, and see Section 2107.14 reproduced below. The salient portion of Section 2107.14 is, Section 2107.14.4, which specifies maximum 'event' center related noise levels and location to determine noise level compliance.

Section 2107.14.4 – indicates maximum 'event' center noise levels of,
40 dBA (Slow) – from 7am to 7pm, and
35 dBA (Slow) – from 7pm to 7am

Section 1705A – measurement of Sound Levels (See Below).
Indicates compliance sound levels shall be measured at a distance of 25-feet or more from the Lot line where the source of noise is located, Section 1705A.02.

Section 2107.14.3 – Set-backs. Indicates,
'Structures, outdoor assembly areas, and parking lots used for the event center shall be setback a minimum of 200 feet from all adjacent property lines.

Note: One existing structure on the event center property is not compliant with this set-back distance.

2.0 Cerjan Noise Report – Noise Prediction Methodology

Section 4.0 of the Cerjan report discusses the 'Noise Prediction Methodology'.

First Paragraph in Section 4.0 – indicates that the computer modeling program SoundPlan v8.2 was used to complete the noise modeling. EDI is familiar with this noise prediction program and its general acceptance in the acoustics community and its validity.

Concerns: None.

Section 4.1 – of Cerjan Report, 'Atmospheric Conditions'

Describes Atmospheric Conditions used as input in the SoundPlan analysis. These assumptions are reasonable.

Concerns: None.

Section 4.2 – of Cerjan Report, 'Terrain and Ground Effects'

Describes Terrain and Ground Effects Conditions used as input in the SoundPlan analysis. These assumptions are reasonable.

Concerns: None.

Section 4.3, Table 1 – of Cerjan Report, 'Barn Sound Levels and Structural Design'

Table 1 – shows the assumed sound levels that will be generated inside the 'barn' during events, of 80dBA. This assumption indicates that these are maximum sound levels which will be generated inside the 'Barn' building.

This assumption is not realistic. EDI has completed a number of analysis', similar to the Cerjan analysis for the Cherry Creek Events Center, and noise levels, for amplified music and voices are never assumed to be this low, for types of events that will be held at the Cherry Creek Events Center.

Typical, amplified music and voice levels, for events, such as weddings, graduation parties, etc. are typically in the 90 to 100 dBA range, depending on the DJ or size of band.

For reference – normal speech sound levels between two people, standing 3-feet apart are in the 60 to 70 dBA range.

Concerns: The assumed maximum sound levels are not realistic and indicate that Cerjan report under predicts, significantly, the property lines noise levels, form Cherry Creek Event Center operations.

Note: Section 5.0, Table 3 and Figure 3 of the Cerjan report show predicted noise levels at nearby residences and the Event Center property lines. Figure 3, shows predicted noise contours with the barn doors open, and with a note indicating noise levels inside the barn at 70 and 72 dBA. The narrative in Section 5.0 does not mention this operational reduction in noise levels for conditions when the barn doors are open.

Section 4.3, Table 2 – of Cerjan Report, 'Barn Sound Levels and Structural Design'

Table 2 – shows the expected noise level reduction from inside to outside the 'barn'. The anticipated level of noise reduction is given in terms of a Sound Transmission Class (STC) rating, which is a standard method, in acoustical analysis to define noise attenuation through a partition.

This level of noise reduction is reasonable for the composite STC rating of the barn walls and windows. However, there is no mention of the expected STC rating or what modifications will be made to 'large barn doors on the north and south sides of the barn'. Typical, barn doors are single thickness of 3/4 to 1-inch thick wood slats, and will have an STC rating less than 30.

Concerns: The report does not indicate how or if the barn doors on the north and south sides of the 'barn', will be modified to have a higher STC rating. The barn doors will be a significant noise leak, unless they are extensively modified.

Section 4.4 – of Cerjan Report, 'Manmade Barriers'

Describes existing structures on the property used as input in the SoundPlan analysis. The methodology and results, Section 5.0 of Cerjan report, do not indicate what level of noise attenuation, if any, these structures will provide.

Concerns: The extents, lengths, widths and heights, of the existing structures on the property indicates that these structures will provide minimal to no noise attenuation of either indoor or outdoor sound levels to the adjacent properties.

Section 4.5 – of Cerjan Report, 'Types of Noise Predictions'

Describes that noise levels to determine compliance with the Douglas County Zoning ordinance, were at a distance of 25-feet from the Cherry Creek Event Center property line as required in Douglas County Zoning Ordinance 1705A.02.

Concerns: None.

3.0 Cerjan Noise Report – Predicted Noise Levels and Assessment of Compliance

Section 5.0 of the Cerjan report discusses the 'Predicted Noise Levels and Assessment of Compliance'.

First Paragraph in Section 5.0 – discusses conditions for which noise impact and compliance was predicted. The last sentence in the first paragraph indicates that for the properties to the east the compliance location was 25-feet onto the adjacent properties. .

