Behrens and Associates, Inc.
Acoustics, Noise and Vibration Consultants

October 29, 2010

Geosyntec Consultants
2100 Main Street
Suite 150
Huntington Beach, CA 92648

Attention: Yonas B. Zemuy, Project Engineer

Subject: Lopez Canyon Equipment Acoustical Analysis

Dear Mr. Zemuy,

As requested, we have completed the equipment noise measurements and mitigation analysis of the equipment employed at the Lopez Canyon landfill. Measurements were obtained of the mechanical equipment operating at the green waste facility at the landfill in order to develop mitigation recommendations. Additional sound level measurements were obtained in the residential community to the east of the site.

Frequency spectrum measurements were made of the equipment that can be heard at the residences in order to assess the noise for the presence of pure tones or high-level low frequency noise. In addition, measurements of the vehicle backup alarms were obtained to assess compliance with the California Code of Regulations.

Noise Measurement Procedure

The noise measurements were performed with a Model 2250 Type 1 integrating sound level meter manufactured by Brüel & Kjaer. The sound level meter was calibrated using a model QC-10 calibrator manufactured by Quest Technologies.

Grinder Noise Measurement Results

Noise measurements of the two grinders were obtained at the site, including the frequency spectra of the equipment. For each grinder the noise was measured at three positions around the machine. The measurement results are provided in Table 1.

Table 1. Grinder Noise Levels

Equipment	Measurement Position	Noise Level (dBA)
Diamond Z Grinder (no exhaust system) No. E6000B-9	50 feet to rear (behind engine)	89
	50 feet to side (level with engine)	89
	100 feet in front	72
Diamond Z Grinder (with exhaust system) No. E6000B-8	50 feet to rear (behind engine)	88
	50 feet to side (level with engine)	89
	100 feet in front	73

The measured noise levels indicate that there is no significant difference in noise levels between the two grinders, with differences of only 1 dB between corresponding measurement locations on the two pieces of equipment. The measurements at the front of the equipment were significantly lower than those obtained close to the engine due to the increased distance to the engine and shielding of its noise by the grinder tub.

Attachment 1 provides a one-third octave band frequency spectrum of the two grinders. The graph shows that there are relatively large differences of up to 10 dB in the one-third octave bands below 80 Hz, with the grinder fitted with the exhaust system producing lower level than the one without the system. Little difference between the grinders' noise is seen in the bands that have the highest contribution to the overall noise level, between 100 Hz and 4 kHz. In the one-third octave bands above 4 kHz, the grinder with the exhaust system has a higher noise level than the grinder without the system. It is noted that high frequency noise attenuates at a greater rate with respect to distance than low frequency noise and the high frequency noise is not an issue in the residential community.

It is not known whether the differences seen at the low and high ends of frequency spectrum are due to the silencers or differences in the way the machines were operating when measured.

Equipment Noise Measurement Results

The average noise levels of each piece of equipment at 50 feet from the machine, as well as an overall facility noise level measurement, are provided in Table 2. The turner was not in operation during our measurements. The results indicate that the grinders produce significantly higher noise levels than the other equipment at the facility.

Table 2. Noise Measurement Results

Equipment	Model/Serial No.	Noise Level at 50 feet (dBA)
Grinder (without exhaust system)	Diamond Z E6000B-9	89
Grinder (with exhaust system)	Diamond Z E6000B-8	89
Trommel Screen	McClosky 733	81
Trommel Screen	Morbark 737	77
Loader (operating as normal, with intermittent use of backup alarm)	Deere 744J 262-47-5001	79
Sweeper		75

Additional noise measurements of the overall facility noise were made at the locations indicated in Attachment 2. The noise measurements were obtained for a ten minute period at each location. The results of the measurements, including the average noise levels and grinder noise levels are provided in Table 3.

Table 3. Overall Facility Noise Measurement Results

Location No.	Description	Average Noise Level (dBA)	Grinder Noise Level (dBA)
1	West side of Green Waste Facility	60	54 to 56
2	Intersection of Kagel Canyon Road and Barca Drive	52	36 to 38
3	South end of Cemetary	42	38 to 40
4	In front of 11321 Blue Sage Drive	46	45 to 47

The average noise levels measured in the residential community (Locations 2, 3 and 4) represent the ambient noise level of all sources at each location, including vehicles, wildlife, aircraft and gunshots. The facility equipment that could be heard at Locations 2, 3 and 4 were the grinders and the vehicle backup alarms. At Location 2 the grinder noise was just audible and was not a dominant noise source. At Location 3 the grinder noise was more clearly audible and contributed more significantly to the overall noise level, but was still below the average noise level. At Location 4 the grinder was clearly audible and contributed significantly to the overall noise level. The vehicle backup alarms were audible in the residential community; however the noise levels of these were too low to measure and did not contribute significantly to the overall noise level.

