NOISE ASSESSMENT

Proposed RaceTrac Facility
11710 Dixie Highway (31W)
Louisville, Kentucky

HMB PROFESSIONAL ENGINEERS, INC.
3 HMB CIRCLE
FRANKFORT, KY 40601

AUGUST 28, 2020

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 – INTRODUCTION

At the request of RaceTrac Petroleum, Inc., HMB Professional Engineers, Inc. conducted a noise evaluation to determine the sound levels at nearby residential properties with an operational RaceTrac facility. This report summarizes the survey methodology and results, utilizing the following sources for data to calculate the anticipated potential sound levels for the areas around the project and for nearby residences:

Field measurements of the ambient, or existing sound levels, the measurement of sound levels at a surrogate site to determine the sound contribution of a similar operational facility, a quantitative assessment of noise generated at the proposed location with sound level measurements in both the ambient and noise generating conditions, based on surrogate site data, and a barrier assessment to evaluate the effectiveness of a wall for sound reduction.

1.1 PROJECT DESCRIPTION

The proposed project is a new RaceTrac retail facility at 11710 Dixie Highway (31W) in Jefferson County, KY. This location is just south of Exit 1 of the Gene Snyder Freeway (I-265), at the Dixie Highway intersection with Flowervale Lane and bounded to the southeast by East Orell Road (See Figure 1.2-1).

The proposed gas station will be equipped with two separate pump canopies, one being designated for gasoline, and the other designated for diesel fuel. This separate diesel canopy would be primarily used by pickup trucks, typically used to haul trailers, and the occasional semi-truck, both of which require additional room to maneuver. A noise evaluation is required for this development to address noise concerns from the residents to the southeast along East Orell Road. A project site map of the proposed facility is shown in Figure 1.2-1.

1.2 EXISTING NOISE ENVIRONMENT

The noise environment in the vicinity of the proposed RaceTrac facility and the closest residences is generally comprised of highway traffic noise (Dixie Highway, and I-265), and localized noise sources, including local traffic, residential noise generators (e.g. A/C compressors, conversations and lawn mowers), and a railway corridor just south of the proposed site.

Commercial operations bound two sides of the property, including a Thornton's gas station and a self-storage facility to the west and a Dairy Queen to the north. The site is bounded by a railroad line to the south.

The purpose of this evaluation was to determine if the proposed RaceTrac gas station would affect the residences located to the southeast on Orell Road.

The closest house among the adjacent residences to the east along Orell Road is over 250 feet from the proposed diesel canopy.