Concerns: EDI does not agree with this compliance assessment location. Douglas County Zoning Ordinance Section 17 – Noise Overlay Districts, subsection 1705A.02, specifies that noise levels compliance will be determined 25-feet from the property line of the property on which the noise source is located. There is no provision in 1705A.02 to indicate, that for this case, noise compliance should be measured 25-feet onto the properties on the east side of S.H. 83.

Second Paragraph in Section 5.0 – references predicted noise levels in Table 3 and Figure 3.

As discussed in Section 2.0 of this report, the assumed maximum noise levels inside the 'barn' are on the order of 10 to 20 dBA less than is typical for weddings, graduations, etc. in this type of events center. With noise levels at events in the 90 to 100 dBA range the noise contours show in Figure 3 of the Cerjan report, will extend out two to four times further than shown.

Figure 3.1, of this report shows expected realistic 35 dBA noise contour location for Event Center operations, with amplified music and voice noise levels at 90 to 100 dBA. Inspection of Figure 3.1 shows that, with realistic noise levels, the Event Center is NOT in compliance with Douglas County Zoning Resolution, Use by Special Review, Section 2107.14 Event Center, Noise Limits.

Additionally, with realistic noise levels inside the 'barn', noise levels at five of the seven residences modeled in the Cerjan report will have noise levels in excess of 35 dBA.

Concerns: The Cherry Creek Event Center noise impact report, significantly underestimates, realistic noise inside that will occur during operations at the Events Center, and therefore, underestimates the noise impacts, both for compliance with property line noise limits and noise levels at nearby residences.

4.0 Information not Included in Cerjan Report

Review of the proposed Cherry Creek Events Center application indicates that, in the future an outdoor gathering area will be or is intended to be built on the north side of the 'barn'. Outdoor venues have more direct noise impact; there, is no substantial noise mitigation between the outdoor area and the adjacent property lines.

For this type of outdoor area, noise compliance with any type of amplified music or voice is unlikely to not possible, unless substantial noise mitigation is installed. With no noise mitigation installed, the only music / voice that will be in compliance is strictly acoustic (non-amplified) with two to four string instruments. Brass or wind instruments and drums will not be in compliance with the 35 dBA noise limit.

5.0 Conclusion

The results of the Cherry Creek Event Center noise impact assessment report, significantly underestimates what will be, in practice, actual noise levels inside the 'barn', and does not address the impact of the outdoor gathering area on the north side of the 'barn'.

If reasonable amplified music and voice noise levels inside the 'barn' were used in the Cerjan report, predicted noise levels and anticipated noise levels will not be in-compliance, with Douglas County Zoning Resolution, Use by Special Review, Section 2107.14.4, 25-feet from the

- a. The north, south and east Event Center property lines, and
- b. Noise levels will exceed the 35 dBA maximum (7pm to 7am) at five of the seven, nearby existing residences.

Additionally, with the Event Center at the proposed configuration and if operated in its current proposed configuration, it is anticipated that Douglas County will receive regular noise complaints, during Event Center events, which will require response from the Douglas County Sheriff's office, and associated costs to monitor Cherry Creek Event Center operations.

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Recommendation: The noise report for the Cherry Creek Events Center needs to be re-done with realistic indoor noise levels from amplified music and voice, and needs to include noise impact from outdoor gathering / event area.

If you have any questions, please contact me at our Englewood office.

Sincerely,
ENGINEERING DYNAMICS, INC.

