Environmental Noise Assessment

Silver Oaks Residential Development

Clayton, California (Contra Costa County)

BAC Job # 2013-072

Prepared For:

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September 24, 2013

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CEQA Checklist

NOISE – **Would the Project Result in:**	**NA – Not Applicable**	**Potentially Significant Impact**	**Less than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?				**X**	
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?				**X**	
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?				**X**	
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above level existing without the project?			**X**		
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project to excessive noise levels?					**X**
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?					**X**

Introduction

This section assesses the Silver Oaks Residential Development (Project) compliance with applicable noise and vibration standards and recommends feasible mitigation, where necessary, to ensure compliance with those standards as well as compliance with the standards set forth in the CEQA guidelines. This report assesses noise and vibration impacts generated by project construction, operation of a water well on the site, and impacts associated with off-site traffic on Oakhurst Drive.

Background on Noise and Vibration

Noise

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second) they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz). Please see Appendix A for definitions of terminology used in this report.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness. Table 1 shows examples of noise levels for several common noise sources and environments.

The perceived loudness of sound is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

Figure 1

Silver Oaks Residential Development - Clayton, California

Project Area and Traffic Noise Measurement Locations

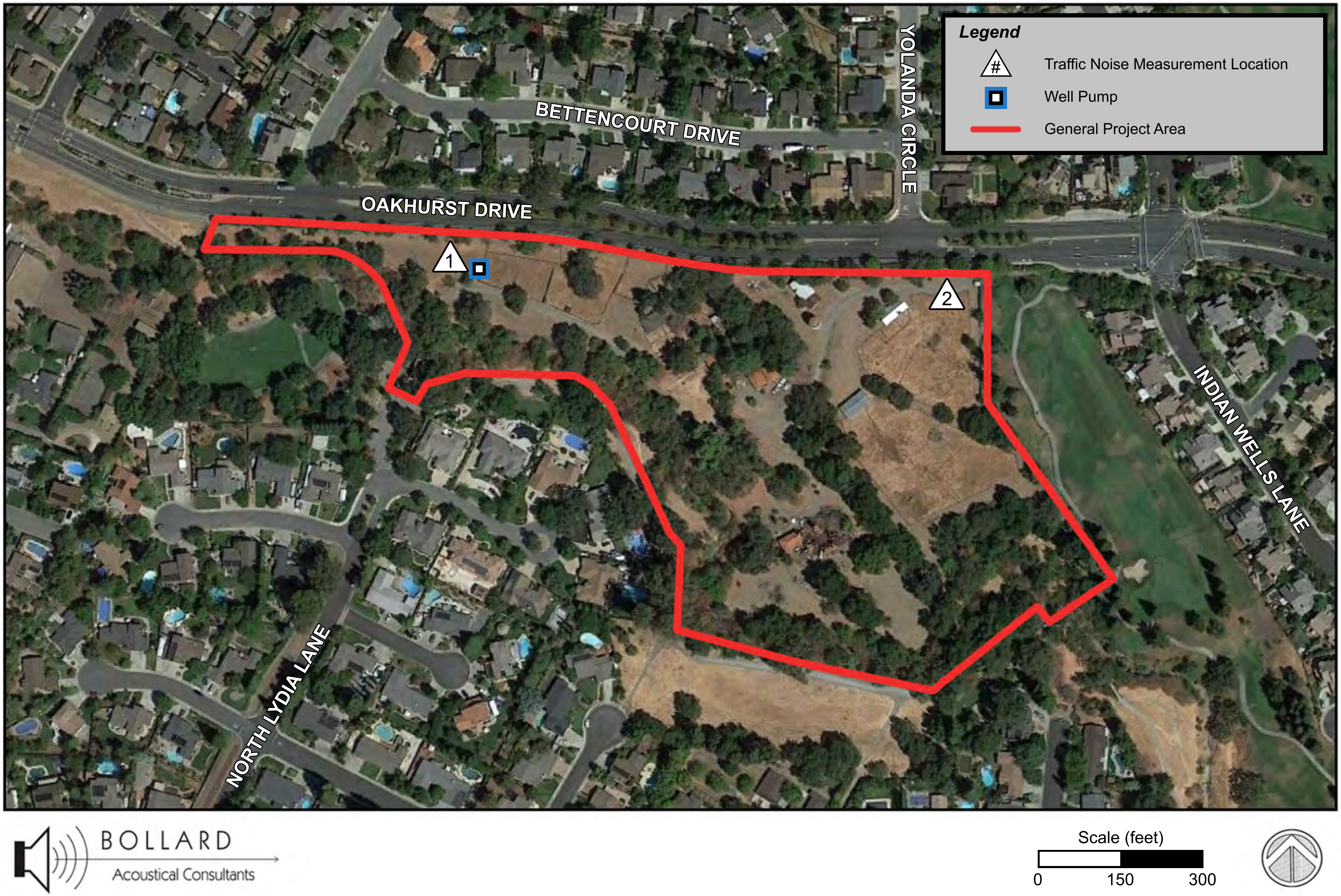

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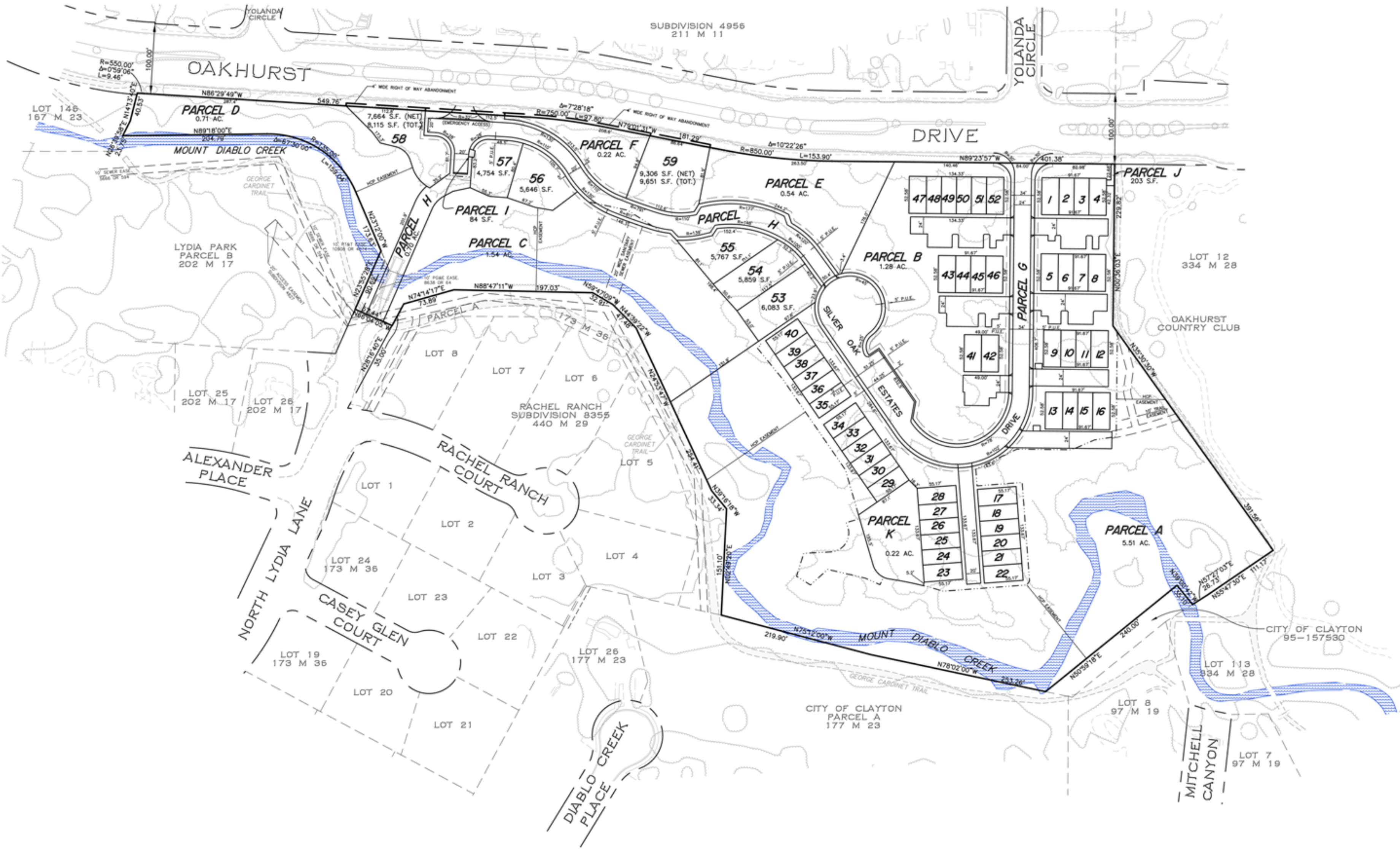
Figure 2

Silver Oaks Residential Development - Clayton, California

Project Site Plan



Scale (feet)

0 125 250

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Table 1
Typical A-Weighted Sound Levels of Common Noise Sources

Loudness Ratio	dBA	Description
128	130	Threshold of pain
64	120	Jet aircraft take-off at 100 feet
