

“H”

Noise Study

Balloons Above the Valley Hot Air Balloon Launch Site
Use Permit P19-00303
Planning Commission Hearing September 2, 2020



Acoustical & Audiovisual Consultants

OUTDOOR SOUND STUDY FOR:

Balloons Above the Valley
5360 Washington Street
County of Napa, CA
RGD Project #: 19-086

PREPARED FOR:

Bob Barbarick
Balloons Above the Valley
5360 Washington St.
Napa, CA

PREPARED BY:

Alan Rosen
Principal

Tsz (Anthony) Wong
Consultant

DATE:

31 December 2019

1. Introduction

Balloons Above the Valley is located at 5360 Washington Street in unincorporated Napa County. This report assesses noise associated with the launch of the hot air balloon with respect to the County Noise Ordinance standards.

2. Environmental Noise Fundamentals

Noise can be defined as unwanted sound. It is commonly measured with an instrument called a sound level meter. The sound level meter captures the sound with a microphone and converts it into a number called a sound level. Sound levels are expressed in units of decibels.

To correlate the microphone signal to a level that corresponds to the way humans perceive noise, the A-weighting filter is used. A-weighting de-emphasizes low-frequency and very high-frequency sound in a manner similar to human hearing. The use of A-weighting is required by most local General Plans as well as federal and state noise regulations (e.g. Caltrans, EPA, OSHA and HUD). The abbreviation dBA is sometimes used when the A-weighted sound level is reported.

Because of the time-varying nature of environmental sound, there are many descriptors that are used to quantify the sound level. Although one individual descriptor alone does not fully describe a particular noise environment, taken together, they can more accurately represent the noise environment. The maximum instantaneous noise level (L_{max}) is often used to identify the loudness of a single event such as a car passby or airplane flyover.

To express the average noise level the L_{eq} (equivalent noise level) is used. The L_{eq} can be measured over any length of time but is typically reported for periods of 15 minutes to 1 hour. The background noise level (or residual noise level) is the sound level during the quietest moments. It is usually generated by steady sources such as distant freeway traffic. It can be quantified with a descriptor called the L_{90} which is the sound level exceeded 90 percent of the time.

In environmental noise, a change in noise level of 3 dB is considered a just noticeable difference. A 5 dB change is clearly noticeable, but not dramatic. A 10 dB change is perceived as a halving or doubling in loudness.

3. Acoustical Criteria

Napa County Code of Ordinances

Chapter 8.16 of Napa County Code of Ordinances contains noise regulations which regulate the noise generation of land uses by specifying noise limits for potentially affected land uses. The exterior noise limits are excerpted below.

8.16.070 - Exterior noise limits.

A. Maximum Permissible Sound Levels by Receiving Land Use.

- 1. The noise standards for the various categories of land use identified by the noise control officer, as presented in Tables 8.16.060 and 8.16.070 shall, unless otherwise specifically indicated, apply to all such property within a designated zone.*
 - 2. No person shall operate, or cause to be operated, any source of sound at any location within the unincorporated area of the county, or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level, when measured on any other property, either incorporated or unincorporated, to exceed:*
 - a) The noise standard for that land use as specified in Table 8.16.070 for a cumulative period of more than thirty minutes in any hour [L_{50}]; or*
 - b) The noise standard plus five dB for a cumulative period of more than fifteen minutes in any hour [L_{25}]; or*
 - c) The noise standard plus ten dB for a cumulative period of more than five minutes in any hour [L_5]; or*
 - d) The noise standard plus fifteen dB for a cumulative period of more than one minute in any hour [L_2];*
 - e) The noise standard plus twenty dB or the maximum measured ambient level, for any period of time [L_{max}].*
 - 3. If the measured ambient noise level differs from that permissible within any of the first four noise limit categories above, the allowable noise exposure standard shall be the ambient noise level.*
 - 4. If the measurement location is on a boundary between two different zones, the sound level limit applicable to the quieter noise zone shall apply.*
 - 5. Wherever possible, the ambient noise level shall be measured at the same location along the property line utilized in subsection (A)(2) with the alleged offending noise source inoperative. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period sufficient to measure the ambient noise level, the ambient noise level may be determined by traveling away from the noise source to a point where a steady-state decibel reading is achieved. If this test is not possible, the noise level measured while the source is in operation shall be compared directly to the noise level standards.*
- B. Correction for Character of Sound. In the event the alleged offensive noise, as judged by the noise control officer, contains a steady, audible tone such as a whine, screech or hum, or is a repetitive noise such as hammering or riveting, or contains music or speech, the standard limits set forth in Tables 8.16.060 and 8.16.070 shall be reduced by five dB, but not lower than forty-five.*

