Ambient Noise Readings
Technical Memorandum

Little Canyon Mountain
Prineville District
Central Oregon Resource Area

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Introduction

The purpose of this technical memorandum is to provide a summary of ambient noise readings for an area near Canyon City, Oregon, Township 14 South, Range 32 East, and Section 6. The Bureau of Land Management allows Off Highway Vehicle (OHV) activity. The noise generated from this activity has become a part of the ambient noise environment in the Little Canyon Mountain Area.

Noise Criteria

Sound is created when an object vibrates and radiates part of its energy as acoustic pressure or waves through a medium such as air, water, or a solid object. Sound levels are expressed in units called decibels (dB). Since the human ear does not respond equally to all frequencies (or pitches), measured sound levels (in dB at standard frequency bands) are often adjusted or weighted according to the frequency response of human hearing and the human perception of loudness. The weighted sound level is designated as the A-weighted sound level in decibels, or dBA, and is measured with a calibrated sound level meter. Typical sound levels experienced by people range from about 40 dBA, the daytime level in a typical quiet living room, to 85 dBA, the approximate level produced by a food blender at 3 feet.

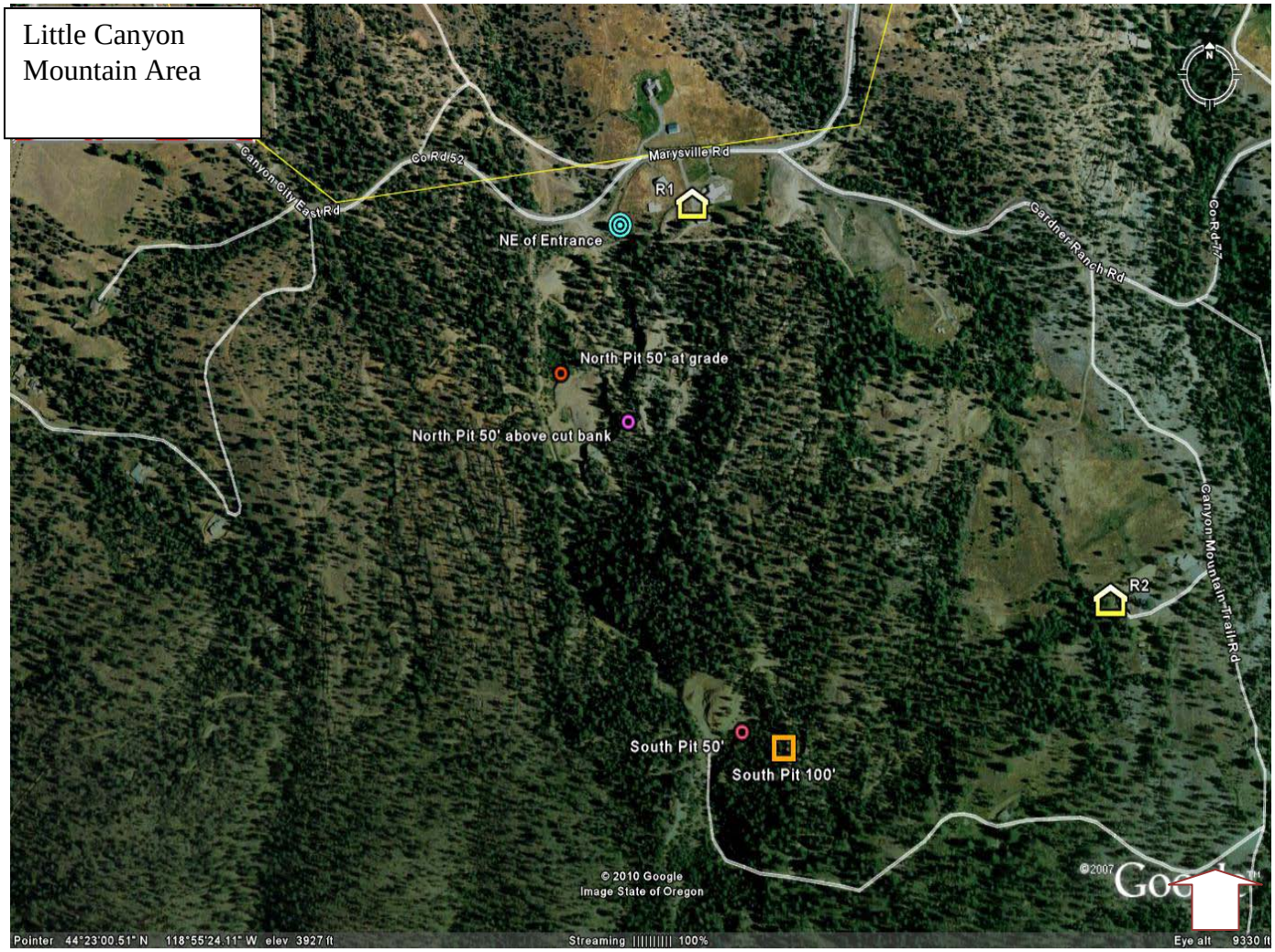
Noise is defined as unwanted sound. The ability of an average individual to perceive changes in noise levels is well documented. Generally, changes in noise levels less than 3 dBA will be barely perceived by most listeners, whereas a 10 dBA change normally is perceived as a doubling of noise levels. The general principle on which most noise acceptability criteria are based is that a perceptible change in noise is likely to cause annoyance wherever it intrudes upon the existing noise from all other sources (i.e., annoyance depends upon the noise that exists before the introduction of a new sound).