32	110	Riveting machine at operators position
16	100	Shotgun at 200 feet
8	90	Bulldozer at 50 feet
4	80	Diesel locomotive at 300 feet
2	70	Commercial jet aircraft interior during flight
1	60	Normal conversation speech at 5-10 feet
1/2	50	Open office background level
1/4	40	Background level within a residence
1/8	30	Soft whisper at 2 feet
1/16	20	Interior of recording studio

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The Day-Night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn} based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through a structure. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities (inches/second). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity.

Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases.

Existing & Future Noise and Vibration Environments

General Ambient Noise Environment

The existing ambient noise environment in the immediate project vicinity is consistent with that of typical rural areas and is defined primarily by traffic and natural sounds, (wind, birds, etc.). To quantify the existing ambient noise environment in the project area at proposed residential locations on the project site, two (2) continuous ambient noise level measurements were conducted at the locations shown on Figure 1 on September 10-11, 2013.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute.

The numerical summaries of the ambient noise level measurements are provided in Table 2. The Table 2 data include daytime and nighttime, average and maximum noise levels for the continuous measurements, as well as the L_{dn} values computed from the hourly average noise levels. Appendix B shows a tabular listing of the ambient noise measurement results, and Appendix C shows a graphical representation of those same results.

Table 2
Summary of Ambient Noise Monitoring
Silver Oaks Residential Development – September 10-11, 2013

	Average Measured Hourly Noise Levels (dB) 90 feet from C/L						
	Daytime (7 a.m. to 10 p.m.)			Nighttime (10 p.m. to 7 a.m.)			
Location[1]	L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}	L_{dn}
Site 1	50	48	68	45	43	60	53
Site 2	52	50	71	47	42	65	55

Notes:
[1] See Figure 1 for noise measurement locations.
Source: Bollard Acoustical Consultants, Inc.

Aircraft Noise

The project site is located over 6 miles from the nearest airport (Buchanan Field in Concord). As a result, the project site is not appreciably affected by aircraft noise.

