ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
*1 Willowbrook Court, Suite 120*
*Petaluma, California 94954*
*Tel: 707-794-0400* *Fax: 707-794-0405*
*www.illingworthrodkin.com* *illro@illingworthrodkin.com*

April 4, 2017

Narsai Tailo
Meridian Investment Management, Inc.
702 Marshall Street, Suite 322
Redwood City, CA 94063

**VIA E-Mail:** **ntailo@gmail.com**

**SUBJECT:** **3150 Dutton Avenue, Santa Rosa, CA –**
**Environmental Noise Assessment**

Dear Narsai:

The construction of a 107-unit market rate multifamily community is proposed on a vacant 5.95-acre lot located at 3150 Dutton Avenue in Santa Rosa, California. Access to the apartments would be provided via two driveways on Dutton Avenue. The property is joined to the east by the Sonoma-Marin Area Rail Transit (SMART) railroad tracks and commercial properties to the north and south.

This study evaluates the proposed project's compatibility with the future noise environment expected at the project site. This report includes a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, discusses the results of the ambient noise monitoring survey completed to document existing noise conditions, summarizes future noise levels expected at the project site, and describes measures necessary to reduce noise levels to acceptable levels. Based on a review of project plans and information, preliminary acoustical recommendations regarding environmental noise control at project interiors were determined.

**Fundamentals of Environmental Noise**

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called $L_{eq}$. The most common averaging period is hourly, but $L_{eq}$ can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The *Day/Night Average Sound Level* ($L_{dn}$) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

**TABLE 1 Definition of Acoustical Terms Used in this Report**

| Term | Definition |
|---|---|
| Decibel, dB | A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals. |
| Sound Pressure Level | Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter. |
| Frequency, Hz | The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz. |
| A-Weighted Sound Level, dBA | The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. |
| Equivalent Noise Level, $L_{eq}$ | The average A-weighted noise level during the measurement period. |
| $L_{max}$, $L_{min}$ | The maximum and minimum A-weighted noise level during the measurement period. |
| $L_{01}$, $L_{10}$, $L_{50}$, $L_{90}$ | The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period. |
| Day/Night Noise Level, $L_{dn}$ or DNL | The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m. |
| Community Noise Equivalent Level, CNEL | The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m. |
| Ambient Noise Level | The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location. |
| Intrusive | That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level. |

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

**TABLE 2 Typical Noise Levels in the Environment**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | 110 dBA | Rock band |
| Jet fly-over at 1,000 feet | | |
| | 100 dBA | |
| Gas lawn mower at 3 feet | | |
| | 90 dBA | |
| Diesel truck at 50 feet at 50 mph | | Food blender at 3 feet |
| | 80 dBA | Garbage disposal at 3 feet |
| Noisy urban area, daytime | | |
| Gas lawn mower, 100 feet | 70 dBA | Vacuum cleaner at 10 feet |
| Commercial area | | Normal speech at 3 feet |
| Heavy traffic at 300 feet | 60 dBA | |
| | | Large business office |
| Quiet urban daytime | 50 dBA | Dishwasher in next room |
| Quiet urban nighttime | 40 dBA | Theater, large conference room |
| Quiet suburban nighttime | | |
| | 30 dBA | Library |
| Quiet rural nighttime | | Bedroom at night, concert hall (background) |
| | 20 dBA | |
| | | Broadcast/recording studio |
| | 10 dBA | |
| | 0 dBA | |

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

## Regulatory Background

The proposed project would be subject to noise-related policies established within the City of Santa Rosa General Plan. These policies are implemented during the environmental review process to limit noise exposure at proposed noise sensitive land uses.

***City of Santa Rosa General Plan 2035.*** The City of Santa Rosa's General Plan[1] establishes noise and land use compatibility standards that are used to evaluate a project's compatibility with the noise environment. Multifamily residential land uses are considered "normally acceptable" in noise environments of 65 dBA DNL or less. The City of Santa Rosa also establishes policies in the Noise and Safety Element of the General Plan in order to achieve the goal of maintaining an acceptable community noise level. The following policies are applicable to the proposed project:

NS-B-1 Do not locate noise-sensitive uses in proximity to major noise sources, except residential is allowed near rail to promote future ridership.