Several descriptors are used to express noise levels, which correlate with human perception. The energy equivalent level (L_{eq}) noise exposure is a descriptor for assessing noise from vehicles. L_{eq} is calculated by averaging the dBA noise levels measured over a specified period of time. The use of L_{eq} is appropriate for transportation noise analyses because these levels are sensitive to both the frequency of occurrence and duration of noise events.

Noise Monitoring Locations

Presently, the Little Canyon Mountain area is comprised of a mixture of open OHV use two open pit mines where there is a hub of OHV activity and an area which is limited to designated roads for OHV use. There are 3 residential houses nearby. Monitoring locations were chosen to confirm decibel drop off levels associated with the distance from the noise source to the noise receiver. Monitoring locations are identified in the following Figure.

Figure 1. Noise Monitoring Locations



Methods

The existing noise environment has been documented through a series of field measurements in the study area on February 9, 2010. These measurements were made at:

- 2 of the 3 residences in the area (R1 and R2),
- offsets of 50-feet (ft) and 100-ft from the center of South Pit OHV travel way
- offsets of 50-ft from the center of North Pit OHV travel way at grade and at 20 vertical feet above the center of the pit.

The noise level (L_{eq}) was averaged and then rounded off to the nearest whole decibel (dBA). The criteria for acceptability of the measurements were that different

measurements were within +/- 3 dBA of each other, and no extraneous sound sources contaminated the data. Noise measurements were taken until noise levels during a particular sample timeframe stabilized at each monitoring location. Repeat measurements were obtained until the measurements agreed within 1 dBA. Measurements were averaged to establish one set of noise data for each position.

The equipment used to conduct the measurements included a Larsen-Davis integrating sound level meter model XLT (Type 1) system. The system was calibrated before and after each measurement session. The procedures and protocols followed were in accordance with Oregon's Department of Environmental Quality's Motor Vehicle Sound Measurement Procedures Manual (April 1983). The measurement locations are shown in Figure 1.

Air temperature, humidity, wind speed, and wind direction were recorded simultaneously with the noise measurement using field meteorological instruments. Each monitoring site was sketched on the field data form and digitally photographed. A GPS coordinate each monitoring location was obtained. Other noise sources other than OHVs, such as passenger vehicles along roadways and aircraft were noted for each monitoring measurement.

Data acquisition involved noise measurements at selected locations to represent three field conditions: OHVs in use at the North and South Pits and OHVs not in use. OHV use at maximum volume and speeds within the pits that could be safely achieved was used to replicate the upper limit of capacity within the pits. Public OHV use could generate different volumes and speeds. However, it is likely speeds would decrease with greater volumes. Reduced OHV operating speeds typically would reduce noise levels. The following OHVs were used to generate noise: 2 motorcycles, 3 all terrain vehicles, and 2 Diesel 4x4 trucks. Vehicles were tested to determine exhaust system sound levels. A 2100 Qwest sound level meter (Type 2) was used. The measurement results are found in the following tables.

Results of Field Measurements

The following tables indicate the results of data obtained on February 9, 2010.