Changes in Off-Site Traffic Noise Environment

To describe existing and future noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. The model is based upon the Calveno reference noise factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the area. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions. To predict traffic noise levels in terms of L_{dn}, it is necessary to adjust the input volume to account for the day/night distribution of traffic.

Traffic volumes for existing and future conditions were provided by Abrams Associates (*Transportation Impact Analysis, Silver Oak Estates*, September 9, 2013). Table 3 shows the predicted unshielded traffic noise levels in terms of L_{dn} at a reference distance of 100 feet from the centerline of Oakhurst Drive. A listing of the FHWA Model input data for existing conditions is provided in Appendix D.

Table 3
Summary of Existing Traffic Noise Exposure
Silver Oaks Residential Development– Clayton, California

Roadway	Scenario	L_{dn}, dB @ 100 Feet
Oakhurst Drive	Existing	61.1
	Existing + Project	61.2
	Future (Cumulative)	62.0
	Future + Project	62.1

Sources: Abrams Associates Traffic Engineering, Inc. and Bollard Acoustical Consultants, Inc.

Predicted Oakhurst Drive Traffic Noise Levels at Proposed Residences

The project proposes residences approximately 70 feet from the centerline of Oakhurst Drive. Because the western portion of the project site project site is depressed relative to that roadway, there is substantial shielding of Oakhurst Drive traffic noise at the proposed residences on Lots 53-59. As noted in Table 2, the measured day/night average noise levels (Ldn) at the project site ranged from 53-55 dB Ldn. According to Table 3, existing traffic noise levels at the same approximate distance to the Oakhurst Drive centerline (90 foot measurement distance vs 100 foot distance modeled in Table 3) were predicted to be 61 dB Ldn. As a result, it can logically be concluded that the existing shielding by intervening topography resulted in a 6-8 dB decrease in traffic noise levels at the proposed residential locations. Although site grading would increase the elevations of Lots 1-4 and 47-52, Lots 53-59 will remain shielded by intervening topography.

Lots 1-4 and 47-52 will face Oakhurst Drive, thereby locating the rear patio areas further from the roadway and shielding it from view of the roadway by the intervening residences. As a result of the topographic shielding at Lots 53-59, and the orientation of Lots 1-4 and 47-52, a -6 dB offset was applied to predicted future traffic noise levels at the residential locations to conservatively account for this shielding.

Using the FHWA Model with an input distance of 70 feet from the roadway centerline and the aforementioned 6 dB offset, the predicted future traffic noise level at the outdoor areas of all of the nearest residences to Oakhurst Drive was computed to be 58 dB Ldn or less.

Existing Vibration Environment

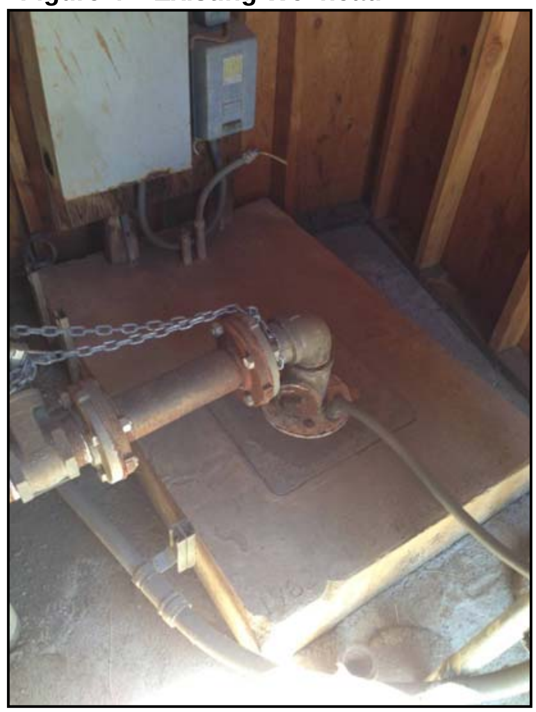
The existing ambient vibration environment in the immediate project vicinity is extremely low, as would be expected in a rural area with no appreciable sources of local vibration. Because there were no identified sources of appreciable existing vibration in the project vicinity, baseline vibration levels around the project perimeter were well below the threshold of perception.

Noise Generation of On-Site Water Well

As noted on Figure 1, there is a water well pump located in the northwestern area of the project site. Figures 3 and 4 illustrate the existing pump house and wellhead. To quantify the noise generation of this well, BAC conducted noise level measurements at distances of 5 and 15 feet from the wellhead on September 9, 2013. The submersible pump was barely audible over background noise at the 15 foot distance, registering a noise level of 45 dBA. At the 5 foot distance (directly above the wellhead), the measured average noise level with the pump running was 52 dB Leq. The nearest proposed residence (Lot 57) would be located approximately 20 feet or more from the wellhead. Because of the low noise generation of the submersible pump, the predicted noise level at that location would be less than 45 dB Leq. The corresponding Ldn of that pump at the nearest residence would be below 50 dB Ldn.

Figure 3 – Existing Well Building

Figure 4 – Existing Wellhead



Construction Noise Environment

During the construction phases of the proposed project, noise from construction activities would add to the noise environment in the immediate project vicinity. Activities involved in typical construction would generate maximum noise levels, as indicated in Table 4, ranging from 85 to 90 dB at a distance of 50 feet.