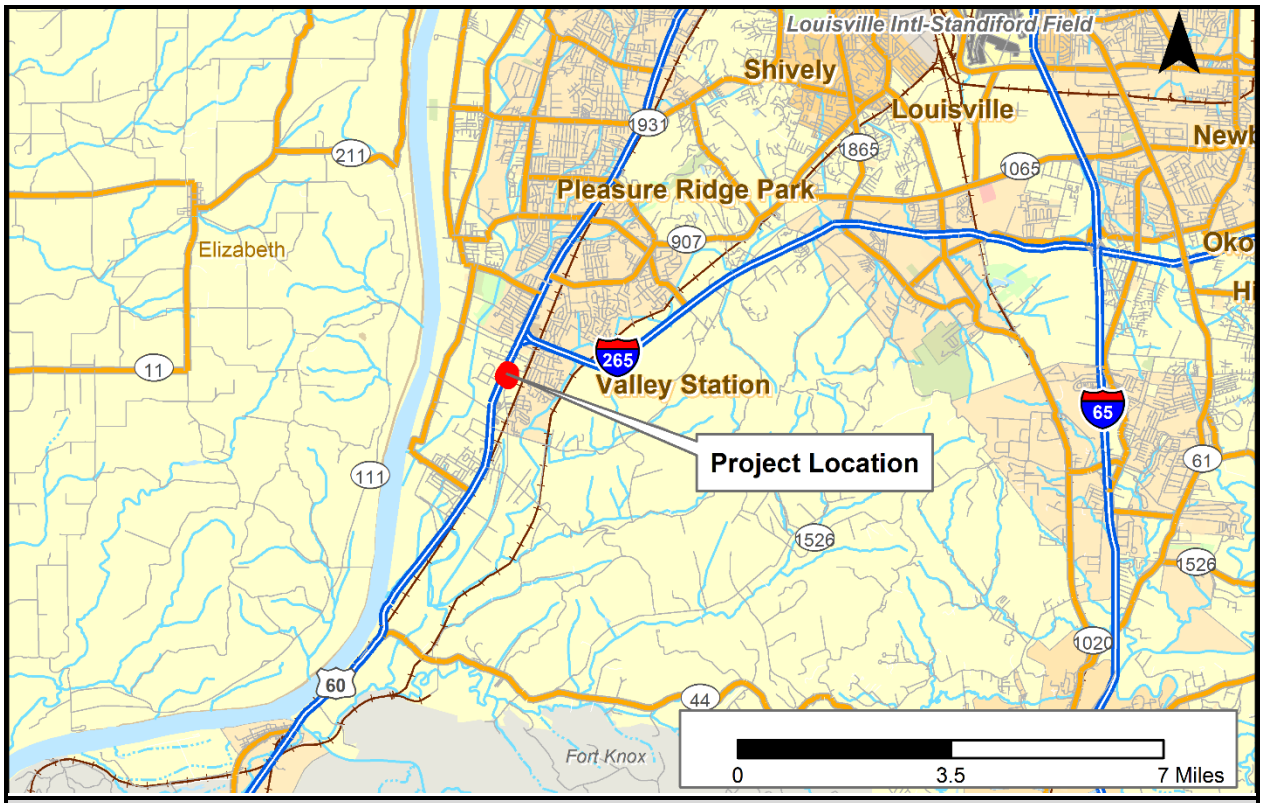

Figure 1.2-1. Location of the Proposed Development

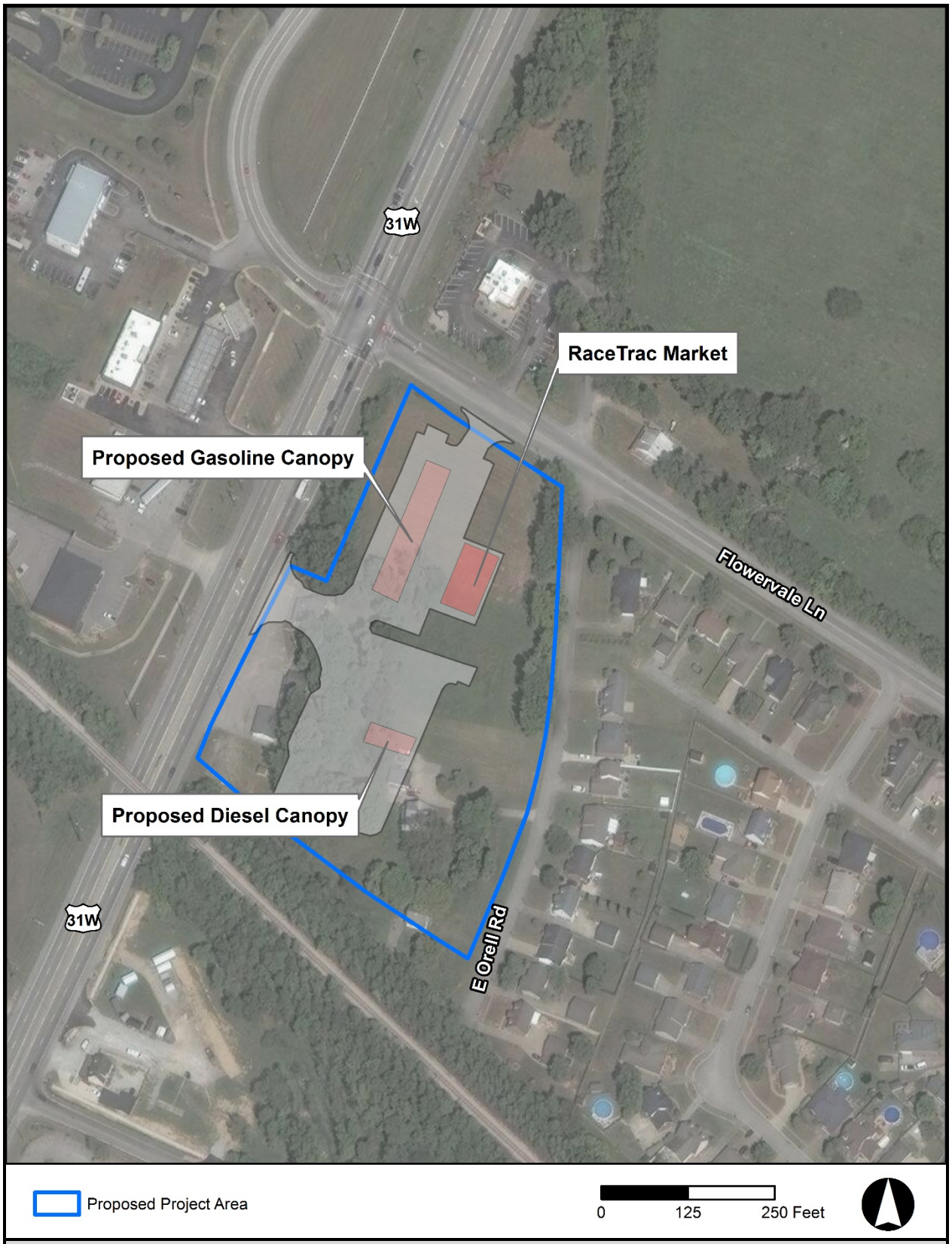

Figure 1.2-2. Proposed RaceTrac Site Map

CHAPTER 2 – METHODOLOGY

2.1 QUANTITATIVE NOISE ASSESSMENT METHODOLOGY

To quantify the noise contribution of the proposed RaceTrac facility (Site A) to the noise environment of the residences to the southeast along Orell Road, ambient (existing) sound pressure level measurements were conducted at the proposed site.

Similar readings were also taken at a surrogate site, a Fivestar gas station (Site B) located at Blue Lick Road and Brenton Way in Louisville, KY. This site was chosen due to a similar configuration that includes a separated operational diesel canopy. Sound pressure level measurements were also taken at a vacant field (Site C) adjacent to the surrogate site concurrently. This site was chosen to compare results simultaneously recorded with the operational gas station, to differentiate sound generated by the roadway and general environment and that generated by the fueling operation. These sites are shown in 2.3-1.

In addition to the similarity in configuration, it was determined that Blue Lick Road at Site B has a similar traffic volume (average daily traffic, ADT) and truck percentage (%T) to those along Dixie Highway at Site A. Utilizing the Kentucky Transportation Cabinet's (KYTC) Interactive Traffic Map, Dixie Highway has a traffic volume of 32,874 ADT and a truck percentage of 9.78%, at Site A whereas Blue Lick Road has a traffic volume of 26,145 ADT and a truck percentage of 7.98% at Site B. With a similar configuration and traffic, the sound pressure level measurements at Site B were used to develop a calculated level for the surrounding areas of the proposed RaceTrac, should it be constructed and operating at the project site along Dixie Highway.