Vehicle Backup Alarm Standards

The California Code of Regulations, Title 8, Section 1592 states that the warning device on a vehicle "*shall be of such magnitude that it will normally be audible from a distance of 200 feet*".

Backup Alarm Noise Levels

The pieces of equipment regularly using backup alarms were tested to assess the level of the alarm relative to the noise level of the other equipment at the site. The alarms were measured at a distance of 50 feet from the rear of the vehicles. The noise levels of the alarms were fixed and could not be adjusted during our testing. The results of the testing are provided in Table 4.

Table 4. Backup Alarm Test Results

Equipment Type and Model No.	Equipment No.	Backup Alarm Type	Maximum Noise Level 50 feet Behind Vehicle (dBA)
Loader CAT 966H	KW8H65	Beeper	75
Loader Case 921C	261-52-5901	Beeper	86
Loader CAT 936G	RY7M65	Beeper	82
Loader Deere 644K	VC7F67	Beeper	88
Loader CAT 938G	RV8Y69	Broadband Noise	82
Loader Case 721D	VL8F33	Broadband Noise	71
Loader Deere 744J	262-47-5001	Beeper	87

The results of the backup alarm testing show widely varying noise levels, from 71 to 88 dBA at a distance of 50 feet from the rear of the vehicles. Comparison of the backup alarm noise levels with the overall facility noise indicate they are high enough to normally be audible at a distance of 200 feet and are therefore in compliance with the California Code of Regulations. However, the alarms may not be audible at this distance for employees working in high noise areas such as in the vicinity of the grinder engines. To ensure employees in these areas can hear the alarms, audibility tests should be performed with the grinders in operation.

Recommendations

It is understood that the grinder engines cannot be fully enclosed. Due to the low level of background noise in the residential community and limitations on the mitigation measures that can be implemented, it may not be possible to reduce the facility noise to an inaudible level in the community. The following mitigation measures are recommended to minimize the facility noise in order to reduce the possibility of noise disturbances in the residential community:

1. One of the following alternatives for mitigating the grinder noise should be implemented:

   Alternative 1.

   The grinders should both be oriented so that their engines are on the west side of the machine. The engines should be semi-enclosed with a three-sided structure as shown in Attachments 3 and 4. The walls of the structure should have an STC rating of at least 32 and the top of the walls should extend above the top of the exhausts. Sixteen foot high STC-32 acoustical blankets mounted on frames are suitable for use. This structure is designed to reduce noise levels while still allowing airflow to the engine. If this alternative is implemented, it is recommended that grinder E6000B-9 is fitted with the exhaust system.

   Alternative 2.

   The grinders should both be oriented so that their engines are on the east side of the machine. Noise barriers should be constructed using the existing frames at the site. The barriers should consist of a layer of plywood at least ½" thick. The barriers should be arranged as shown in Attachment 5 and should be placed as close as possible to the engine. There should be no holes or openings in the barriers and they should be abut each other so that there are no gaps between barriers.

2. The loaders should be audibly tested to ensure their backup beepers can be heard by a person working in the vicinity of the grinder engines when the loader is a suitable distance from the machine and set to the lowest level possible. This should be done after mitigation has been installed. The alarms should be adjusted or replaced accordingly. If the audibility testing does not allow the level of the loudest beeper alarms to be lowered, broadband noise alarms should be