Table 4
Typical Construction Equipment Noise

Equipment Description	Maximum Noise Level at 50 feet, dBA
Auger drill rig	85
Backhoe	80
Bar bender	80
Blasting	94
Boring jack power unit	80
Chain saw	85
Clam shovel	93
Compactor (ground)	80
Compressor (air)	80
Concrete batch plant	83
Concrete mixer truck	85
Concrete pump truck	82
Concrete saw	90
Crane (mobile or stationary)	85
Dozer	85
Dump truck	84
Excavator	85
Flat bed truck	84
Front end loader	80
Generator (25 kilovolt-amperes [kVA] or less)	70
Generator (more than 25 kVA)	82
Grader	85
Hydra break ram	90
Impact pile driver (diesel or drop)	95
Jackhammer	85
Mounted impact hammer (hoe ram)	90
Paver	85
Pickup truck	55
Pneumatic tools	85
Pumps	77
Rock drill	85
Scraper	85
Soil mix drill rig	80
Tractor	84
Vacuum street sweeper	80
Vibratory concrete mixer	80
Vibratory pile driver	95
Welder/Torch	73

Source: Federal Highway Administration 2006.

Regulatory Setting

City of Clayton Noise Element

In California, cities and counties are required to adopt a noise element as part of their general plan. Cities and counties can also adopt noise control requirements within their zoning ordinances or as a separate noise ordinance. The Project site is located in Clayton, California, which has both a Noise Element and a Noise Ordinance. Applicable noise-level criteria for the City of Clayton are discussed below.

The City of Clayton Noise Element establishes 60 dB Ldn and 45 dB Ldn as acceptable exterior and interior noise environments for residential land uses, respectively. In addition, the City restricts hours of construction to 7 am to 5:30 pm on weekdays and 9 am to 6 pm on weekends when adjacent neighbors are affected.

Noise Level Increase Criteria

The Federal Interagency Commission on Noise (FICON) has developed a graduated scale for use in the assessment of project-related noise level increases. Table 4 was developed by FICON as a means of developing thresholds for impact identification for project-related noise level increases. The rationale for the graduated scale is that test subject's reactions to increases in noise levels varied depending on the starting level of the noise. Specifically, with lower ambient noise environments, such as those below 60 dB L_{dn}, a larger increase in noise levels was required to achieve a negative reaction than was necessary in more elevated noise environments.

Table 5
Significance of Changes in Cumulative Noise Exposure

Ambient Noise Level (No Project), dB L_{dn}	Increase Required for Finding of Significance, dB
<60	+5 or more
60-65	+3 or more
>65	+1.5 or more

Source: Federal Interagency Committee on Noise (FICON)

Based on the FICON research, a 5 dB increase in noise levels due to a project is required for a finding of significant noise impact where ambient noise levels without the project are less than 60 dB L_{dn}. Where pre-project ambient conditions are between 60 and 65 dB L_{dn}, a 3 dB increase is applied as the standard of significance. Finally, in areas already exposed to higher noise levels – specifically pre-project noise levels in excess of 65 dB L_{dn} – a 1.5 dB increase is considered by FICON as the threshold of significance.

According to the FICON study, "if screening analysis shows that noise-sensitive areas will be at or above DNL 65 dB and will have an increase of DNL 1.5 or more, further analysis should be conducted." The FICON study also reported that "every change in the noise environment does not necessarily impact public health and welfare."

While CEQA requires that noise impacts be assessed relative to ambient noise levels that are present without the project, it should be noted that audibility is not a test of significance according to CEQA. But CEQA specifically requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change.

Vibration Criteria

Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 6 indicates that the threshold for damage to structures ranges from 2 to 6 in/sec peak particle velocity (ppv). One-half this minimum threshold, or 1 in/sec ppv is considered a criterion that would protect against significant architectural or structural damage. The general threshold at which human annoyance could occur is noted as one tenth of that level, or 0.1 in/sec ppv.

Table 6
General Human and Structural Responses to Vibration Levels

Effects on Structures and People	Peak Vibration Threshold (in./sec. ppv)
Structural damage to commercial structures	6
Structural damage to residential structures	2
Architectural damage to structures (cracking, etc.)	1
General threshold of human annoyance	0.1
General threshold of human perception	0.01

Sources: Survey of Earth-borne Vibrations due to Highway Construction and Highway Traffic, Caltrans, 1976

Project Impacts and Mitigation Measures

Impact 1: Project-generated Traffic Noise Level Increases

As noted in Table 3, project-generated traffic would result in an increase in existing and projected future traffic noise levels of 0.1 dB Ldn. As noted in Table 5, traffic noise level increases ranging from 1.5 to 5 dB are considered significant, depending on the baseline ambient conditions. Because the project-generated 0.1 dB Ldn increase is below even the lowest threshold of 1.5 dB, this impact is considered ***less than significant***.

Mitigation for Impact 1: *None Required*

Impact 2: Future Oakhurst Drive Traffic Noise Levels at Proposed Residences

As described above, future Oakhurst Drive traffic noise levels are predicted to be approximately 58 dB Ldn or less at the outdoor activity areas of the proposed residences in this development. At interior locations within residences, future traffic noise levels would be 25 dB lower, or approximately 33 dB Ldn. Because the predicted exterior and interior noise levels would satisfy the 60 dB Ldn exterior and 45 dB Ldn interior noise level standards of the City of Clayton, this impact is considered ***less than significant***.

Mitigation for Impact 2: *None Required*

Impact 3: Water Well Noise Levels at Nearest Residences

As described above, the predicted noise generated by the on-site water well is predicted to be approximately 50 dB Ldn or less at the nearest residence. Because the predicted exterior noise level of 50 dB Ldn would satisfy the 60 dB Ldn exterior noise level standard of the City of Clayton, this impact is considered ***less than significant***.

Mitigation for Impact 3: *None Required*

Impact 4: Aircraft Noise Levels at Proposed Residences

As described above, the nearest airport is over 6 miles from the project site. As a result, aircraft noise exposure at the project site is well below 60 dB Ldn at the proposed residences. Because the predicted aircraft noise levels are well below the 60 dB Ldn exterior noise level standard of the City of Clayton, this impact is considered ***less than significant***.