Noise measurements at Sites A and Site C were conducted with a Rion NL-20 precision integrating sound level meter that was factory calibrated and certified to within specifications (see Appendix C) and field calibrated prior to each measurement with a Rion NC-73 acoustical calibrator to ensure the accuracy of the measurements. A second noise meter was required at Site B to record simultaneously with Site C. A Bruel & Kjaer Type 2236 precision integrating sound level meter that was factory calibrated and certified to within specifications (see Appendix B) and field calibrated prior to each measurement with a Bruel & Kjaer Type 4230 acoustical calibrator to ensure accuracy of the measurements. All sound level values were measured in and are expressed in terms of A-weighted decibels (dB[A]). Definitions of terms used in this evaluation are included in Appendix A.

Thirty-minute ambient noise measurements were conducted simultaneously at Sites B and C (the surrogate site) at 7:00 AM, 12 Noon, 4:30 PM, 10:00 PM and 1:00 AM on July 29, 2020. For Site A (the proposed RaceTrac location), readings were taken at the same five times on August 5, 2020. These hours were selected to represent a composite of noise levels on a typical day, including the busiest operating hours of an operational gas station, to determine the contribution of highway traffic noise to the existing noise environment, and to evaluate any impacts the proposed RaceTrac facility might have on the existing noise environment. The number of vehicles using the diesel pumps or idling in the vicinity of the pumps was also recorded. Each noise meter was placed approximately 460 feet from the largest noise contributor, Dixie Highway at Site A and John Harper Highway (KY 1526) and Blue Lick Road at Site B and C.