**Table 1 [Napa Code of Ordinances Table 8.16.070] Exterior Noise Limits
(Levels not to be exceeded more than 30 minutes in any hour)**

Land Use Type	Time Period	Noise Level (dBA) By Noise Zone Classification		
		Rural	Suburban	Urban
Residential Single and Double	10 p.m. to 7 a.m.	45	45	50
	7 a.m. to 10 p.m.	50	55	60
Residential multiple and country	10 p.m. to 7 a.m.	45	50	55
	7 a.m. to 10 p.m.	50	55	60
Commercial	10 p.m. to 7 a.m.	60		
	7 a.m. to 10 p.m.	65		
Industrial, including wineries	Anytime	75		

4. Noise Measurement Program

To quantify the noise from the launch of a hot air balloon, noise measurements were made at four measurement locations at and around the balloon launch site on the morning of December 16, 2019. Weather conditions were 32 degrees Fahrenheit with clear skies and calm wind.

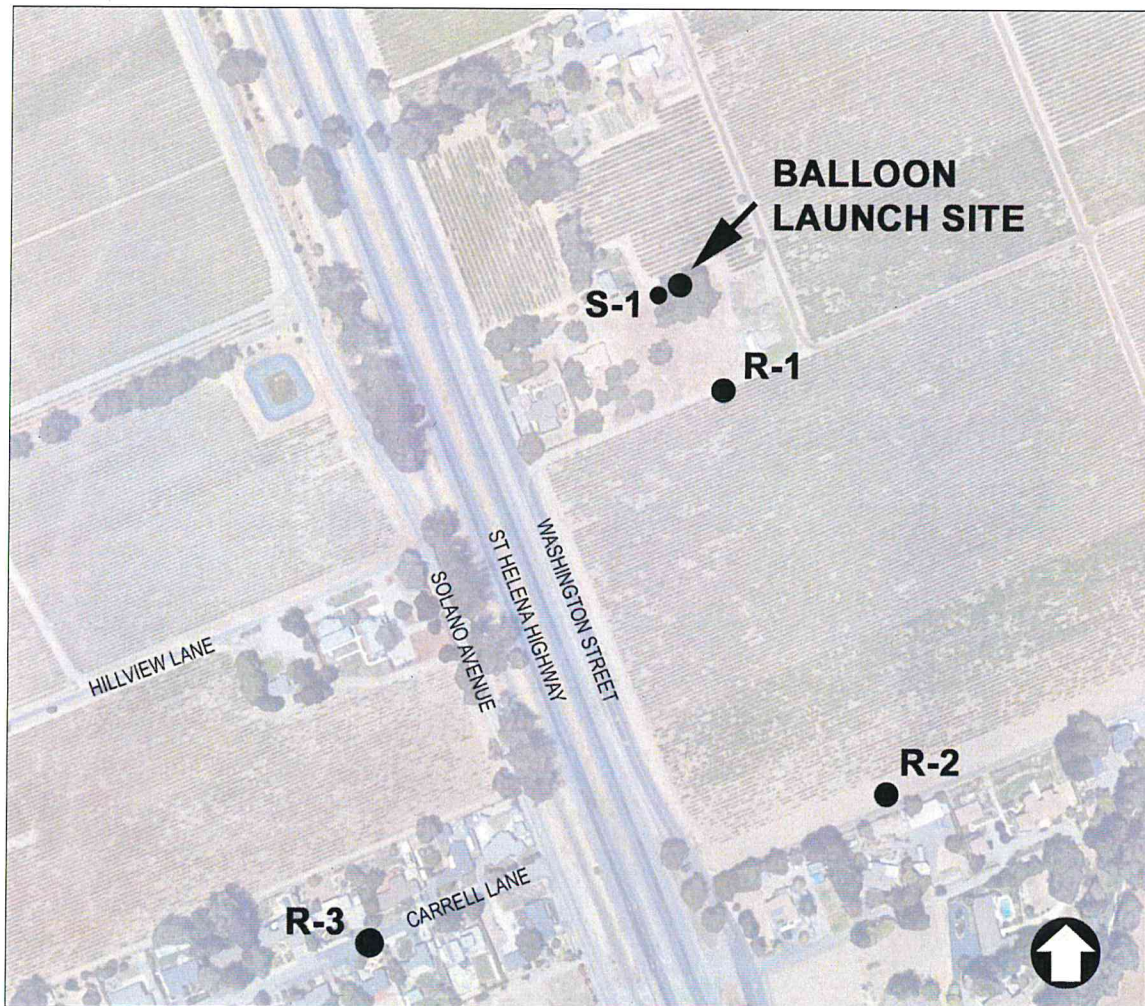
Noise monitor R-1 was set up along the project's southern property line, approximately 234 feet from the balloon launch. Monitor R1 consisted of a sound level meter and audio recorder. Noise monitors R-2 and R-3 were set up near the potentially affected residences to the south of the project site as identified by the project applicant. The measurements at R-2 and R-3 were made using a tripod mounted sound level meter and were attended by an acoustical consultant. A fourth noise monitor (S-1) was setup near the balloon launch site at a reference distance of 50 feet to quantify the sound of the balloon launch for use in future noise level calculations. All noise monitors were set with the microphone five feet above ground. The balloon launch site and the noise measurement locations are shown in Figure 1.