Mitigation for Impact 4: *None Required*

Impact 5: Project Construction Noise at Existing Residences

As shown in Table 4 above, project construction activities generate high noise levels which could result in short-term increases in ambient noise conditions at existing residences in the immediate project vicinity. Although construction activities would only occur for a limited duration, due to the potential for substantial short-term increases in ambient noise conditions, this impact is considered ***potentially significant***.

Mitigation for Impact 5:

MM 5a: Project construction activities should be limited to daytime hours.

MM 5b: The distances between on-site construction and demolition staging areas and the nearest surrounding residences should be maximized to the extent possible.

MM 5c: All project construction and demolition equipment which utilizes internal combustion engines shall be fitted with manufacturer's mufflers or equivalent.

Significance after mitigation: ***Less than Significant***

Impact 6: Exposure of Proposed Residences to Vibration

The proposed project does not include any substantive sources of vibration, nor are there any sources of existing vibration which appreciably affect the project site. As a result, vibration levels at the proposed residences are predicted to be well below the thresholds identified in Table 6. As a result, this impact is considered ***less than significant***.

Mitigation for Impact 6: *None Required*

Conclusions

This analysis concludes there are no adverse noise impacts due to or upon the proposed residential development within the Silver Oak Estates development which cannot practically be mitigated.

This concludes BAC's assessment of potential noise impacts associated with this development project. Please contact Paul Bollard at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this study.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B-1

Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 1
Tuesday, September 10, 2013

Hour	Leq	Lmax	L50	L90
0:00	45	64	44	43
1:00	44	58	43	42
2:00	43	54	43	41
3:00	41	51	41	40
4:00	41	53	41	39
5:00	44	60	41	38
6:00	47	66	45	41
7:00	50	64	48	46
8:00	48	67	47	43
9:00	49	69	46	43
10:00	48	67	46	44
11:00	52	78	47	44
12:00	48	60	47	44
13:00	48	65	47	44
14:00	51	67	49	46
15:00	51	70	49	46
16:00	50	70	48	45
17:00	52	74	49	47
18:00	50	61	49	46
19:00	50	70	48	45
20:00	49	67	47	45
21:00	48	61	46	44
22:00	46	62	45	43
23:00	47	68	44	42

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	52.1	47.7	49.8	46.9	41.1	44.7
Lmax (Maximum)	77.6	59.7	67.3	68.3	50.9	59.5
L50 (Median)	49.5	46.1	47.6	45.2	40.7	43.0
L90 (Background)	47.0	43.2	44.8	43.3	38.5	41.2

Computed Ldn, dB	52.3
% Daytime Energy	84%
% Nighttime Energy	16%

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Appendix B-2

Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 1
Wednesday, September 11, 2013

Hour	Leq	Lmax	L50	L90
0:00	44	60	42	41
1:00	43	65	42	40
2:00	42	54	42	40
3:00	41	51	41	40
4:00	41	60	40	38
5:00	45	59	43	40
6:00	51	73	46	43
7:00	50	67	49	46
8:00	50	65	48	45
9:00	50	75	47	44
10:00	53	79	47	44
11:00	49	69	47	44
12:00	49	65	48	46
13:00	49	61	48	46
14:00	50	65	48	45
15:00	50	67	48	45
16:00	50	63	49	46
17:00	53	76	50	46
18:00	51	72	49	46
19:00	50	65	49	45
20:00	49	66	48	45
21:00	47	58	46	44
22:00	47	58	46	44
23:00	46	55	44	43

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	53.1	47.4	50.3	51.0	41.4	45.6
Lmax (Maximum)	79.1	58.3	67.6	72.7	51.4	59.4
L50 (Median)	49.6	46.3	48.0	46.4	39.9	42.8
L90 (Background)	46.4	44.1	45.3	44.1	38.3	41.0

Computed Ldn, dB	53.1
% Daytime Energy	83%
% Nighttime Energy	17%

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Appendix B-3

Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 2
Tuesday, September 10, 2013

Hour	Leq	Lmax	L50	L90
0:00	46	72	42	40
1:00	51	79	41	39
2:00	41	55	39	38
3:00	41	59	38	37
4:00	44	53	41	37
5:00	48	68	44	39
6:00	50	66	47	42
7:00	54	72	51	47
8:00	52	66	49	45
9:00	51	70	48	44
10:00	51	67	49	45
11:00	53	81	48	44
12:00	51	73	48	44
13:00	51	68	48	44
14:00	53	73	51	47
15:00	53	75	51	47
16:00	53	74	50	46
17:00	54	73	52	47
18:00	53	66	51	47
19:00	52	78	50	45
20:00	52	77	48	45
21:00	50	66	48	45
22:00	48	68	46	43
23:00	47	67	44	41

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	53.8	50.0	52.3	51.4	41.3	47.4
Lmax (Maximum)	81.4	66.1	72.0	79.5	53.4	65.2
L50 (Median)	51.6	47.9	49.4	47.5	38.4	42.5
L90 (Background)	47.3	43.7	45.4	43.1	36.6	39.5

Computed Ldn, dB	54.9
% Daytime Energy	84%
% Nighttime Energy	16%

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Appendix B-4

Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 2
Wednesday, September 11, 2013