In addition, to the thirty-minute ambient measurements, one fifteen-minute validation reading was conducted at 7:50 AM on August 5, 2020, in the proposed development area within 500 feet of Dixie Highway. This will be used to validate the model that was used for the noise barrier analysis.

All noise measurements were conducted during meteorologically appropriate periods (i.e., no rain, wind less than 10 miles per hour [mph]). Measurement locations can be viewed in Figure 2.3-1.

2.2 TNM BARRIER METHODOLOGY

Since the dominant noise source for the proposed location is highway traffic noise a model was created to assess sound levels from the traffic noise and evaluate the potential sound level reductions that could be obtained by building a sound wall along the back edge of the proposed property, between the RaceTrac and the residences. Roadway segments were modeled in TNM for the existing Dixie Highway and Flowervale Road roadways. This includes roadway features such as lane lines and shoulders. Terrain lines were also added to the model to account for changes in the surrounding landscape, such as drainage ditches or rock cuts. The TNM model will be used to determine the potential sound level reductions of both a 6-foot and an 8-foot noise barrier.

2.3 MODEL VALIDATION

While the TNM model uses the traffic volumes for predicting noise level, the field noise measurements are used to "validate" the models. The validation process involved obtaining noise measurements at a selected point near the existing roadway while making simultaneous classification counts and estimating travel speed. The observed traffic counts were then converted to hourly volumes. These volumes, along with the estimated travel speeds, were entered into a TNM model created for the project area. The posted speed limit for Dixie Highway relative to the project area is 50 mph. Modeled noise levels were compared to the field measured noise levels, and if they were within 3 dB(A) of the measured levels the model is considered validated and can be used for making highway traffic noise predictions. The location of the field noise measurement can be seen in Figure 2.3-1.

The predicted values for the validation receiver were found to be within 3 dB(A) of the field measured values. A summary of noise level validation results is provided in Table 2.3-1. With validated results, the TNM model was used to predict values for receivers, or modeled points in the model that equate to a single residence, in the immediate vicinity of the roadways based on existing traffic data for the facility.

Table 2.3-1. Noise Level Validation Summary

RECEIVER	DESCRIPTION	START TIME	MEASURED SOUND LEVEL DB(A)	MODELED SOUND LEVEL DB(A)	VALIDATION SUCCESSFUL?
V1	Vacant Field	7:50 a.m.	53.7	52.0	Yes

At the time of the noise measurements, traffic density could be less than normal as a result of commuters working from home due to the Covid-19 pandemic, excluding professions deemed "essential." However, while this could potentially cause a noise sound level that's lower than normal conditions, the purpose of the measurements is only for comparison with the noise levels predicted by the TNM model and to validate the model. The TNM model uses the traffic volumes as described, which is independent of the traffic density observed during the Covid-19 pandemic and reflect normal conditions along Dixie Highway. Field measurement sound levels are strictly to validate the TNM model.