Stuart D McGregor

Stuart D. McGregor, P.E.
President



Figure 1.1: Cherry Creek Event Center Location

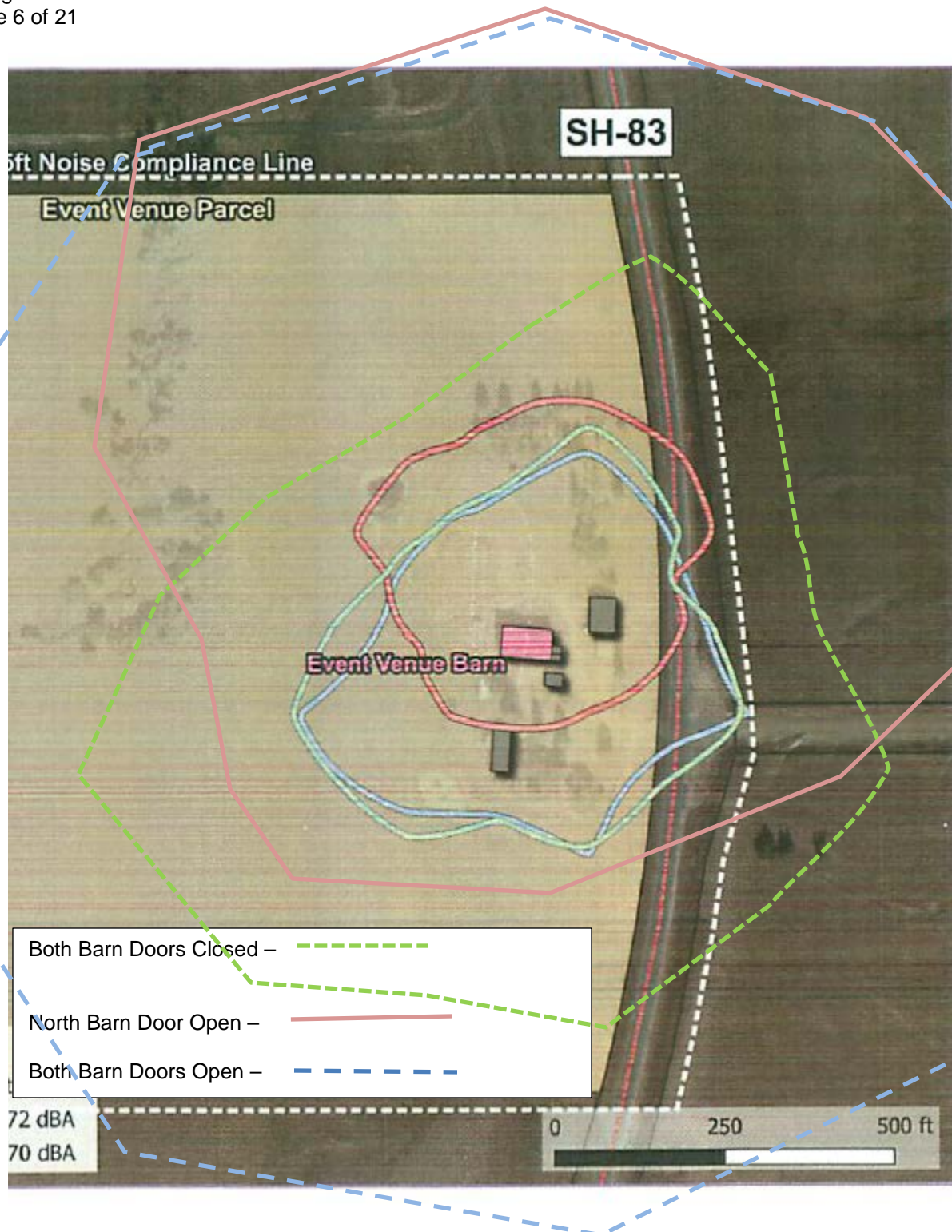


Figure 3.1: Realistic Cherry Creek Event Center 35 dBA Noise Contour

DOUGLAS COUNTY ZONING RESOLUTION

Section 21 Use By Special Review

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SECTION 21 USE BY SPECIAL REVIEW

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- 2107.12 Day-care center, preschool, or day-care home - large: A-1, LRR, RR, ER, SR, MF, and MH zone districts provided that such uses shall be situated on a lot of not less than 10,000 square feet and that a solid fence or wall 6 feet in height shall completely enclose the yard used for playground purposes
- 2107.13 Dude ranch: A-1 zone district
- 2107.14 Event Center: CMTY and D zone districts, subject to the following additional requirement:
- 2107.14.1 A noise study shall be submitted demonstrating compliance with the limits established in Section 1703A of the Noise Overlay District.
- A-1 zone district, subject to the following additional requirements:
- 2107.14.2 Structures used for the event center shall be of a scale and design that is compatible with the surrounding rural environment.
- 2107.14.3 Structures, outdoor assembly areas, and parking lots used for the event center shall be setback a minimum of 200 feet from all adjacent property lines.
- 2107.14.4 Noise generated by the event center use shall not result in noise levels which exceed 40 dB(A) between 7:00 a.m. and 7:00 p.m., and 35 dB(A) between 7:00 p.m. and 7:00 a.m., measured in accordance with Section 1705A.
- 2107.14.5 A noise study shall be submitted demonstrating compliance with the event center noise standard.
- 2107.14.6 In addition to the management plan components specified in Section 2112, operational limitations for the event center shall address the following:
- (1) Maximum number of event patrons.
 - (2) Frequency of events including times of day and days of week.
 - (3) The number of outdoor and indoor events.
 - (4) Specific mitigation measures to limit the impacts of any exterior lighting.
 - (5) Specific limitations or mitigation measures to ensure compliance with the noise standards consistent with the noise study.
- 2107.14.7 In addition to the information required for the project narrative specified in Section 2111, the event center narrative shall include a discussion of the following:

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- (1) The ability of the existing or proposed structures to comply with building and fire code requirements for public assembly uses.
- (2) The ability to provide sanitation service for the proposed use by connection to a sanitary sewer or provision of on-site wastewater treatment.
- (3) The ability to connect to a central water provider or to obtain a well permit for the proposed use.