NS-B-2 Encourage residential developers to provide buffers other than sound walls, where practical. Allow sound walls only when projected noise levels at a site exceed land use compatibility standards in Figure 12-1 (not shown).

*In some established neighborhoods and subdivisions, sound walls may provide the only alternative to reduce noise to acceptable community standards. The Design Review process shall evaluate sound wall aesthetics and landscaping to ensure attractiveness along with functionality.*

NS-B-4 Require new projects in the following categories to submit an acoustical study, prepared by a qualified acoustical consultant:

- All new projects proposed for areas with existing noise above 60 dBA DNL. Mitigation shall be sufficient to reduce noise levels below 45 dBA DNL in habitable rooms and 60 dBA DNL in private and shared recreational facilities. Additions to existing housing units are exempt.
- All new projects that could generate noise whose impacts on other existing uses would be greater than those normally acceptable (as specified in the Land Use Compatibility Standards).

NS-B-5 Pursue measures to reduce noise impacts primarily through site planning. Engineering solutions for noise mitigation, such as sound walls, are the least desirable alternative.

NS-B-9 Encourage developers to incorporate acoustical site planning into their projects. Recommended measures include:

- Incorporating buffers and/or landscaped earth berms;

[1] *Santa Rosa General Plan 2035*, November 3, 2009.

- Orienting windows and outdoor living areas away from unacceptable noise exposure;
- Using reduced-noise pavement (rubberized-asphalt);
- Incorporating traffic calming measures, alternative intersection designs, and lower speed limits; and
- Incorporating state-of-the-art structural sound attenuation and setbacks.

**Existing Noise Environment**

The project site is located at 3150 Dutton Avenue in Santa Rosa, California. Figure 1 shows the project site plan overlaid on an aerial image of the site vicinity. The site is bordered by commercial land uses to the north, south, and southwest, opposite Dutton Avenue. The SMART railroad tracks border the site to the east, with residential land uses on the opposite side of the tracks.

A noise monitoring survey was performed to quantify and characterize ambient noise levels at the project site between Thursday, March 2, 2017 and Friday, March 3, 2017. The noise monitoring survey included two long-term noise measurements (LT-1 and LT-2) and three short-term noise measurements (ST-1 through ST-3), as indicated in Figure 1. The noise environment at the site results primarily from vehicular traffic along Dutton Avenue and SMART trains along the railroad tracks. SMART train operations are currently in the testing phase, and without current operational quiet zones, the trains are blowing their horns.

Long-term noise measurement LT-1 was made along the northern property line of the site, approximately 100 feet east of the Dutton Avenue centerline. Hourly average noise levels at this location ranged from 54 to 66 dBA $L_{eq}$ during the day, and from 48 to 62 dBA $L_{eq}$ at night. The calculated day-night average noise level from Thursday, March 2, 2017 to Friday, March 3, 2017 was 63 dBA DNL. The daily trend in noise levels at LT-1 is shown in Figure 2.

Long-term noise measurement LT-2 was also made along the northern property line of the site, approximately 125 feet west of the SMART railroad centerline. Hourly average noise levels at this location ranged from 48 to 69 dBA $L_{eq}$ during the day, and from 43 to 53 dBA $L_{eq}$ at night. The calculated day-night average noise level from Thursday, March 2, 2017 to Friday, March 3, 2017 was 61 dBA DNL. The daily trend in noise levels at LT-2 is shown in Figure 3.

