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ACOUSTICS, NOISE & VIBRATION

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SUBJECT: Peer Review – CEQA Noise Study
High Plains Shooting Sports Center, Shasta County, CA

Dear Mr. Mooney,
We have reviewed the High Plains Shooting Sports Center noise technical report (the "noise report"). Our comments are as follows:

I. Very low ambient noise levels
The report indicates that *Existing ambient noise at the project site is minimal*[1]. This has the effect of increasing people's sensitivity to noises that are significantly different and much louder than those prevailing in the current environment as it is the case with those originating from firearm discharges. Current noise in the environment is of such low levels that it falls below the detection threshold of the sound level meter devices used for the study[2]. For further information on the deficiencies of the instrumentation used as a support for the predictions in this report, please see item IV below.

II. Atmospheric effects ignored
No consideration is given to wind or temperature inversion effects. Although several studies[3], widely accepted computer noise prediction models[4] used by the industry and even an international standard[5] describe and provide tools for the calculation of the potential adverse effects that atmospheric conditions can and routinely do create on the propagation of noise over long distances, the report fails to account for these. This issue is specifically

[1] Page 7, last paragraph.

[2] Page 16, second paragraph.

[3] *How Weather Affects the Noise You Hear from Highways*. NCHRP RESEARCH REPORT 882. Research sponsored by the American Association of State Highway and Transportation Officials in cooperation with the Federal Highway Administration. Available online at: https://nap.nationalacademies.org/catalog/25226/how-weather-affects-the-noise-you-hear-from-highways

[4] CadnaA by DataKustik (CadnaA – State-of-the-art Noise Prediction Software - Datakustik GmbH), SoundPlan (SoundPLAN - SoundPLAN) and others are commonly used for noise studies such as this.

[5] *Acoustics - Attenuation of sound during propagation outdoors.* International Standards Organization (ISO) Standard 9613. Available online at: https://www.iso.org/standard/20649.html

mentioned in the now outdated reference used by the noise report[6] which warns about significant effects of wind and "sound channels" created by thermal inversions, indicating that research by Caltrans has shown increases in noise levels of 3 decibels at distances as short as just 250 feet. Other studies[7],[8] and computer modeling software use even higher corrections for meteorological conditions for longer prediction distances, reaching, for instance to 14 decibels enhancements due to wind or to inversions at distances of 1,600 feet, which are significantly shorter than those to many of the houses where predictions are made in this report.
These adverse meteorological conditions are generally prevalent during the early morning hours and can last well beyond the 7:30 am opening time for the Center and start again in the early evening hours before the scheduled sunset closure times, particularly in the winter.

III. Simplistic prediction methodology prone to significant errors

The methodology and equations chosen for the prediction of noise levels by the nearest homes are based on very simple assumptions that were designed for highway noise prediction and for sound propagating for relatively short distances. The assumptions made for the prediction are those contained in the Caltrans design handbooks. Due to the significant inaccuracies related primarily to atmospheric effects on noise such as wind direction and strength and thermal inversions, but also due to ground impedance effects, these handbooks clearly indicate that predictions by computer models have not been validated for distances in excess of 500 feet[9].

In particular, the noise report relies heavily on decay rates (or *noise attenuation rates*) of 7.5 decibels per doubling distance (dB/DD) to calculate expected noise levels for point sources, even for predictions at distances in excess of 500 feet. This potentially yields results that can significantly underpredict noise levels, even if atmospheric effects are not taken into consideration. See item II above. This decay rate is used for the prediction of not only firearm noise but also for estimates of construction-related noise.

The location of the shooter with respect to the measurements of firearm noise made at several locations is not indicated in the report, neither in the text nor in Figure 2, nor was a close-up location to the firearms evaluated for noise to be used as a reference and thus corroborate the validity of the 7.5 dB/DD decay rate used for later predictions at farther receptors.

Further, the report incorrectly describes the estimated levels due to construction noise as shown in Table 6, page 15 as being *conservative* levels, when the opposite will be true under

[6] Caltrans Technical Noise Supplement (TeNS), 1998 edition, page 29, section N-2143.

[7] *How Weather Affects the Noise You Hear from Highways (2018)*, National Cooperative Highway Research Program (NCHRP), National Academies of Science, Research Report 882, available online at: https://nap.nationalacademies.org/catalog/25226/how-weather-affects-the-noise-you-hear-from-highways

[8] Atmospheric Effects Associated with Highway Noise Propagation , Arizona Department of Transportation's (DOT), available online at: https://apps.azdot.gov/ADOTLibrary/publications/project_reports/PDF/AZ555.pdf

[9] Caltrans TeNS, page 7-2, section 7.1.1.1 for instance.

adverse meteorological conditions that result in sound enhancement over that predicted by the fixed decay rate used.