2107.15 Feed yard - confinement center: A-1 zone district, provided that such use is located at least 500 feet from all property lines, and that such use is approved by Tri-County Health Department

2107.16 Firing range - outdoor: A-1 and GI zone districts provided that the use is located at least 100 feet from all property lines; an indoor range may be permitted as an accessory use to an outdoor range in the A-1 zone district

2107.17 Golf course legally established as a Use by Special Review prior to June 22, 2005: A-1, LRR, RR, ER, and SR zone districts subject to the following:

- (1) Such use may be amended in accordance with the provisions established herein.
- (2) No amendment shall have the effect of changing the boundary of the area subject to the legally established Use by Special Review as it existed on June 22, 2005. *(Amended 2/12/19)*

2107.18 Greenhouse: A-1 zone district

The following may be restricted based upon compatibility with the surrounding land uses:

- Location, size, height and use of structures
- Number of vehicle trips
- Lighting and hours of operation
- Location and type of materials stored outside
- Retail sale of items
- Parking area setbacks

2107.19 Group Residential Facility: A-1, LRR, MF, MH, B, C, and LI zone districts provided that the Group Residential Facility does not include more than 1 registered sex offender over the age of 18 *(Amended 5/14/03)*

All requests shall be submitted to the Placement Alternative Commission as a referral.

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Section 17A Noise – Overlay District

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SECTION 17A NOISE – OVERLAY DISTRICT

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Section 17A Noise – Overlay District

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1704A.08.4 Animals.

1704A.08.5 The maintenance of real property between the hours of 8:00 am and the next 8:00 pm.

1704A.08.6 Firearms.

1705A Measurement of Sound Level

1705A.01 Sound shall be measured on the "A" weighting scale on a sound level meter of standard design and quality and characteristics established by the American National Standards Institute.

1705A.02 Sound shall be measured twenty-five feet or more from the lot line where the source of the noise is located, unless otherwise specified. [§25-12-103(1), C.R.S.]

1705A.03 Measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour [§25-12-103(8), C.R.S.], or ten miles per hour with the windscreen.

1705A.04 For all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurement. [§25-12-103(9), C.R.S.]

June 29, 2022

Ms. Pamela Solly
8635 S. State Highway 83
Franktown, Colorado 80116

NOISE ASSESSMENT OF PROPOSED FRANKTOWN EVENTS CENTER

Per your request, Cerjan Consulting conducted a noise analysis for the anticipated noise resulting from music being played inside a venue at the proposed Franktown Events Center located at 8635 S. State Highway 83 in Franktown, Colorado. The predicted noise levels were then compared to the applicable noise regulations as defined by Douglas County, Colorado. The following provides my qualifications, a brief project description, the prediction methodology, and the results and assessment of compliance.

1.0 QUALIFICATIONS

Mr. Jeff Cerjan has a BS in Aerospace Engineering from the University of Kansas (1994) and is a full member of the Institute of Noise Control Engineering. He has worked in the structural dynamics and acoustics field for nearly his entire career with the past 20 years conducting noise studies in Colorado, across the US, and internationally. Some of the primary fields of study include oil and gas, mining, land development, performance venues, power facilities (i.e.: wind turbines, power plants, solar, etc.), and transportation. Applicable to this project, Mr. Cerjan has direct experience measuring, modeling and assessing sound levels resulting from music and events from smaller wedding venues to large outdoor amphitheaters. Cerjan Consulting also has a geographic informational systems analysis (GIS) available as needed. Finally, Mr. Cerjan routinely presents his finding in technical reports designed for submittal and review by county planners and commissioners.

2.0 PROJECT DESCRIPTION

The location of the 35-acre property is at 8635 S. State Highway 83, Franktown, Colorado 80116 and is identified as Parcel Number 2603-290-00-024 as shown in Figure 1. This property includes the barn that will be remodeled to be used as the primary events venue, a ranch style house, and a few other outbuildings. The hours of operation are expected to include both daytime and nighttime hours. The properties that surround the site are all zoned Agricultural with the nearest residences identified as R1 to R7 with R2 being the closest at and 1,100 feet away from the barn. The nearest residence to the west is over two miles away. Existing noise levels in the area are dominated by traffic along State Highway 83 which is immediately adjacent to the east and/or local farming and ranching activities.