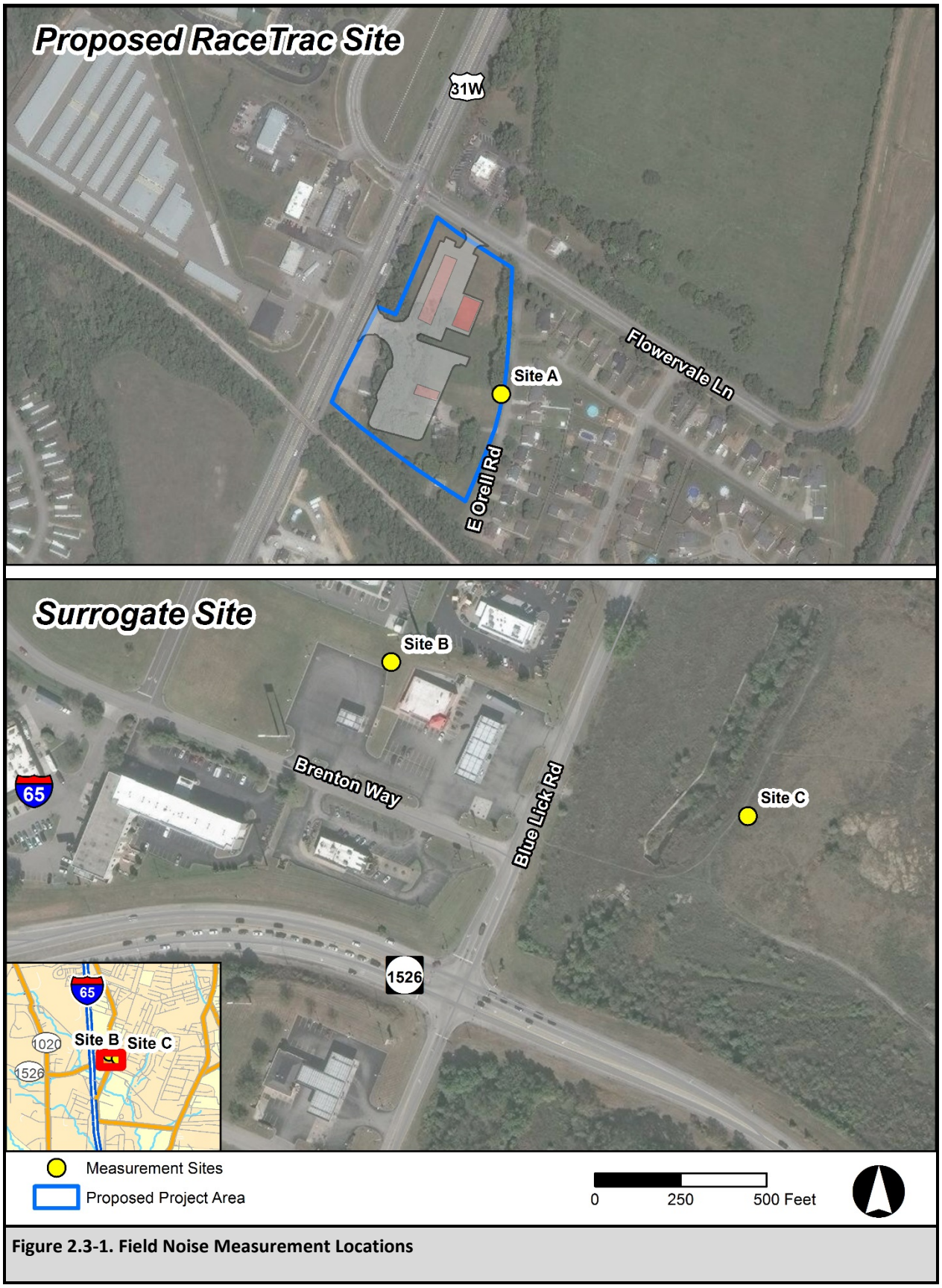

Figure 2.3-1. Field Noise Measurement Locations

CHAPTER 3 – RESULTS

3.1 QUANTITATIVE ASSESSMENT

On July 29, 2020 the following measurements were recorded for the Fivestar surrogate site (Site B): 62.1 dB(A), 61.5 dB(A), 58.2 dB(A), 57.9 dB(A), and 58.9 dB(A), at 7:00 AM, 12 Noon, 4:30 PM, 10:00 PM, and 1:00 AM, respectively. The following measurements were recorded simultaneously in the vacant field (Site C) adjacent to the Fivestar surrogate site: 57.3 dB(A), 55.3 dB(A), 60.9 dB(A), 60.5 dB(A), and 59.7 dB(A), at 7:00 AM, 12 Noon, 4:30 PM, 10:00 PM, and 1:00 AM, respectively. These levels represent a composite of the ambient noise environments for these two locations. However, the largest noise contributor for Site B is trucks using the diesel pumps, combined with traffic noise, and the largest noise contributor for Site C is traffic noise from Blue Lick Road and KY 1526. In addition, these two sites are within 2,000 feet of I-65, and in the flight path for commercial flights into Muhammed Ali International Airport (SDF), where planes were observed periodically throughout measurement times; thus, contributing to the ambient noise levels in the area. However, because these measurements were taken simultaneously, they all account for ambient and transportation related noise sources. Sound level measurement results for these sites are provided in Table 3.1-1.