Short-term noise measurement ST-1 was made in the southwest corner of the project site, approximately 145 feet east of the Dutton Avenue centerline. The 10-minute average noise level measured at this location between 9:50 a.m. and 10:00 a.m. on Friday, March 3, 2017 was 61 dBA $L_{eq}$ and the estimated day-night average noise level was 63 dBA DNL. During the measurement at ST-1, a SMART train passed along the railroad tracks without using its horn and produced a maximum noise level of 52 dBA $L_{max}$. Short-term noise measurement ST-2 was made in the southeast corner of the project site, approximately 155 feet west of the SMART railroad tracks centerline. The 10-minute average noise level measured at this location between 10:10 a.m. and 10:20 a.m. on Friday, March 3, 2017 was 46 dBA $L_{eq}$ and the estimated day-night average noise level was 60 dBA DNL. Short-term noise measurement ST-3 was made in the center of the project site, approximately 330 feet east of the Dutton Avenue centerline and approximately 320 feet west of the SMART railroad tracks centerline. The 10-minute average noise level measured at this location between 10:30 a.m. and 10:40 a.m. on Friday, March 3, 2017 was 45 dBA $L_{eq}$ and the estimated day-night average noise level was 56 dBA DNL. Table 3 summarizes the results of the short-term measurements.