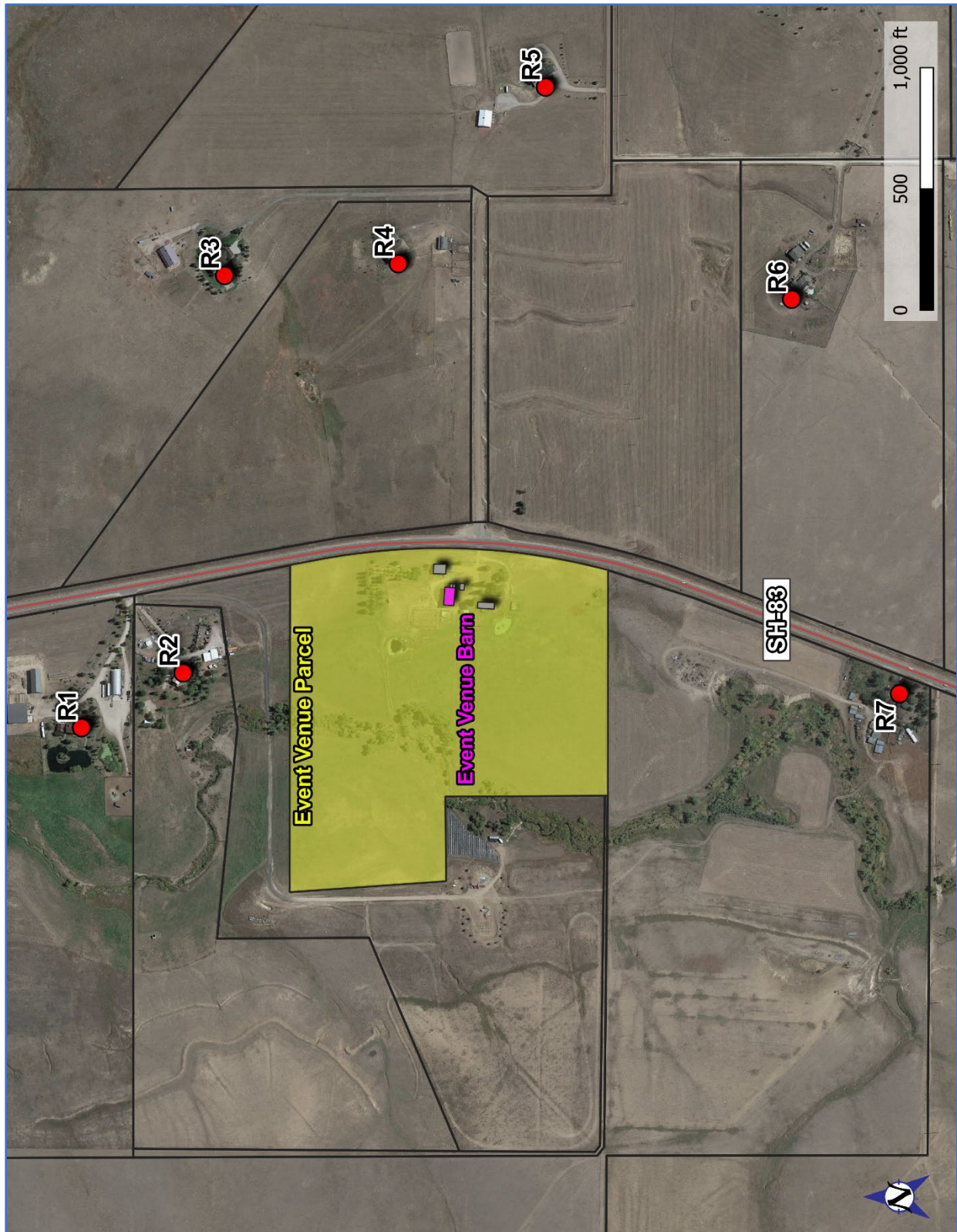


Figure 1 – View of Proposed Events Venue and Surrounding Area

3.0 APPLICABLE NOISE REGULATIONS

The applicable noise regulations were identified within the Douglas County Zoning Resolution, Use by Special Review, Section 2107.14 Event Center. This property is zoned A-1 and is subject to additional requirements. The noise regulation portion of these requirements are provided here.

2107.14.4 Noise generated by the event center use shall not result in noise levels which exceed 40 dBA between 7:00 am and 7:00 pm, and 35 dBA between 7:00 pm and 7:00 am, measured in accordance with Section 1705A.

2107.14.5 A noise study shall be submitted demonstrating compliance with the event center noise standard.

The measurement of the sound level is defined by Section 17A – Noise Overlay District and more specifically by 1705A Measurement of Sound Levels as outlined below.

1705A.01 Sound shall be measured on the “A” weighting scale on a sound level meter of standard design and quality and characteristics established by the American National Standards Institute.

1705A.02 Sound shall be measured twenty-five feet or more from the lot line where the source of noise is located, unless otherwise specified.

1705A.03 Measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour, or ten miles per hour with the windscreen.

1705A.04 For all sound level measurements consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurement.

In summary, during the daytime hours from 7:00 am to 7:00 pm the sound level limit is 40 dBA and during the nighttime hours this limit drops to 35 dBA. Thus, this analysis needs to show that the event venue is capable of achieving the most restrictive limit of 35 dBA. The locations of compliance are 25 feet outside the venue’s property line to the north, west and south, and 25 feet inside the property line to the east as it abuts State Highway 83 and thus the nearest applicable property line is across the street. For any compliance sound level measurements taken of the venue, consideration should be given to the existing ambient noise level of the area including traffic noise along State Highway 83 as this may be significantly louder than 35 or 40 dBA. Furthermore, it is strongly recommended that regardless of wind speed, use a properly designed and fitted windscreen should be used to avoid inaccurate readings.

4.0 NOISE PREDICTION METHODOLOGY

Noise levels were predicted per *International Organization for Standardization (ISO) 9613-2: 1996 – Acoustics – Attenuation of Sound During Propagation Outdoors* using the SoundPLAN v8.2 software package. ISO 9613-2:1996 predicts noise levels assuming slight downwind conditions (wind blowing from source to receiver) with an accepted accuracy of ± 3 dB out to 1,000 meters. A sample view of the acoustical model is provided in Figure 2. The following describes how this prediction method was applied on this Project.