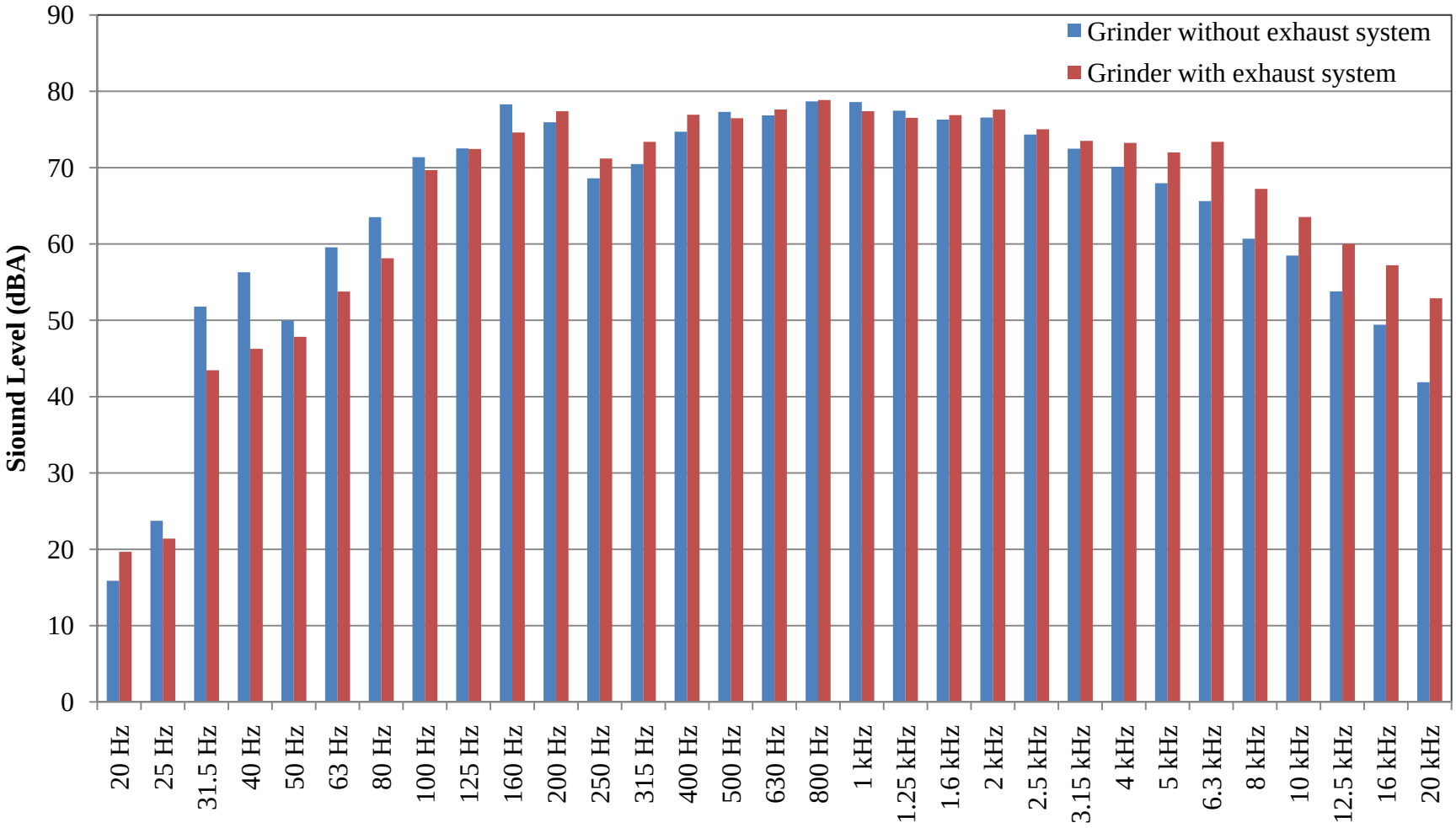
considered as replacements for these alarms. It is likely that the broadband alarms will need to be set to a higher level than the beeper alarms due to the different noises produced by each; however the character of the noise from the broadband alarms is less disturbing than the beeper alarms and therefore this the preferable alternative.

Please contact the undersigned with any questions or comments.