Table 1. Meteorological Data

Location	Time	Ambient Temperature (^oF)	Relative humidity (%)	Wind Direction	Wind Speed (mph)
R1	10:30 AM	40	53	SW	1.5
South Pit	10:50 AM	41	50	-	0
R2	12:23 PM	38	51	SW	2.5
North Pit	2:20 PM	44	50	SW	0.5

Table 2. Noise Levels at Receivers				
Location	**Measured at Distance (feet [ft.]) from house or 'edge' of travel way**	**Ambient Noise Leq (dBA)**		
		Field Condition		
		OHV not in use	**OHV in use South Pit**	**OHV in Use North Pit**
R1	14	40*	31	47
R2	10	33	39	No Measurement
South Pit	50	No Measurement	66	No Measurement
	100	No Measurement	57 [a]	No Measurement
North Pit	50 at grade	No Measurement	No Measurement	67
	50 above grade	No Measurement	No Measurement	54
NE of North Pit Entrance	see map for location	No Measurement	No Measurement	49[a]

[a:] One motorcycle was not in use. R=Residence *Passenger vehicles were observed during measurements.

Table 3. Vehicle Emissions					
Vehicle Characteristics				**dBA**	
Type	**Manufacturer**	**Model**	**Year**	**Sound Limit**	**Sound Test Result (dBA)**
Motorcycle	Honda	250 R	1989	99	85
	Kawasaki	KDX 200	1994		89
ATV	Kawasaki	Prairie 700	2004	95	91
	Honda	Foreman 500 TRX	2006		83
	Polaris Range XP[a]	700 EFI	2007		83
4x4 Truck	Ford	F250 XL Diesel	2009	95	85*
	Ford	F250 XL Diesel V8 Power Stroke	2007		85*

Sound Limit= as defined by Oregon Noise Regulations Table 4 [a:] UTV
*not Field tested, noise source:
http://www.dieselpowermag.com/features/ford/0707dp_2008_ford_super_duty_gas_vs_diesel/index1.html

Traffic Noise Model Screening

There is not a noise model to predict future noise levels for OHVs travel with varied topography, ground cover and speeds. Noise levels propagate with different absorption and reflections parameters. The preferred procedure for noise level prediction of OHV use in a particular area is to measure at a comparable location and use that data to predict future noise levels. The purpose of the data collection in the Little Canyon Mountain area was to establish a baseline of existing noise conditions. This baseline may be used for future use. However, if future predictions were to be desired, the Federal Highway Administration's (FHWA) noise model could be used as a reference tool for understanding noise levels associated with speeds, offsets, and vehicle volumes.

The FHWA uses Traffic Noise Model 2.5 Look-Up (TNM Look) Software to screen for potential traffic noise impacts. This model is to analyze highway traffic noise and its accuracy for applying it to OHVs in the setting the Little Canyon area is unknown. The TNM Look model assumes very simplified conditions which is an infinitely long, straight paved roadway on flat terrain with known vehicle sound reference levels at various speeds.

Typically the noise model's accuracy reduces as the distance between the receiver and roadway increases. For the TNM Look program, modeling distance is confined between 32 feet (ft) and 984 ft between the roadway and receiver. Idling and traveling OHV vehicles emit different sound levels than highway vehicles. However, the TNM Look program can include trucks and motorcycles for various setbacks from a 2-lane paved roadway at various speeds.

For example, in a test example using TNM Look, with soft terrain, no barriers, with 150 highway trucks, 300 motorcycles were traveling at a speed of 35 mph. The noise level at 50-ft from the roadway would be 66 dBA. The noise level at 100-ft from the roadway would be 60 dBA. These parameters use a greater number of motorcycles and trucks than what is realistic for the even the existing 2-lane paved roadway in the Little Canyon Mountain Area.

Conclusions

Based on the ambient field measurements, noise propagation from the pits drops off at a minimum of 6 decibels per distance doubling. The topography surrounding the pits helps to reduce OHV noise because steep cut banks act as noise barriers. Vegetation in the area surrounding the pits reduces noise levels from OHVs because of its density (cannot be seen through). A 200-foot width of dense vegetation between the noise source and the receiver can reduce noise by 10 decibels, which cuts the loudness of noise in half.

Ambient noise levels measured at residences are no greater than 47 decibels with OHVs in use for this field test. The change in dBA was roughly 6 to 7 with OHVs in use at R1

and R2. This level may be compared to living on quiet residential street. The ambient noise level increases are minimized due to the distance between the pits and the residences, topography and dense vegetation.