IV. Inaccurate and incomplete measurements

A set of measurements were conducted on March 12, 2014 to determine the level of noise to be expected at sensitive receptors from the firing of various types of weapons at the Center. These measurements were inaccurate and incomplete in various aspects such as:

- No information on the distance from or location of the shooter with respect to the various noise monitoring locations is provided. This information is paramount to validate or reject the simplistic 7.5 dB/DD decay rate assumption later made in the prediction of expected average noise levels by the homes nearby. (see item III above)
- No close-up reference measurements were made at distances where the effects of meteorological variables and/or ground absorption/enhancements are minimal and thus can be used for predictions at farther distances.
- No information is provided as to the meteorological conditions prevailing at the time of the measurements. Significant variations in the observed levels of noise at any particular location can take place depending on the direction and velocity of wind, the degree of cloud cover and air temperature variations with height over the ground, particularly when the points at which noise form the firearms are at significant distances from the weapon (see item II above for further information on this subject).
- The instrumentation used (Metrosonics dB308 sound level meters) is not sufficiently sensitive to asses the very low levels of noise currently prevailing in this rural community, particularly when no vehicular traffic noise is present in the area. Hence it is not possible to determine the potential increase in ambient noise levels resulting from the operation of the Center.
- The instrumentation used does not provide information on the frequency characteristics of the noise being measured, but only single-number metrics such as the A-weighted (dBA) or the C-weighted levels. This prevents from making accurate calculations of the mitigation benefits that could be provided by topography, noise barriers or the reduction in noise provided by a building's shell (windows, doors, walls, roof) in the determination of interior noise levels when the Center operates and makes the predictions shown in Table 6, for instance, highly questionable, as these shell elements as well as outdoor barriers and topography have significantly different *Transmission Loss* characteristics (commonly referred to as sound blocking) for sounds consisting of different frequencies (or pitch). Hence, they more effectively block noise from higher-pitched sources such as car traffic than that of rifles and other weapons which are characterized by richer low frequency (bass) content.

V. Use underestimation

The report seems to underestimate the number of rounds that could be fired each hour.

The number of rounds used in the estimation of the firing of .22 caliber rifles is 240 rounds per hour. Yet, the number of shots fired by a single shooter during the measurements conducted for the study were 20 in a period of five minutes. Extrapolating to a full hour, this is equivalent to just one shooter operating in the rifle range at a time. Similarly, the number of shots used in the predictions for the average noise level in an hour when 9mm handguns

and 4570 rifles are 120 rounds each hour, also corresponding to just one shooter operating each of those two firearms each hour. As the report correctly notes[10], "*with more gunfire in an hour the average noise levels would be increased".* As a reference point, two simultaneous shooters would increase noise levels by 3 decibels from those stated in the report, four would increase it by 6 decibels, eight by 9 decibels, and so on. The number of shooters could significantly increase above those assumed in the report during special events, competitions, etc. and even during routine use.

VI. Outdated references

The report uses as a reference the 1998 version of the *Technical Noise Supplement (TeNS)* report by Caltrans[11]. However, an updated version of the same that included refinements based on the latest research available at the time was released to the public on September 2013, three and a half years before the production of the High Plains noise report. Similarly, the report uses as a reference the 1998 version of Caltrans *Traffic Noise Analysis Protocol*[12] but a 2011 version of the same has been available since May 2011.

VII. General Plan objectives

1. To protect County residents from the harmful and annoying effects of exposure to excessive noise (underlying added)
2. To protect the economic base of the County by preventing incompatible land uses from encroaching upon existing or programmed land uses likely to create significant noise impacts (underlying added)
3. To encourage the application of state-of-the-art land use planning methodologies in the area of managing and minimizing potential noise conflicts (underlying added)

To this end, even conformity with the thresholds of significance of the General Plan is not sufficient to mitigate the significant environmental effects caused by a project[13] yet the Noise Report uses the criteria in the Noise Element of the Shasta General Plan *exclusively* and this particular statute uses metrics that are not appropriate for the determination of adverse effects due to loud, short duration noises.

VIII. Loud impact noises predicted

The report indicates that "*There would still be audible and sometimes loud impact noise from the gunfire from the range*". This is to be expected due to the a) low prevailing level of environmental noise as discussed in (I above, b) the under estimation that results from using a 7.5 dB/DD decay rate (see III above, c) the nature of the noise due to firearm discharges

[10] Page 18, third paragraph

[11] Page 23, *References*, first reference.

[12] Page 23, References, second reference.

[13] At least two courts have held that "conformity with a general plan does not insulate a project from EIR review where it can be fairly argued that the project will generate significant environmental effects" (Oro Fino Gold Mining Corp. v. County of El Dorado (1990) 225 Cal.App.3d 872), citing City of Antioch v. City Council (1986) 187 Cal.App.3d 1325). In Oro Fino Gold Mining. Extracted from the document: *Thresholds of Significance: Criteria for Defining Environmental Significance,* CEQA Technical Advice Series, Governor's Office of Planning And Research

whose instantaneous maximum levels are significantly higher than the hourly averages used in the analysis.

Averaging over time the very short duration, high intensity noises due to firearms, with the very low environmental noise currently prevailing in the area results in low averages that underpredict its potential adverse effects.

For example, if the hourly 50 dBA Leq average limit imposed by the Noise Element were to be met as a result of averaging the instantaneous noise level of a burst of shots lasting only five seconds with the otherwise low ambient noise that is present for the rest of the hour, then such instantaneous noise could reach levels of 78 dBA and still meet the County criteria. However, our hearing would clearly perceive the noise from each shot, likely eliciting negative responses towards it by the average person with normal hearing sensitivity. Tables 7 and 8 in the report illustrate the differences in noise levels predicted between the instantaneous level (Lmax) and hourly equivalent averages (Leq) at various receptors and for three types of weapons. These differences were presumably observed during the measurements conducted, as the type of noise meter used allows for the simultaneous measurement of both metrics and clearly illustrate differences of between 10 decibels for a .22 rifle to as much as 26 decibels for the 4570 rifle.

Please feel free to contact me with any questions on this information.

Very truly yours,

WILSON IHRIG

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Principal, Sr. VP

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