Table 3.1-1. Ambient Noise Levels at Measurement Sites in dB(A) (Leq)

MEASUREMENT TIME	SITE B AMBIENT NOISE LEVEL dB(A)	SITE C AMBIENT NOISE LEVEL dB(A)	EFFECTIVE CONTRIBUTION OF OPERATING DIESEL STATION dB(A)
7:00 AM	62.1	57.3	**4.8**
12 Noon	61.5	55.3	**6.2**
4:30 PM	58.2	60.9	**0**
10:00 PM	57.9	60.5	**0**
1:00 AM	58.9	59.7	**0**

As expected, Site B had a higher noise level than Site C when there were more vehicles using the diesel pump and/or idling in the vicinity of the pumps, as seen with the 7:00 AM and 12 Noon values in Table 3.1-1. The diesel pump canopy had a total of five light trucks (two-axle trucks), one medium truck (three-axle trucks), and two heavy trucks (semi-trucks, or trucks with more than three-axles) at 7:00 AM, which lead to the 4.8 dB(A) difference between Site B and C. At 12 Noon, there was one light, one medium, and one heavy truck using the diesel pumps, contributing to a 6 dB(A) difference between Site B and C. During the 4:30 PM readings, there was one light and one medium truck using the diesel pumps. The lack of use of the pumps and a firetruck passing by Site C along KY 1526 and continuing down West Hebron Lane contributed to Site C having a greater noise level by 2.7 dB(A). For both the 10:00 PM and 1:00 AM readings, there were no trucks recorded using the diesel pumps, which contributed to Site C having a greater noise level by 2.6 dB(A) and 0.8 dB(A), respectively. Furthermore, for the 4:30 PM, 10:00 PM, and 1:00 AM readings, the contribution of an operating diesel pumping station to the common noise environment is less than that of an open field, so a 0 dB(A) noise level was determined as seen in Table 3.1-1. This can be attributed to reduced traffic volumes due to the time of day, and the local ambient noise overtaking vehicle traffic as the major noise contributor during these readings. In addition, Site C is situated in a field with tall grass and the night noise environment being dominated by

insect noise, while the noise meter at Site B was setup in recently mowed and maintained grass at the curb of northeastern corner of the diesel pump pavement. An increase in noise levels at night was also observed at the proposed RaceTrac Site due to ambient insect and wildlife noise, and a reduced traffic volume on Dixie Highway. It is important to note that for both locations, along heavily traveled roadways with commercial development, the overall noise level is due to the road, commercial operations and general ambient noise and does not meaningfully change between 7:00 AM and 1:00 AM (see Site B in Table 3.1-1).

On August 5, 2020 the following measurements were recorded for the proposed RaceTrac Site (Site A), 54.2 dB(A), 54.4 dB(A), 53.8 dB(A), 56.6 dB(A), and 55.8 dB(A), at 7:00 AM, 12 Noon, 4:30 PM, 10:00 PM, and 1:00 AM, respectively. These levels represent a composite of the ambient noise environment with Dixie Highway being the largest noise contributor at the proposed site. In addition, there is a railway corridor that is located south of the proposed RaceTrac facility that periodically contributes to the ambient noise levels in the area. Sound level measurement results for these sites are provided in Table 3.1-2.

The difference between Site B and Site C, as shown above, were then added to the ambient sound level measured at Site A for each hour at 7:00AM, 12 Noon, 4:30 PM, 10:00 PM, and 1:00AM, to express the sound levels at the border of the proposed RaceTrac project site. Those values are given in Table 3.1-2.

Table 3.1-2. Noise Contribution of Operating RaceTrac Facility at Site A

MEASUREMENT TIME	SITE A AMBIENT NOISE LEVEL dB(A)	CONTRIBUTION OF OPERATING DIESEL STATION dB(A)	PREDICTED TOTAL NOISE LEVEL dB(A)
7:00 AM	54.2	4.8	59.0
12 Noon	54.4	6.2	60.6
4:30 PM	53.8	0	53.8
10:00 PM	56.6	0	56.6
1:00 AM	55.8	0	55.8

To provide a reference for the measured and calculated sound levels a range of common sounds and their associated levels is included here.