Hour	Leq	Lmax	L50	L90
0:00	45	63	43	41
1:00	43	68	41	39
2:00	41	58	40	38
3:00	41	53	40	38
4:00	42	59	38	36
5:00	47	64	43	39
6:00	53	74	48	43
7:00	52	63	51	46
8:00	53	68	51	46
9:00	51	70	49	44
10:00	51	75	48	44
11:00	51	72	48	43
12:00	52	69	50	46
13:00	52	71	50	46
14:00	52	64	50	46
15:00	52	69	50	46
16:00	54	80	51	46
17:00	55	75	51	47
18:00	53	70	51	47
19:00	52	68	50	46
20:00	51	69	48	45
21:00	49	64	47	43
22:00	48	64	45	42
23:00	45	57	43	41

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	54.5	49.4	52.2	52.8	41.0	46.7
Lmax (Maximum)	80.2	63.2	69.9	74.3	53.2	62.2
L50 (Median)	51.4	47.2	49.6	48.0	38.1	42.3
L90 (Background)	47.3	43.5	45.5	43.4	35.7	39.6

Computed Ldn, dB	54.5
% Daytime Energy	86%
% Nighttime Energy	14%

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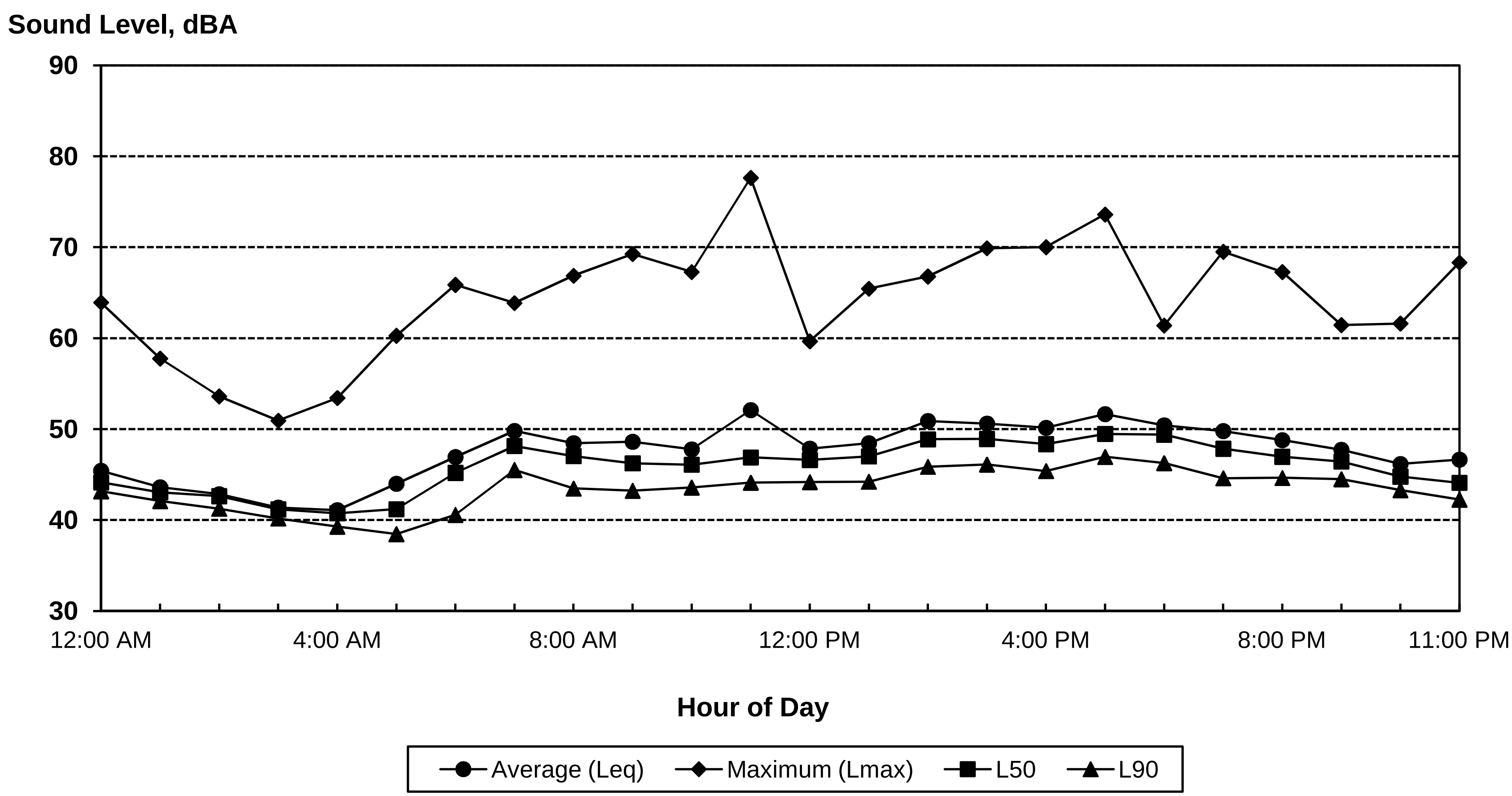
Appendix C-1
Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 1
Tuesday, September 10, 2013