**FIGURE 1 3150 Dutton Avenue Noise Measurement Locations**

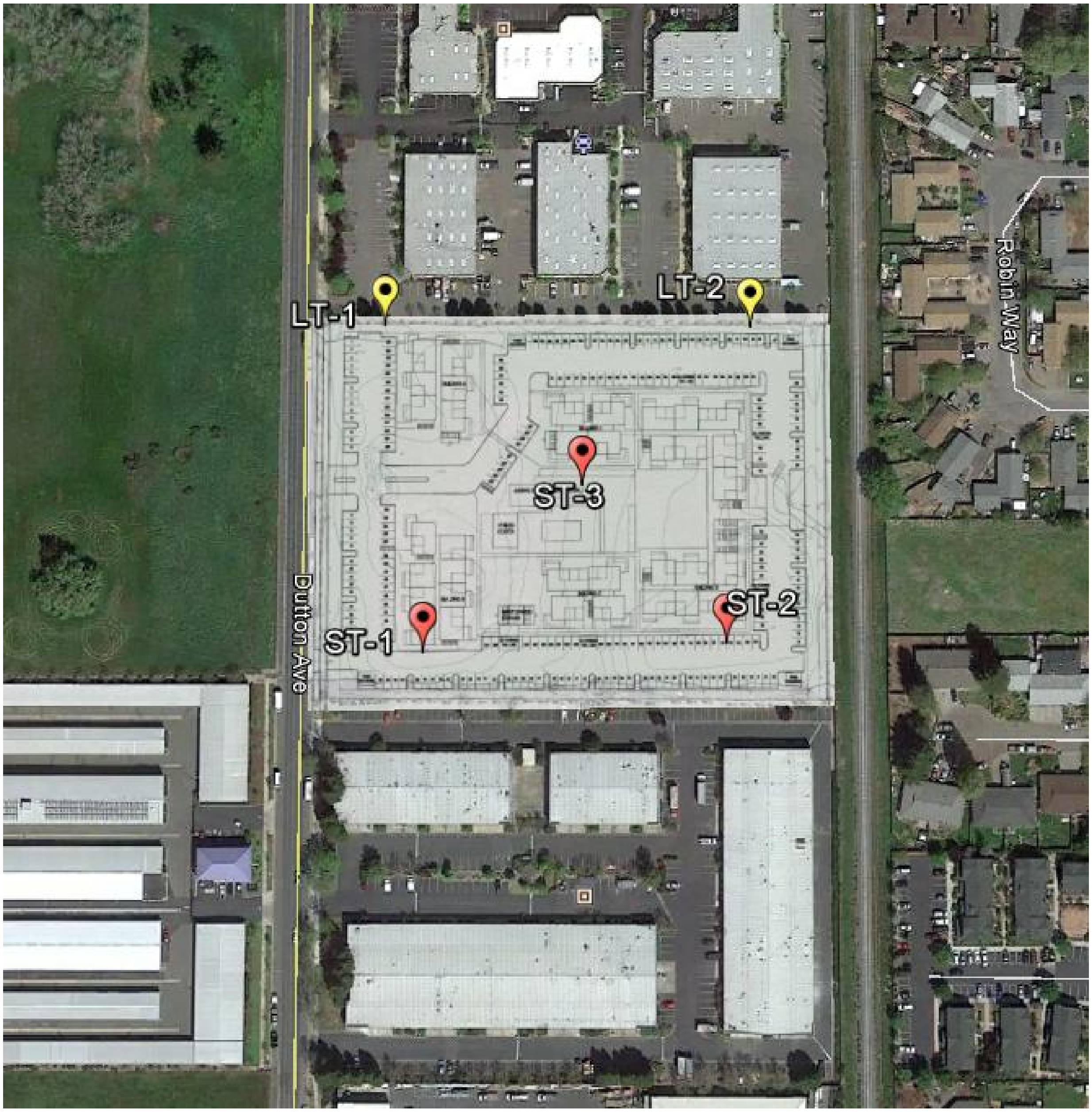

**FIGURE 2 Daily Trend in Noise Levels at LT-1**

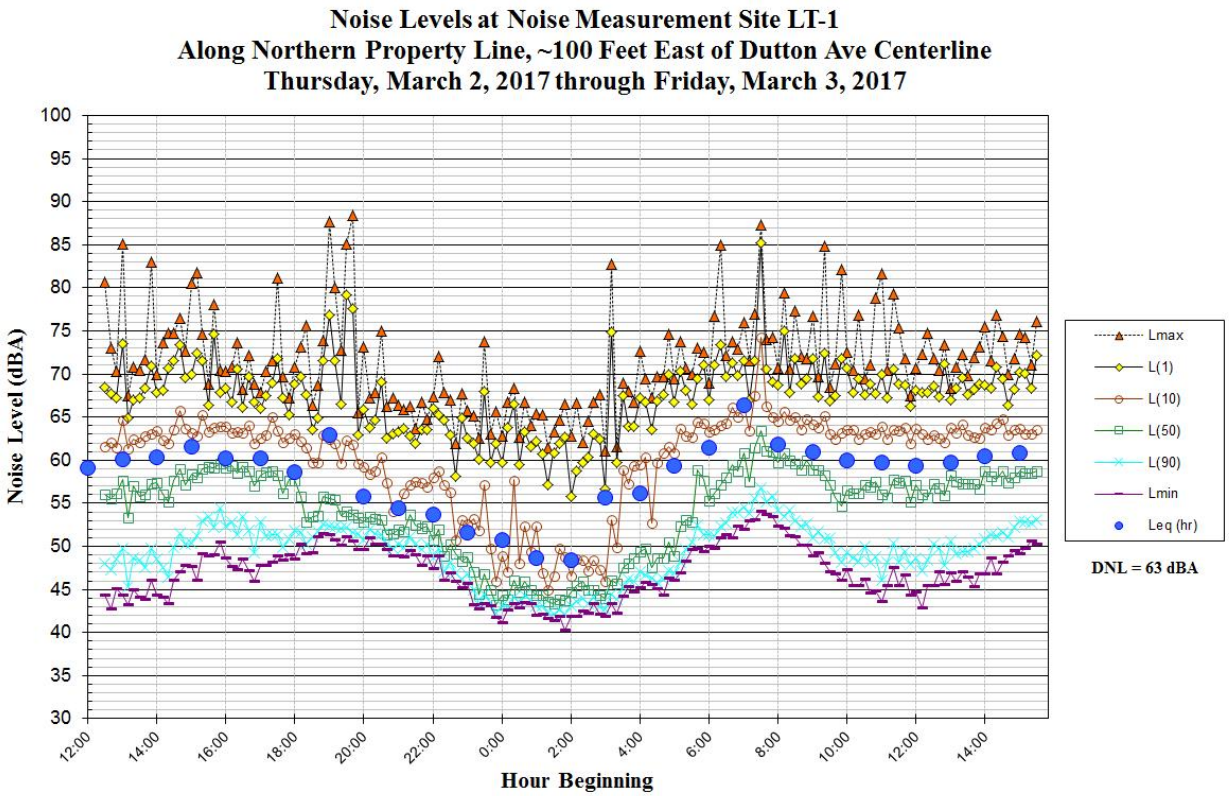


**FIGURE 3 Daily Trend in Noise Levels at LT-2**

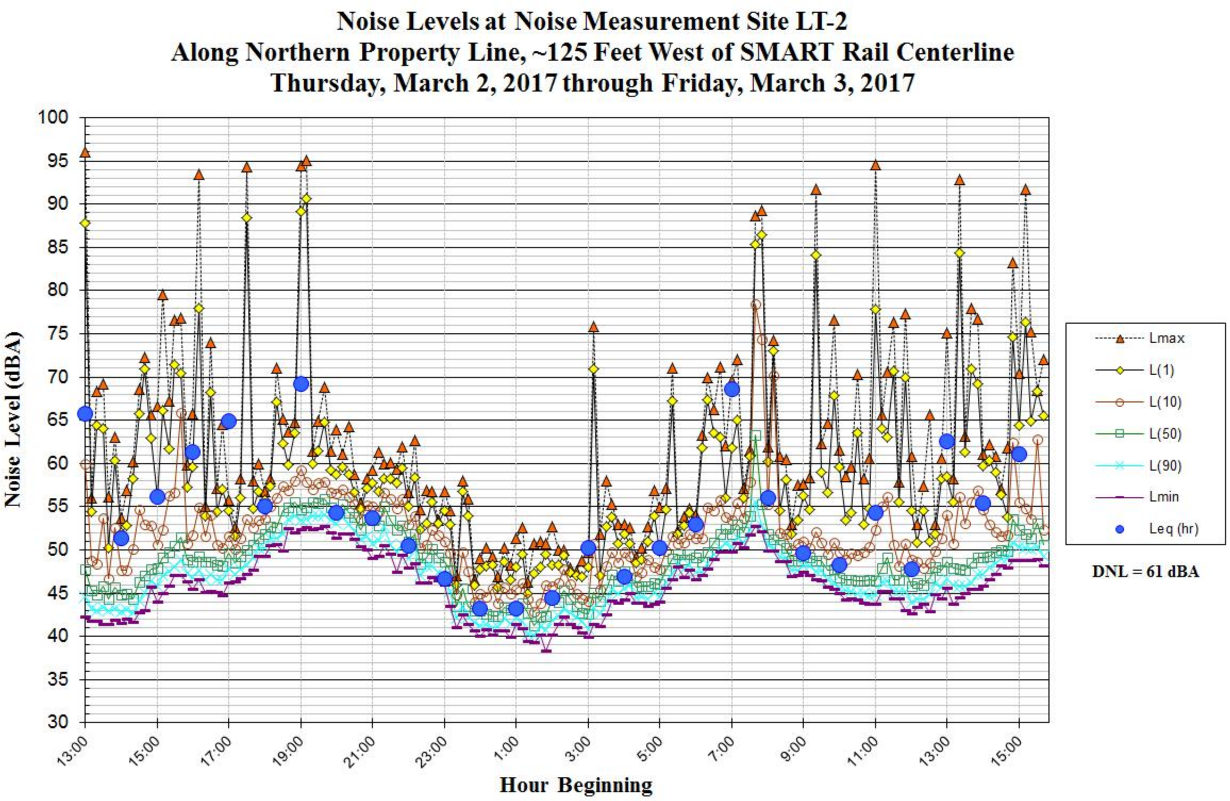

**TABLE 4 Summary of Short-Term Noise Measurement Data (dBA)**

| Noise Measurement Location | $L_{max}$ | $L_{(1)}$ | $L_{(10)}$ | $L_{(50)}$ | $L_{(90)}$ | $L_{eq}$ | DNL |
|---|---|---|---|---|---|---|---|
| ST-1: Southwest corner of site. (3/3/2017, 9:50 a.m. - 10:00 a.m.) | 60 | 59 | 54 | 49 | 45 | 61 | 63 |
| ST-2: Southeast corner of site. (3/3/2017, 10:10 a.m. - 10:20 a.m.) | 61 | 52 | 48 | 44 | 42 | 46 | 60 |
| ST-3: Center of site. (3/3/2017, 10:30 a.m. - 10:40 a.m.) | 52 | 51 | 48 | 45 | 43 | 45 | 56 |

Note: The DNL is determined by correlating the short-term measurement with the representative long-term measurement.

## Future Exterior Noise Environment

The compatibility of proposed exterior use areas are assessed against the Land Use Compatibility Standards established in the City of Santa Rosa General Plan. The City of Santa Rosa considers residential exterior use areas in multi-family residential developments “normally acceptable” in noise environments of 65 dBA DNL or less. Interior noise level shall be maintained so as not to exceed 45 dB DNL.

Traffic noise generated along Dutton Avenue would continue to affect the project site in the future. A traffic study[2] was conducted for the project site to determine the impact of the proposed project on the existing traffic conditions in the area, and the data was utilized to calculate future traffic