Figure 2 – Three-Dimensional View of the SoundPLAN® Noise Model

4.1 Atmospheric Conditions

The air temperature, relative humidity, and atmospheric pressure were set to conditions of 10°C, 70%, and 1 atmosphere, respectively. These values represent a low amount of atmospheric absorption of sound available in the ISO 9613-2:1996 method, and result in good propagation of sound level from the site to any receivers.

4.2 Terrain and Ground Effects

The terrain in the project area was modeled by importing elevation data taken from the Douglas County online geographical information systems website. Natural or manmade terrain can act as effective barriers, but for this site the immediate area is largely flat and thus little to no noise reduction due to terrain is expected. The type of terrain (i.e.: grass, water, etc.) also affects sound propagation due to its reflectivity which is referred to herein as the “ground effect”. This acoustical effect of the ground can be modeled using ground factors from 1.0 (completely absorptive) to 0.0 (completely reflective). For this project we assumed a ground effect of 0.5 which is a reasonable and typical average ground absorption value.

4.3 Barn Sound Levels and Structural Design

A sound pressure level (SPL) at the interior walls and roof was assumed to be 80 dBA using the spectrum shown in Table 1. The level and spectrum ($L_{EQ(1 \text{ min})}$) are from a measurement of music (Ref: *Everyday by Incognito*) played by a professional DJ at a similarly sized venue.

Table 1 – Modeled Source Sound Pressure Level (dB)

Sound Source	1/1 Octave-Band Frequency (Hz)									Overall (dBA)
	31.5	63	125	250	500	1,000	2,000	4,000	8,000	
Music SPL at 30 feet centered on two Speakers	60	93	85	85	75	73	66	63	51	80

The noise model assumed a sound transmission class (STC) of 38 for all building elements (i.e.: walls, roof, doors, and windows) with the corresponding sound reduction per octave band shown in Table 2 (Ref: *Noise Control for Buildings, CertainTeed, May 2018*). For context, an STC 38 would equate to a 2"x4" wall with plywood sheathing, insulation and drywall and is considered "good" for noise reduction with an STC 45 to 55 being considered "very good". Note that the existing barn is expected to be renovated and insulated to include heating and air conditioning with 2"x6" exterior walls, thus a higher STC than 38 is possible. An outdoor balcony is also planned for the west facing façade, but this will be enclosed which is expected to sufficiently mitigate the sound in this direction. The existing large barn doors to the north and south were estimated at 21 feet wide by 12 feet tall.

Table 2 – Modeled Noise Reduction for Building Elements (dB)

Noise Reduction	1/1 Octave-Band Frequency (Hz)								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
STC 38	5 ⁽¹⁾	11 ⁽¹⁾	16	30	32	47	57	54	54

⁽¹⁾ Assumed values based on the STC trend, Testing by Riverbank Acoustical Laboratories

4.4 Manmade Barriers

Existing manmade structures such as garages and houses already on the property were included in this model. Heights and locations of structures were approximated based on aeriels and photographs.

4.5 Types of Noise Level Predictions

Noise levels were predicted at discrete points at the compliance locations 25 feet outside the property lines as well as at each physical residence in the immediate vicinity. In addition, noise level contours were also calculated and overlaid onto maps which help identify the location of a particular sound level.

5.0 PREDICTED NOISE LEVELS AND ASSESSMENT OF COMPLIANCE

Noise levels were predicted for three scenarios. The first being with both large barn doors closed, the second being with the northern large barn door open, and the third being with both large north and south barn doors open. Noise level limits for this event venue are 40 dBA and 35 dBA for daytime (7:00 am to 7:00 pm) and nighttime (7:00 pm to 7:00 am), respectively. Noise level compliance is assessed at locations 25 feet outside the event venue property line with an exception being to the east (State Highway 83) in which the location is across the highway 25 feet inside the adjacent property line.

The predicted music noise levels are shown in Table 3 for each direction from the event venue and compared to the daytime and nighttime noise limits to assess compliance. Table 3 also provides the predicted music noise levels at the nearest physical residences (refer to Figure 1 for locations). Each of the three scenarios meet the daytime and nighttime noise level limits at the compliance locations with the assumed noise reduction shown in Table 2 for building elements and music noise level limited between 70 to 80 dBA (see notes for Table 3) depending on barn door configuration. In addition, any proposed east facing windows should be avoided or should remain closed and also achieve the similar noise reduction. The noise levels at the physical residences are predicted to be at least 9 dB quieter than nighttime limit of 35 dBA. Figure 3 provides the predicted 35 dBA noise level contour for each of the three scenarios.

In conclusion, the intent of this noise study is to show a reasonable “proof of concept” to meet the applicable noise regulations and not provide a precise specifications as there are other combinations of sound source levels and building design elements that could yield similar or better results. Thus, it is my opinion that these assumptions are reasonable, and this study demonstrates compliance with the applicable noise regulations.