Ldn: 52 dB

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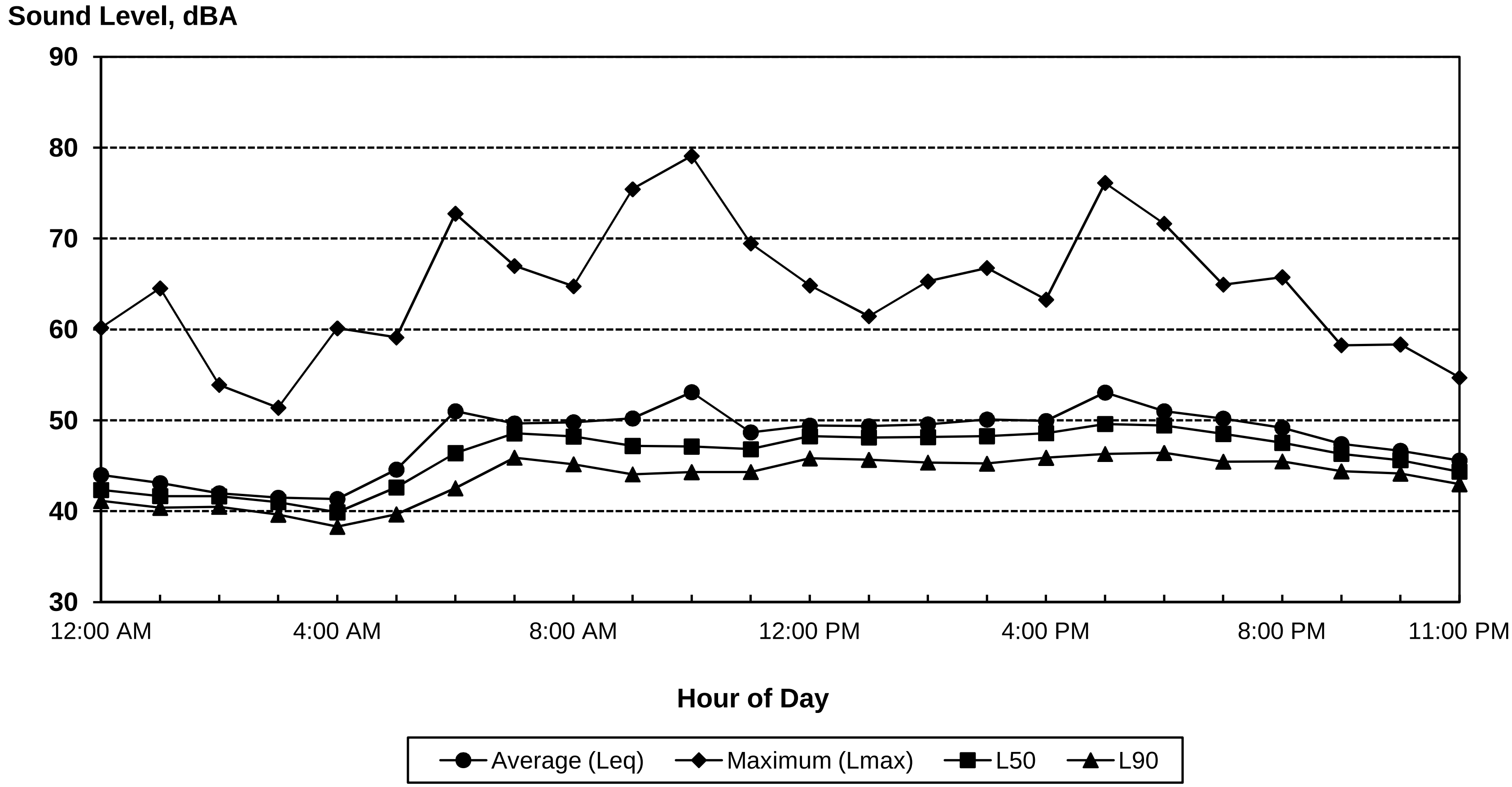
Appendix C-2
Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 1
Wednesday, September 11, 2013



Ldn: 53 dB

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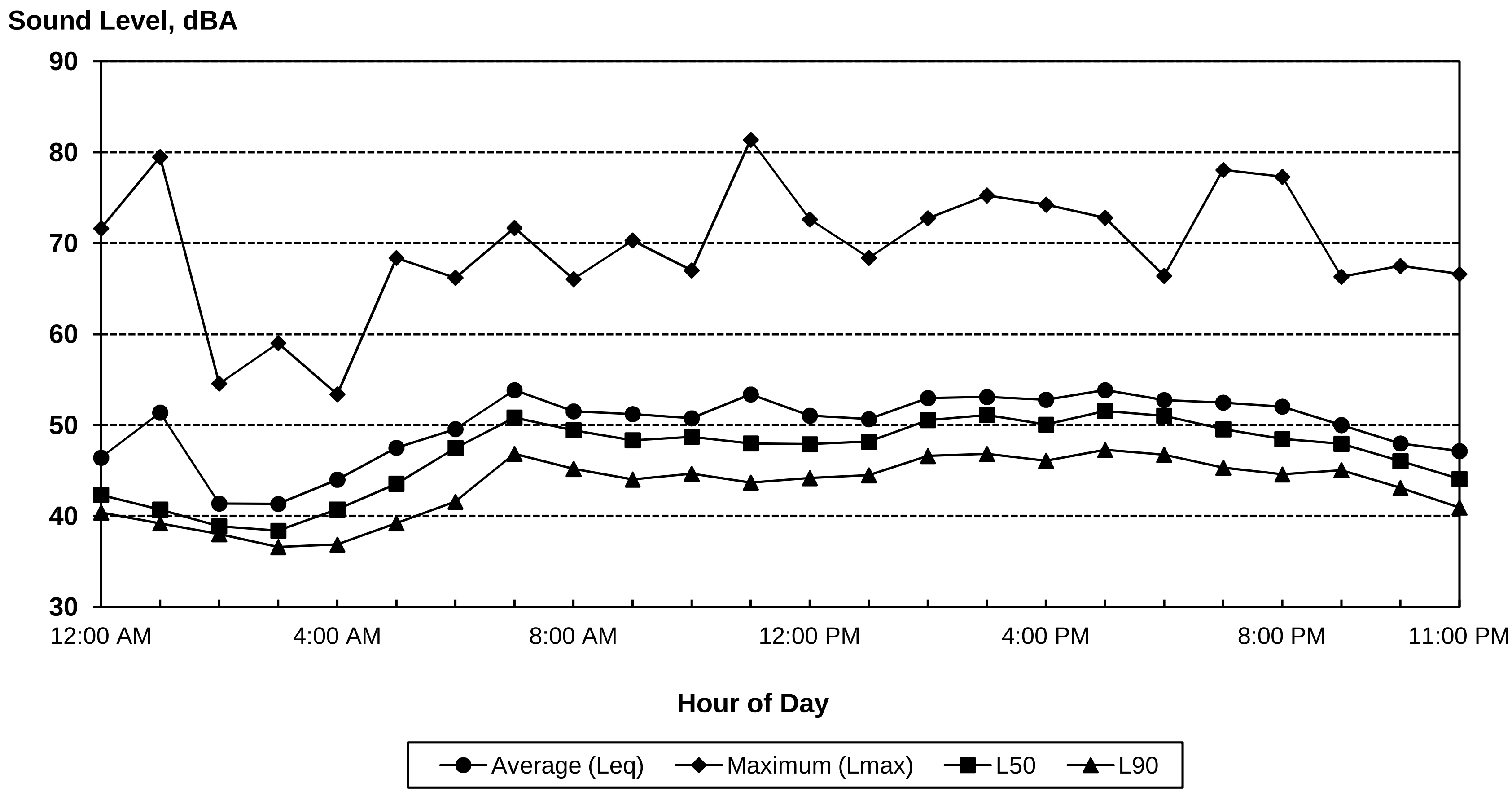
Appendix C-3
Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 2
Tuesday, September 10, 2013