noise level increases. The proposed project is expected to generate an average of 712 trips per day, including 55 a.m. peak hour trips and 66 trips during the p.m. peak hour. From these data and compared to the 2035 future peak hour traffic volumes summarized in the Santa Rosa General Plan 2035, the peak hour traffic due to the project would represent an insignificant increase to traffic volumes along Dutton Avenue and have little effect on the future noise environment. The traffic noise level increase anticipated by the year 2035 would be less than 1 dBA DNL along Dutton Avenue near the project site. Therefore, the future unmitigated traffic noise exposure at the western façade of the proposed project site (residences closest to Dutton Avenue) is calculated to be up to 63 dBA DNL, which would be below the City’s 65 dBA DNL threshold for exterior noise environments at multi-family residential land uses.

SMART train and freight train noise would continue to be the predominant noise source along the eastern boundary of the project site.[3] The SMART Supplemental EIR,[4] dated March 2008, assumes the installation of Quiet Zones in Santa Rosa, which would reduce noise impacts resulting from future passenger and freight trains along the corridor. Since the project site is located between the at-grade railroad crossings at Bellevue Avenue and W. Robles Avenue, it is assumed that trains passing by the site would be traveling no faster than 25 mph. Future noise levels along the Northwestern Pacific Rail corridor, as described in the SMART SEIR Revised Cumulative Impacts Section dated March 2008, are estimated to reach 60 dBA DNL at a distance of 50 feet, assuming a train speed of 25 mph in the Santa Rosa area. Therefore, the future