Table 3 – Predicted Noise Levels and Assessment of Compliance with Mitigations

Prediction Location	Barn Doors Closed	N Barn Door Open ⁽¹⁾	N & S Barn Doors Open ⁽²⁾	Day Limit	Night Limit	In Compliance?
North Compliance (max)	29	30	27	40	35	Yes
South Compliance (max)	29	23	29	40	35	Yes
East Compliance (max)	34	35	35	40	35	Yes
West Compliance (max)	28	24	17	40	35	Yes
R1 (north)	25	25	26	---	---	---
R2 (north)	29	19	17	---	---	---
R3 (northeast)	18	19	17	---	---	---
R4 (east)	20	20	17	---	---	---
R5 (east)	17	10	15	---	---	---
R6 (southeast)	21	15	17	---	---	---
R7 (south)	18	12	17	---	---	---

⁽¹⁾ Source music level reduced by 7 dB to 73 dBA. Similar results expected if only the south door was opened as well.

⁽²⁾ Source music level reduced by 10 dB to 70 dBA.

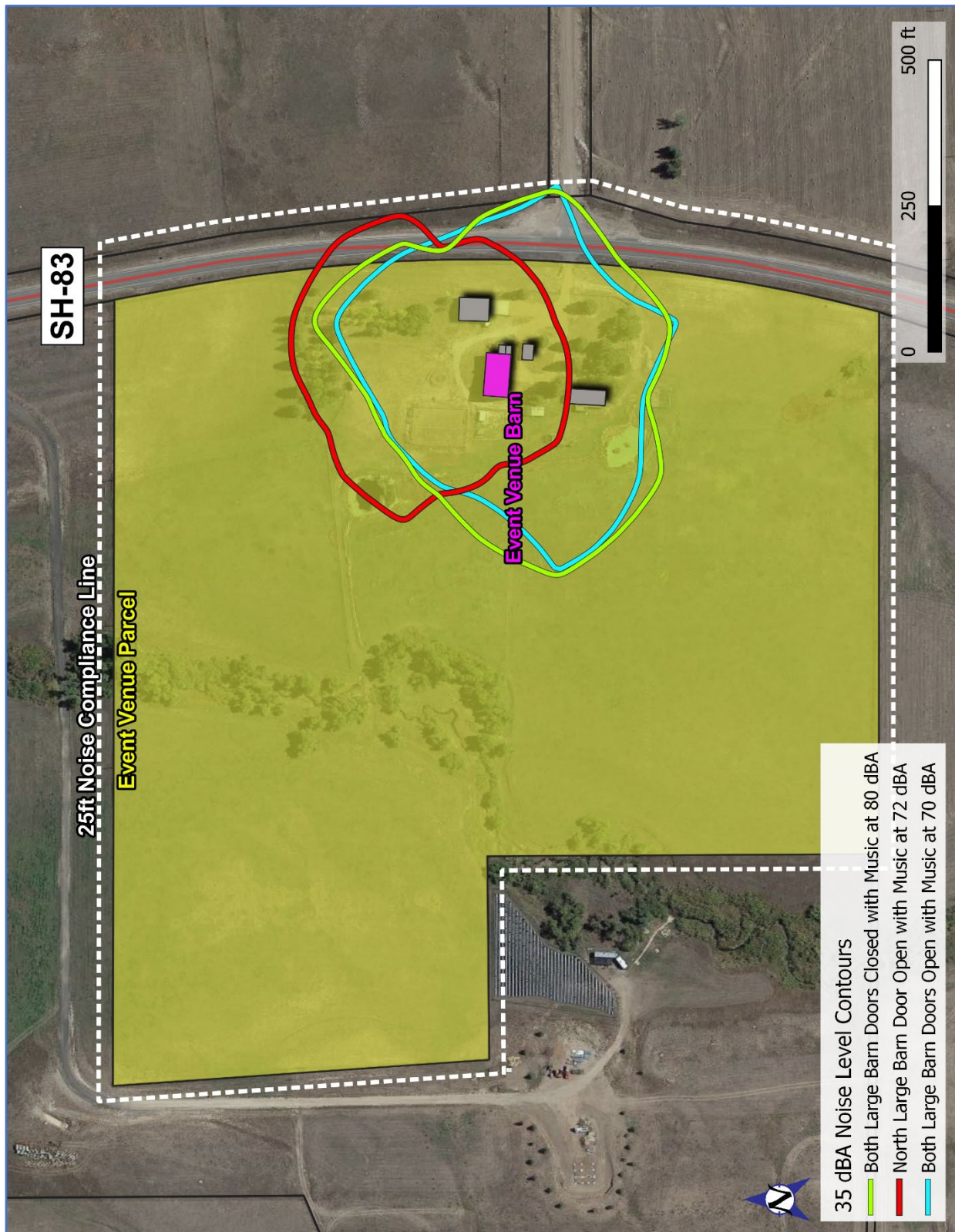


Figure 3 – Predicted Noise Level Contours for the Proposed Events Venue

Thank you for involving us with this effort. Please do not hesitate to contact us if there are any questions

A handwritten signature in black ink, consisting of a stylized 'J' and 'C' that are interconnected.