- 40 dB equates to an average home living room, library;
- 44 dB equates to bird calls;
- 42-56 dB equates to a suburban residential area;
- 50 dB equates to an average office, soft music, or quiet suburban area;
- 60 dB equates to normal conversational speech;
- 70-80 dB equates to a highway at 50 feet;
- 85 dB equates to heavy traffic (including large trucks), a noisy restaurant;
- 90 dB equates to a passing motorcycle at close range;
- 110-120 dB equates to a rock concert.

As shown in Table 3.1-2 above, the noise levels with, or without the RaceTrac facility all fall within typical urban sound environments and for the residents in the area of the proposed facility the noise

level changes with an operational RaceTrac facility would not raise the noise environment above that of typical conversational levels.

3.2 BARRIER ASSESSMENT

To determine if a sound level barrier along the eastern edge of the proposed property would provide meaningful noise attenuation, a barrier analysis was performed. Since it was determined from the surrogate site analysis that for most hours of the day the ambient noise (dominated by the highway traffic) is independent of a single operation, a traffic barrier analysis is valid for determining the effectiveness of mitigation with structural noise walls. Evaluating the results of the barriers, a 6-foot barrier yields an average noise reduction 0.4dB(A) per modeled receiver, with a maximum noise reduction of 0.8 dB(A). A 6-foot barrier at this location is an ineffective means of noise reduction due to the distance from the edge-of-pavement of Dixie Highway and its height.

Modeling an 8-foot barrier in the same location yields an average noise reduction of 0.7 dB(A) per modeled receiver, with a maximum noise reduction of 1.5 dB(A). The noise level with and without a 8-foot barrier and the noise reduction the barrier provides per receiver can be viewed in Table 3.2-1, and their corresponding locations can be viewed on Figure 3.2-1.

Table 3.2-1. 8-Foot Barrier Results

RECEIVER	PREDICTED NOISE WITH NO BARRIER dB(A)	PREDICTED NOISE WITH 8FT BARRIER dB(A)	NOISE REDUCTION dB(A)
7	53.4	51.9	1.5
8	53.1	51.6	1.5
6	52.6	51.3	1.3
4	52.0	50.8	1.2
2	52.2	51.2	1.0
3	51.8	50.9	0.9
5	51.0	50.1	0.9
9	53.5	52.6	0.9
11	53.7	52.8	0.9
20	49.7	48.8	0.9
1	55.9	55.1	0.8
19	49.6	48.8	0.8
21	50.3	49.5	0.8
18	49.2	48.6	0.6
23	51.0	50.5	0.5
10	52.6	52.2	0.4
14	50.7	50.3	0.4
15	50.2	49.8	0.4
22	50.5	50.1	0.4

RECEIVER	PREDICTED NOISE WITH NO BARRIER dB(A)	PREDICTED NOISE WITH 8FT BARRIER dB(A)	NOISE REDUCTION dB(A)
13	51.3	51.0	0.3
16	49.6	49.3	0.3
12	51.9	51.7	0.2
17	49.1	49.0	0.1

Studies have shown that the average human can only detect a difference in sound levels where the is a 3 dB(A) or greater difference. These noise reductions, and associated changes all fall in the attenuation levels that would not be considered perceptible to the human ear.