The balloon launched for the test was a Cameron A-140 with a balloon volume of 140,000 cubic feet. The balloon was inflated with two 8-horsepower Briggs & Stratton inflation fans and then once partially inflated, the air inside the balloon was heated using the balloon's F1 Mirage, Zone 3 burners. The entire process from start of inflation to lift off lasted approximately 15 minutes.

After lift-off, the balloon drifted southerly, in the direction of the homes to the east of Washington Street, and directly over the noise monitor at R-2. According to the pilot, the balloon was approximately 600 feet above ground when it was over noise monitor R-2.

The sound measurements were made with Larson-Davis Model 820 and Larson-Davis Model 824 sound level meters meeting Type 1 specifications (ANSI S1.4). The sound level meter calibration was checked with an acoustical calibrator (Larson-Davis Model Cal200) before and after the measurements.

Figure 1: Balloon Launch and Noise Monitor Locations



4.1. Ambient Noise Environment

The existing ambient noise level is generally dominated by vehicular traffic on Highway 29. Other noise sources included local traffic and occasional birds and aircraft flyovers. The ambient sound levels were measured before and after the balloon operation. A summary of the ambient sound levels is shown in Table 2

Table 2: Ambient Sound Levels Summary

Receiver	Time	A-weighted Sound Level, dBA				
		L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
R-1	7:25 – 7:35	67	59	57	55	54
	7:55 – 8:05	60	56	55	54	53
R-2	7:55 – 8:05	61	59	58	56	55
R-3	7:55 – 8:05	66	60	54	52	51

4.2. Noise from Balloon Operation

At location R-1 (the project’s south property line) we reviewed the sound level data and audio recordings and we found that the noise associated with the balloon was audible but the measured noise levels were significantly affected by traffic on the highway.

At location R-2, traffic noise dominated the measured noise levels and noise associated with the balloon was not distinctly measurable. Noise from the balloon launch operation was generally inaudible except when the balloon was airborne and, at that point, it was just barely audible above traffic noise.

At location R-3, the balloon noise was drowned out by local and highway traffic and was neither audible nor distinctly measurable.

Table 3 shows the measured source sound level at a distance of 50 feet from the balloon launch site (S-1). The sound level descriptors in the County noise standard are presented. Appendix A shows the one-second time history of the sound levels with annotations.

Since the noise measurements at locations R-2 and R-3 were dominated by traffic, we calculated the contribution of balloon related sounds at the two receiver locations based on the measurements at S-1 using a standard attenuation rate of 6 dBA per doubling of distance. To account for the short-term maximum instantaneous burner noise in flight for R-2 and R-3, we used the measured level on the ground and adjusted it to the balloon’s altitude of 600 feet when it was directly over R-2. Table 4 shows the calculated noise levels from balloon operation.