Jeff Cerjan, INCE
Senior Consultant

Stuart D. McGregor, P.E.
President / Senior Engineer

Professional Experience: Mr. McGregor is president of Engineering Dynamics, Inc. His experience in acoustical and vibration engineering encompasses analysis and modeling for environmental and building projects, noise and vibration mitigation design recommendations, testing of structures and devices, presentation before public deliberative bodies and testimony as an expert witness.

Mr. McGregor's noise and vibration engineering and testing experience covers a wide range of applications from building acoustics related to mechanical systems and interior acoustics, environment noise, measurements and modeling for a wide range of projects from gravel pits and oil and gas wells, to automobile race tracks and outdoor concert venues, seismic measurements, equipment vibration and simulated environments testing.

Recent project experience covers:

Building Mechanical Systems – noise from building mechanical systems can make a project unusable for its intended purpose. Over the last 20-years I have been fortunate enough to work on a large number of projects, for new construction and to mitigate noise issues on already constructed building, which pushed the limits of squeezing mechanical systems into small spaces and used innovative mechanical system designs. These opportunities have allowed me to see and analyze a wide variety of mechanical systems and required some very creative solutions. These solutions have been refined with the help of local mechanical HVAC engineers and contractors.

Work I have done for building mechanical systems has included acoustical analysis, design and measurement of noise and vibration issues for new construction as well remediation for existing problems, on residential, commercial, laboratory and industrial applications. Projects have included work to minimize noise and vibration intrusion into occupied spaces from roof top and mechanical room equipment, including chillers, cooling towers, exhaust fans, air handlers, pumps and compressors, as well as noise mitigation for community noise impacts from roof top and ground based mechanical equipment.

Building Interior Acoustics – begins with defining the acoustical goals for the specific project, which can vary significantly depending on the space usage; multi-family residential has very different requirements than open office spaces.

Work on building interior acoustical issues has covered with sound isolation between residential spaces requiring the design / specification of demising wall and floor / ceiling assemblies that meet the project Sound Transmission Class (STC) and Impact Insulation Class (IIC) requirements. Acoustical requirements for commercial office spaces sound isolation between private offices and for conference rooms, as well as appropriate Reverberation Times (lack of echoes) for open office spaces. Noise issues for classrooms, lecture halls, and small theaters are typically limited to appropriate Reverberation Times and minimization of HVAC related noise to enhance intelligibility of the spoken word.

Environmental Noise Impact Analysis – this work begins either with a concept proposal for a proposed project or an existing facility that has received noise or ground vibration complaints. Over the last 15-years EDI has completed a majority of the environmental noise assessments for minerals extraction projects, gravel pits, above ground equipment for mines, and noise permitting for gas compressor stations in the Rocky Mountain Region. Some recent clients include The National Park Service, BP / Amoco Production Company, Lafarge Industries, Aggregate Industries, Williams Field Services and other resource development companies.

Vibration Analysis – small levels of vibration from mechanical equipment or from occupant activities in a building can result in significant audible noise issues or render sensitive scientific instrumentation unusable. As part of EDI's building testing services we perform vibration measurement and analysis on rotating equipment (motors, fans, pumps) diagnosis of vibration transmission in buildings from mechanical equipment or scientific equipment, and designs for mitigation of vibration from sources inside and outside a building.

Acoustics Teaching Experience – Mr. McGregor developed and has taught for approximately 20-years a noise certification course geared towards the requirements that city, county and state police officers, code enforcement and planners have to enforce local noise laws and ordinances. As part of his membership in the NEBB, he is on the Sound and Vibration committee and has taught the NEBB sound and vibration certification courses. He has also, given practical noise lectures to architectural and mechanical engineering student groups at local universities.

Test Engineer – for EDI's Simulated Environments testing lab. Mr. McGregor both supervises and runs various vibration (sine, random and mixed mode), temperature, humidity, acceleration, sand / dust and other tests. Mr. McGregor is responsible for all aspects of the test lab ranging from quoting costs, performing tests, to writing test reports and interfacing with clients.

Previous experience includes: Prior to coming to EDI Mr. McGregor's engineering experience included; Engineering Specialist at McDonnell Douglas Aircraft, Long Beach, CA, with responsibilities that included acoustical modeling, diagnosis of noise and vibration sources, and implementation of design solutions for military and commercial aircraft (1985-88). Engineer, Logicon, Inc., San Pedro, CA, with primary responsibilities including analysis of strategic weapon system effectiveness (1984-85). Engineer, Survivability/Vulnerability Group, Rockwell International, Lakewood, CA, with primary responsibilities to perform survivability analysis on the B-1B bomber (1982-84).

**PROFESSIONAL
AFFILIATIONS:**

Acoustical Society of America (ASA)
Institute of Noise Control Engineering (INCE)
American Society of Heating, Refrigerating, and
Air Conditioning Engineers (ASHRAE)
American Industrial Hygiene Association (AIHA)
National Environmental Balancing Bureau (NEBB)
Vibration Institute CAT III Certified

EDUCATION: B.S., Physics, Colorado State University, 1980

PROFESSIONAL REGISTRATION:

Professional Engineer in the State of Colorado
NEBB Certified, Sound and Vibration
Vibration Institute ISO CAT II Vibration Certified