Very truly yours,

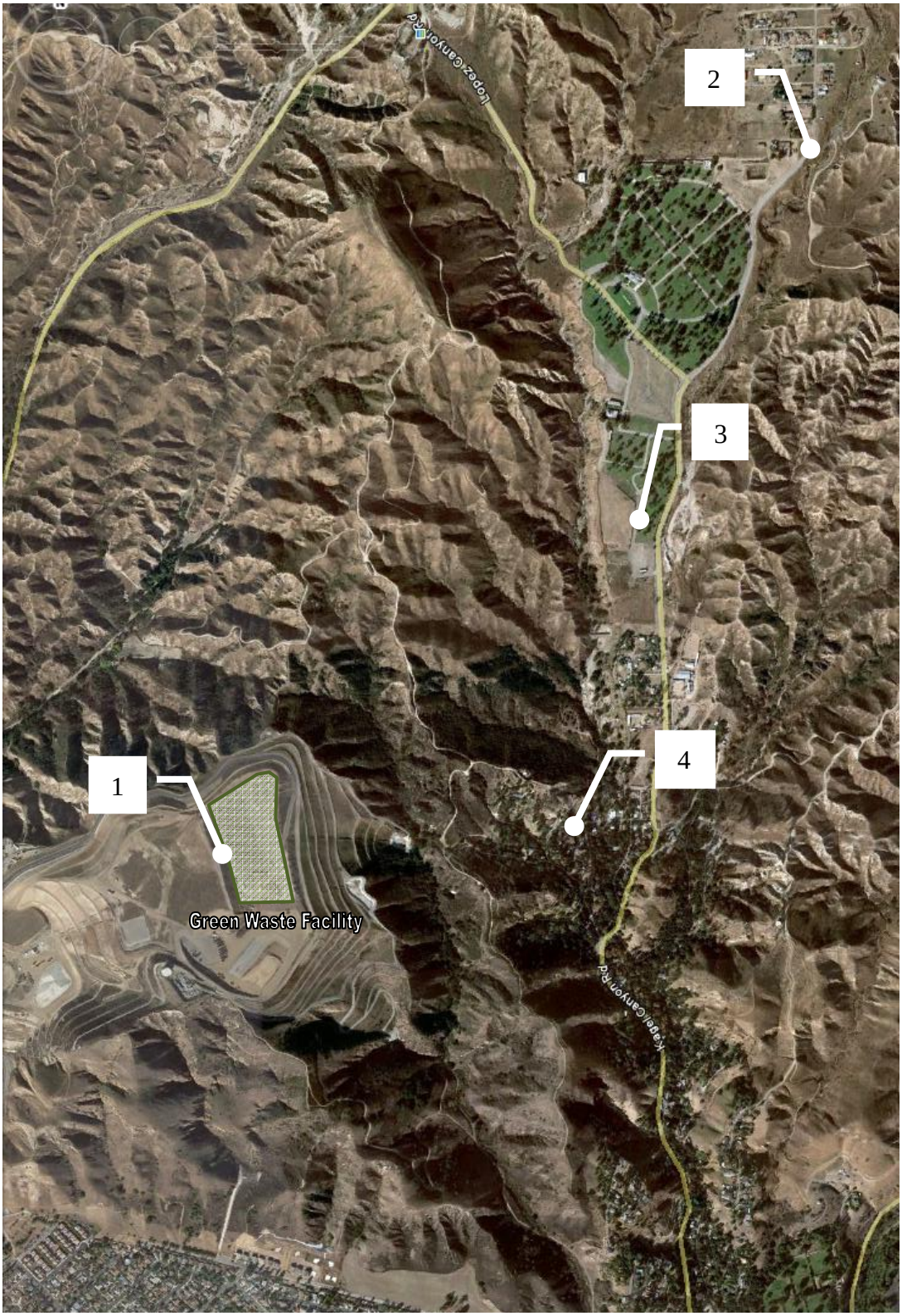
Thomas Corbishley
Acoustical Engineer

One-Third Octave Band Sound Levels of Grinders



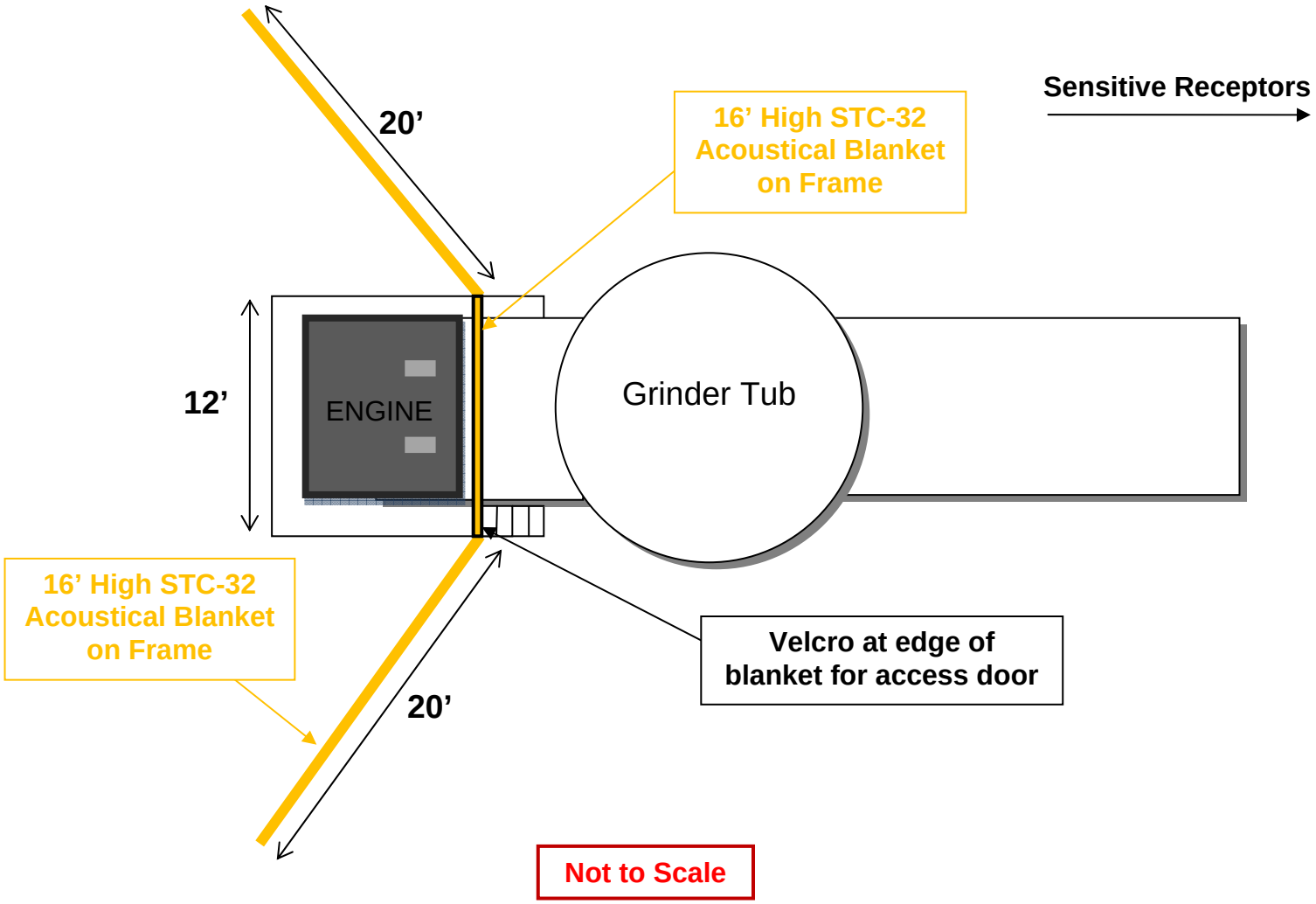
Attachment 1