Table 3: Sound Levels at 50 feet from Balloon Launch Location

Location	Time	A-weighted Sound Level, dBA				
		L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
S-1	7:35 AM – 7:53 AM	83	75	71	67	66

Table 4: Noise Levels from Balloon Operation at Receivers

Location	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
R-1	70	62	58	54	53
R-2	61	48	44	40	39
R-3	61	47	43	39	38

According to the project applicant, the launching of hot air balloons is dependent on weather. During the winter, typically, at most, one balloon is launched per day. During the summer, there could be 3 to 5 balloons per day. Although multiple balloons may be launched per day, the balloons are launched sequentially with no more than one balloon launched at a time.

To quantify the effects of multiple balloon launches, we used the measured balloon source data and assumed balloons are launched within the same hour, one after another. Table 5 shows the calculated sound levels associated with the theoretical operation of launching four balloons in one hour.

Table 5: Noise Levels from Multiple Balloon Launch Operations in One Hour

Location	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
S-1	83	74	71	67	66
R-1	70	64	59	55	53
R-2	61	50	45	41	39
R-3	61	49	44	40	38

5. Analysis

The County of Napa Code of Ordinances identifies maximum permissible sound levels based on the receiving land use and hours of operation. Since the project may launch balloons between the hours of 6 am and 7 am, we compare the balloon noise levels to the daytime (7 am to 10 pm) and nighttime (10 pm to 7 am) standard. The nighttime limit is more restrictive since the allowable levels are increase by 5 dBA during the daytime hours.

The County's maximum permissible sound levels are defined in terms of five statistical sound level descriptors to account for the time varying characteristic of noise sources. In general, the standard allows higher noise levels but limits those to a maximum duration over the course of an hour. The standard also allows for an upward adjustment for higher ambient levels which were applied to the daytime limits based on our measurements. No ambient adjustments were applied to the nighttime limits.

The lands neighboring the project site are designated by the County as agricultural. However, this study applies the Rural Single and Double Residential noise limits for the residential uses near the project site. This is consistent with Napa County's administrative practice of designating as residential the house, and the area around the house used in a residential capacity, when the house occurs on agricultural land¹.

Tables 6, 7 and 8 summarize the applicable County noise standards at the residences based on our measurements.

¹ Telephone conversation with John McDowell, Deputy Planning Director, Napa County, 2 Nov. 2015

Table 6: Maximum Permissible Sound Level Calculations – R-1

Residential Receiver R-1	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Measured Ambient	60	56	55	54	53
Baseline Residential Daytime Noise Standard (L ₅₀ dBA)	50	50	50	50	50
Baseline Residential Nighttime Noise Standard (L ₅₀ dBA)	45	45	45	45	45
Corrections to Noise Standard					
1. Duration (8.16.070.2)	+20	+15	+10	+5	+0
Daytime Noise Standard - Subtotal	70	65	60	55	50
Nighttime Noise Standard - Subtotal	65	60	55	50	45
2. If ambient exceeds standard, allowable noise exposure equals ambient (8.16.070.3)					
Daytime Correction for Ambient (Y/N)	N	N	N	N	Y
Nighttime Correction for Ambient (Y/N)	N	N	N	N	N
Noise Ordinance Criteria – Daytime Residential receiver	70	65	60	55	53
Noise Ordinance Criteria – Nighttime Residential receiver	65	60	55	50	45

Table 7: Maximum Permissible Sound Level Calculations – R-2

Residential Receiver R-2	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Measured Ambient	61	59	58	56	55
Baseline Residential Daytime Noise Standard (L ₅₀ dBA)	50	50	50	50	50
Baseline Residential Nighttime Noise Standard (L ₅₀ dBA)	45	45	45	45	45
Corrections to Noise Standard					
1. Duration (8.16.070.2)	+20	+15	+10	+5	+0
Daytime Noise Standard - Subtotal	70	65	60	55	50
Nighttime Noise Standard - Subtotal	65	60	55	50	45
2. If ambient exceeds standard, allowable noise exposure equals ambient (8.16.070.3)					
Daytime Correction for Ambient (Y/N)	N	N	N	Y	Y
Nighttime Correction for Ambient (Y/N)	N	N	N	N	N
Noise Ordinance Criteria – Daytime Residential receiver	70	65	60	56	55
Noise Ordinance Criteria – Nighttime Residential receiver	65	60	55	50	45