[2] W-Trans, “Draft Traffic Impact Study for a Residential Project at 3150 Dutton Avenue”, December 14, 2016.
[3] However, train horn noise would be substantially reduced when quiet zones are implemented by the City.
[4] Sonoma-Marin Area Rail Transit, “Supplemental Environmental Impact Report,” March 6, 2008.

unmitigated traffic noise exposure at the eastern façade of the proposed project site is calculated to be up to 52 dBA DNL, which would be below the City's 65 dBA DNL threshold for exterior noise environments at multi-family residential land uses.

According to the site plan, three common use outdoor areas are proposed at the project site: a kids play area between Buildings B and C, a swimming pool and barbeque area between Buildings C and E, and a lawn play area located north of Building D. Small decks, porches, and balconies are not considered to be areas of frequent human use that would benefit from a lowered noise level. All three of these common outdoor use areas are acoustically shielded from the roadway traffic and railroad noise by the surrounding residential buildings. The intervening residential buildings, along with the distance of the common outdoor use areas from the noise sources, out provide at least 10 dBA of acoustical shielding for receptors within the common use outdoor areas. This would result in noise levels below the City's 65 dBA DNL threshold for exterior noise environments at multi-family residential land uses. No additional noise control would be recommended to further reduce noise levels at the proposed common outdoor use areas.