Overall Facility Noise Measurement Locations



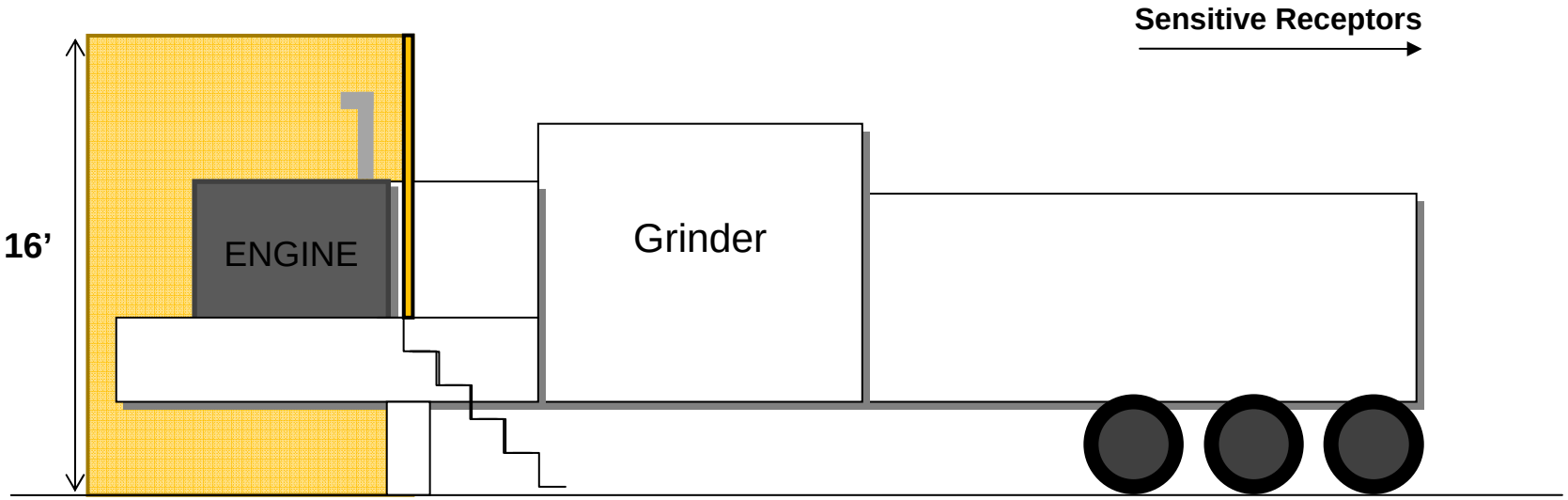
Attachment 2

Proposed Grinder Noise Barriers - Alternative 1



Attachment 3

Proposed Grinder Noise Barriers - Alternative 1