Table 8: Maximum Permissible Music Sound Level Calculations – R-3

Residential Receiver R-3	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Measured Ambient	66	60	54	52	51
Baseline Residential Daytime Noise Standard (L ₅₀ dBA)	50	50	50	50	50
Baseline Residential Nighttime Noise Standard (L ₅₀ dBA)	45	45	45	45	45
Corrections to Noise Standard					
3. Duration (8.16.070.2)	+20	+15	+10	+5	+0
Daytime Noise Standard - Subtotal	70	65	60	55	50
Nighttime Noise Standard - Subtotal	65	60	55	50	45
4. If ambient exceeds standard, allowable noise exposure equals ambient (8.16.070.3)					
Daytime Correction for Ambient (Y/N)	N	N	N	N	Y
Nighttime Correction for Ambient (Y/N)	N	N	N	N	N
Noise Ordinance Criteria – Daytime Residential receiver	70	65	60	55	51
Noise Ordinance Criteria – Nighttime Residential receiver	65	60	55	50	45

Tables 9, 10 and 11 show the noise level from the operation of multiple balloon launches (four in one hour) at the three receiver locations and compares the resulting level with the County’s noise ordinance limits.

Table 9: Comparison of Balloon Sound to Noise Ordinance – R-1

Receiver R-1	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Noise from Multiple Balloon Launch Operations	70	64	59	55	53
Noise Ordinance Criteria - Daytime Residential receiver	70	65	60	55	53
Exceed Daytime Noise Ordinance? (Y/N)	N	N	N	N	N
Noise Ordinance Criteria - Nighttime Residential receiver	65	60	55	50	45
Exceed Nighttime Noise Ordinance? (Y/N)	Y	Y	Y	Y	Y



Table 10: Comparison of Balloon Sound to Noise Ordinance - R-2

Receiver R-2	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Noise from Multiple Balloon Launch Operations	61	50	45	41	39
Noise Ordinance Criteria - Daytime Residential receiver	70	65	60	56	55
Exceed Daytime Noise Ordinance? (Y/N)	N	N	N	N	N
Noise Ordinance Criteria - Nighttime Residential receiver	65	60	55	50	45
Exceed Nighttime Noise Ordinance? (Y/N)	N	N	N	N	N

Table 11: Comparison of Balloon Sound to Noise Ordinance - R-3

Receiver R-3	A-weighted Sound Level, dBA				
	L _{max}	L ₂	L ₈	L ₂₅	L ₅₀
Noise from Multiple Balloon Launch Operations	61	49	44	40	38
Noise Ordinance Criteria - Daytime Residential receiver	70	65	60	55	51
Exceed Daytime Noise Ordinance? (Y/N)	N	N	N	N	N
Noise Ordinance Criteria - Nighttime Residential receiver	65	60	55	50	45
Exceed Nighttime Noise Ordinance? (Y/N)	N	N	N	N	N

According to Tables 9, 10 and 11, noise from the operation of multiple balloon launches would exceed the County's noise ordinance limits at residential location R-1 by up to 8 dBA between the hours of 6 am and 7 am but would not exceed the daytime noise ordinance limits (7 am to 10 pm). At the residences to the south of the project site (R-2 and R-3), noise from multiple balloon operations would not exceed the daytime or nighttime noise ordinance limits.

6. Conclusion

Based on our measurements and analysis, noise from balloon operations would meet the Napa County residential daytime and nighttime noise ordinance limits at the residential homes near locations R-2 and R-3. At these locations, noise from balloon was generally inaudible except for intermittent noise from the burner at location R-2 when the balloon was aloft. Depending on the direction of flight, intermittent noise from the burner may be occasionally audible at either location.

Noise from balloon operations would exceed the Napa County residential noise ordinance limits by up to 8 dBA at the residential homes near the project's property line (R-1) in the early morning (6 am to 7 am). However, since the daytime (7 am to 7 pm) noise ordinance limit is higher, balloon operations after 7 am would meet the daytime noise ordinance limits.

*

*

*

Appendix A:

The following charts show the one second time-history of the measured sound levels. Measurements at location S-1 are shown in black. Measurements at R-1, R-2, and R-3, are shown in orange, green, and blue, respectively.

Appendix A: Balloon Operation – Launch and Flight