Ldn: 55 dB

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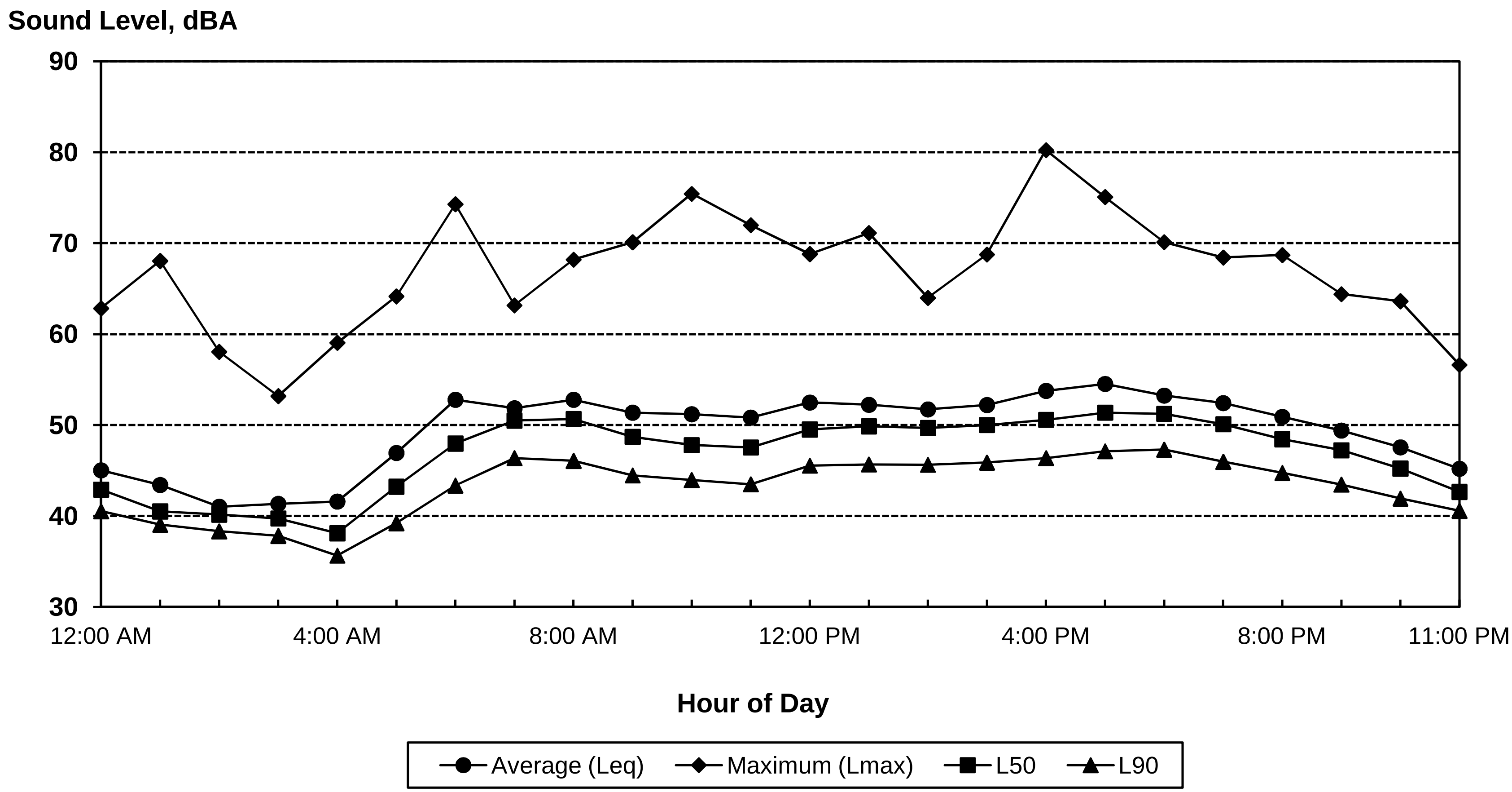
Appendix C-4
Silver Oaks Residential Development
24hr Continuous Noise Monitoring at Site 2
Wednesday, September 11, 2013



Ldn: 54 dB

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