The 2005 SMART DEIR[5] was reviewed to establish groundborne vibration levels expected from trains traveling along the SMART corridor. The DEIR states that, "Groundborne noise and vibration levels at distances greater than approximately 100 feet from the tracks, would be lower than the level generally perceptible to humans." The closest proposed residence is 140 feet west from the railroad track centerline; therefore, groundborne vibration levels would not be perceptible at the nearest residential buildings.

**Future Interior Noise Environment**

The nearest proposed residential façades facing Dutton Avenue would be located approximately 130 feet from the roadway centerline (west façades of Buildings A and B). The west-facing façades of these residential buildings would be exposed to future traffic noise levels of 63 dBA DNL. The northern and southern façades of Buildings A and B would be set back approximately 130 to 195 feet from the centerline of Dutton Avenue. At these distances, the exterior-facing units would be exposed to future exterior noise levels ranging from 61 to 63 dBA DNL. The eastern façades of Buildings A and B would be mostly shielded from traffic noise by the proposed building.

The fitness center and leasing office would be partially shielded from Dutton Avenue traffic noise by Buildings A and B. The fitness center is setback of 230 feet and the leasing office is setback 250 feet from the roadway, and both would be exposed to future exterior noise levels up to 60 dBA DNL. The remaining buildings would be setback far enough from the roadway and/or shielded from the roadway noise by the proposed buildings that the future exterior noise levels would be below 60 dBA DNL.

The nearest proposed residential façades facing the SMART railroad tracks would be located approximately 140 feet from the railroad centerline (east façades of Building D). The east-facing façades of these residential buildings would be exposed to future train noise levels of 52 dBA

[5] *Sonoma-Marin Area Rail Transit DEIR,* November 2005.

DNL with the implementation of quiet zones. The northern and southern façades of Building D would be set back approximately 140 to 250 feet from the centerline of railroad tracks. At these distances, the exterior-facing units would be exposed to future exterior noise levels ranging from 52 to 48 dBA DNL. The western façade of Building D would be mostly shielded from train noise by the proposed building. The remaining buildings would be setback far enough from the railroad tracks and/or shielded from the train noise by the proposed buildings that the future exterior noise levels would be below 48 dBA DNL.

Though the City noise criteria are typically sufficient to achieve an acceptable interior noise environment with common environmental noise sources, when dealing with loud intermittent noise sources, such as passing trains, the achievement of 45 dBA DNL within homes may still result in maximum noise levels within interiors great enough to result in significant sleep disturbance and annoyance. Studies have been undertaken to determine the effect of short-term maximum noise levels on these issues. The conclusions of the studies related to the sleep disturbance typically give a probability of sleep disturbance related to the maximum noise level of the event at the sleep location and the duration of the event. A review of these data shows that limiting maximum noise levels to 55 dBA within bedrooms will limit the probability of waking the future residents of the homes at the subject project when trains pass the site to less than five percent per occurrence.[6] Therefore, though this is not a City or State requirement, I&R recommends the adoption of additional interior sound level criteria limiting maximum noise levels to 55 dBA within bedrooms of the units adjacent to SMART. To limit annoyance and disturbance of non-sleeping residents, we recommend limiting maximum noise levels to 65 dBA in other residential living areas of these homes.

The average day/night noise levels discussed above address with average noise exposure, however the sounding of train horns in the vicinity of grade crossings and the engines of passing trains result in high maximum noise levels during train pass-bys which can cause daytime interruption and/or sleep disturbance. Train operators are required by the State to sound warning horns within ¼- mile from at-grade road crossings, which in this case would occur when northbound locomotives are alongside the development. Information provided in the Draft EIR for the SMART project indicates that the train horns could produce maximum noise levels of approximately 100 dBA at 100 feet sideline distance from the track and the engines of passing trains can produce maximum noise levels of up to 85 dBA at 100 feet from the track.