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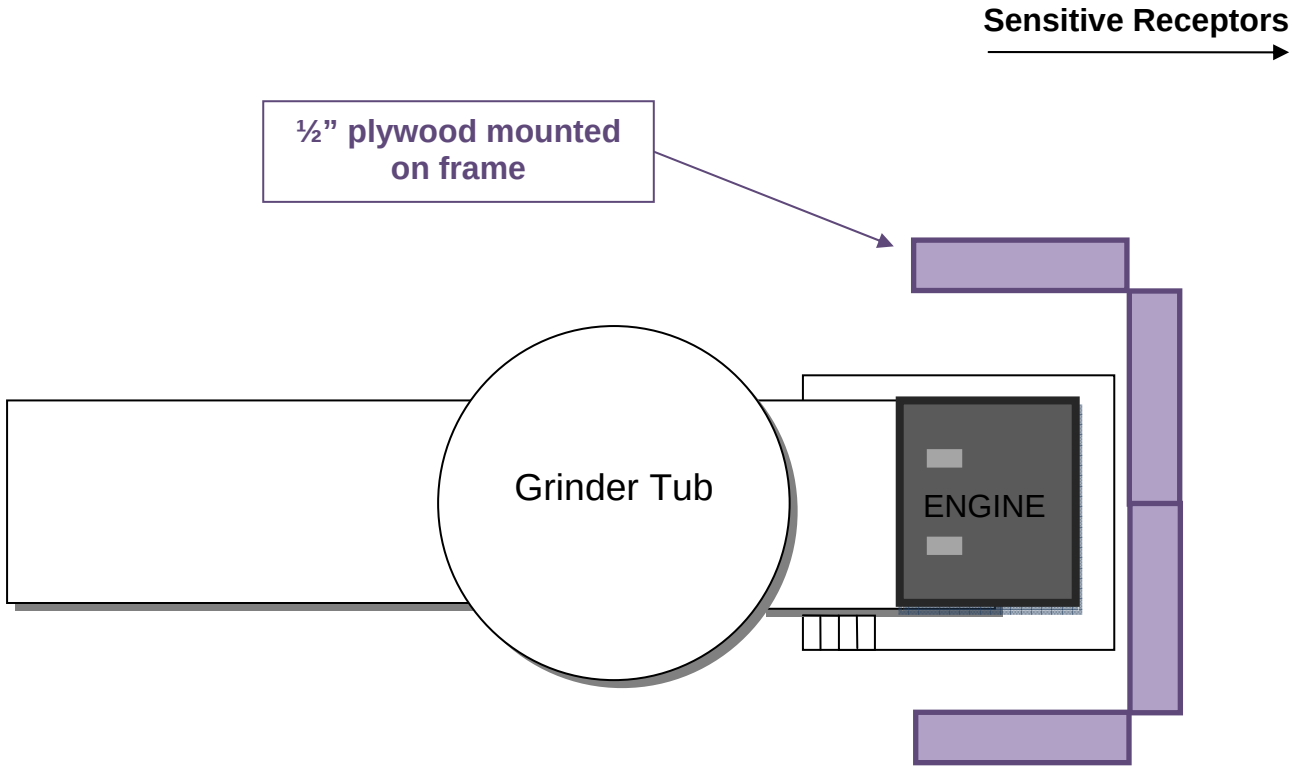
Attachment 4

Proposed Grinder Noise Barriers - Alternative 2



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Attachment 5