A noise mitigation measures in the 2005 Draft and 2006 Final EIR for the SMART project was to obtain Quiet Zone designations at grade crossings in residential areas. Quiet Zones are segments of rail lines where crews are exempt from regularly sounding the train horns at grade crossings. However, the 2005 Draft EIR also noted that since the FRA (Federal Railroad Administration) "has final jurisdiction over Quiet Zone applications, SMART cannot commit to Quiet Zone implementation. SMART has committed to work with any local jurisdictions wishing to be designated Quiet Zones to cooperatively meet the requirements for designation." Despite this, it is understood that the City has requested Quiet Zones throughout the City and within the project area and expect that this will be granted. Thus, though trains would sound their horns as they approach the commercial area north of Bellevue Avenue, and passing trains may sound their horns under emergency conditions, they would not regularly sound their horns adjacent to the

[6] Kryter Karl D., The effects of Noise on Man, Second Edition, Academic Press, Inc. London, 1985, p.444-446

project site. Thus, recurring maximum noise from SMART rail service is assumed to result primarily from the engines of passing trains, which would be expended to reach 85 dBA $L_{max}$ at 100 feet from the tracks.

The east façades of Building D would be 140 feet from the centerline of the tracks. At this distance, the east-facing units would be exposed to future exterior noise levels of 83 dBA $L_{max}$. The northern and southern façades of Building D would be set back approximately 140 to 250 feet from the centerline of railroad tracks. At these distances, the exterior-facing units would be exposed to future exterior noise levels ranging from 83 to 78 dBA $L_{max}$. The western façades of Building D would be mostly shielded from maximum train noises by the proposed building.

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA DNL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA DNL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound-rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant’s discretion.

Assuming standard construction materials and methods, the projected interior noise levels for the proposed project would potentially be as high as 48 dBA DNL at the units located along the western façades of Buildings A and B and as high as 68 dBA $L_{max}$ at the units located along the eastern façade of Building D, assuming windows are partially open. Although the interior buildings of the project site would have average day/night noise levels at or slightly above the 45 dBA interior noise standard with windows partially open, the maximum noise levels would be above 55 dBA.

Attaining the necessary noise reduction from exterior-to-interior spaces is readily achievable with proper wall construction techniques, the selections of proper windows and doors, and the incorporation of forced-air mechanical ventilation systems. Preliminary calculations were made based on a review of the site plan and floor plans. Standard hardie-sided or cement plaster-sided wall construction would be used. To achieve interior noise levels of at least 45 dBA DNL and 55 dBA $L_{max}$ at the units in Building D along the northern, southern, and eastern façades, windows and sliding glass doors with STC ratings of STC 35 to 38 would be required. Along the western façade of Building D, windows and sliding glass doors with STC ratings of STC 28 to 31 would be required.

To achieve interior noise levels of at least 45 dBA DNL and 55 dBA $L_{max}$ at the units in Buildings A and B along the northern, southern, and western façades, windows and sliding glass doors with STC ratings of STC 26 to 28 would be required. The remaining interior buildings would need windows and sliding glass doors with STC ratings of STC 26 to 31 to achieve interior noise standards. All of the units in the proposed buildings should also be provided some form of forced-air mechanical ventilation, satisfactory to the local building official, to adequately ventilate the interior space of the units when windows are closed to control noise.

The above noise insulation features would adequately reduce interior noise levels in all units to 45 dBA DNL or less and 55 dBA $L_{max}$ or less, satisfying the interior noise level requirements of the City of Santa Rosa. The above recommendations should be reviewed by a qualified acoustical consultant during final design of the proposed project when final floorplans and building elevations are available.

♦ ♦ ♦

Please feel free to contact us with any questions on the analysis or if we can be of further assistance.

Sincerely,

Casey Zaglin

Casey Zaglin
Staff Consultant
***Illingworth & Rodkin, Inc*.**

I&R Job: 17-045