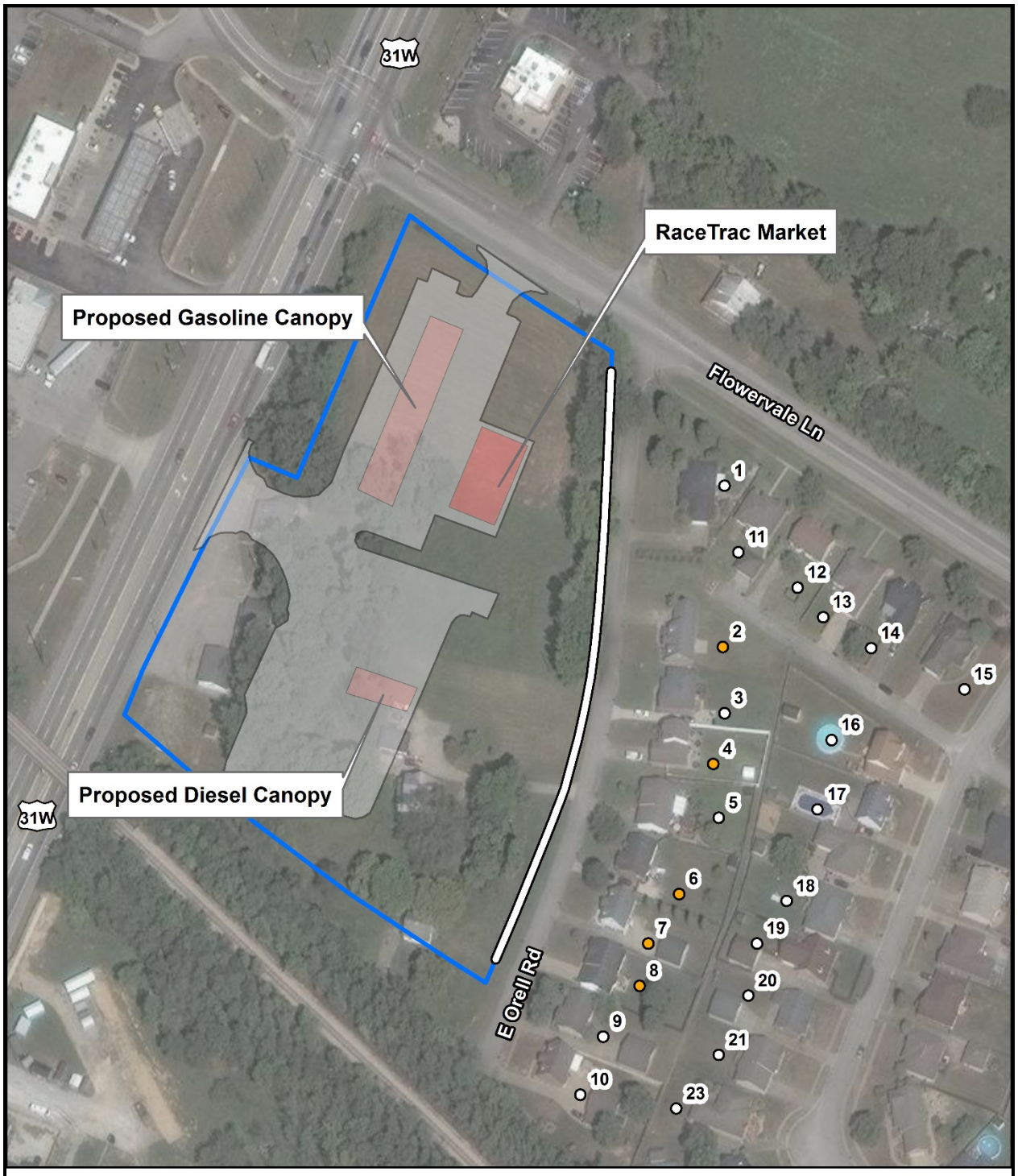

Figure 3.2-1. 8-Foot Barrier Results

CHAPTER 4 – SUMMARY

Based on the field measured ambient sound level data and calculated sound levels using real-world measurements from an operational gas station with a similar configuration to the proposed RaceTrac facility, calculations showed there would be no substantial change in the sound level of the existing noise environments from the implementation of the proposed project.

The following conclusions were reached based on this noise assessment of the proposed RaceTrac facility:

- At ambient measurement Site A, the sound level for the proposed RaceTrac facility was calculated using the difference between the Fivestar surrogate site (Site B) and the adjacent field site (Site C), indicating the contribution of noise levels from an operational gas station. These values were then added to the ambient levels recorded at Site A indicating that the generated sound level could increase from 54.2 dB(A) to 59.0 dB(A), and from 54.4 dB(A) to 60.6 dB(A) at 7:00 AM and 12 Noon, respectively. These levels equate to a typical urban/suburban area background level.

- Combining the calculated sound levels generated from an operational gas station with the existing sound levels results in changes in sound levels that range from 4.8 dB(A) to 6.2 dB(A) for the Site A measurement location. This change in the sound level of for these residences would be considered perceptible (a 3 dB(A) change is the first change considered to be barely perceptible) between 7:00 AM and 12 Noon. This change in the sound level for these residences are perceptible.

- The contribution of noise from an operational gas station, when added to the existing noise environment, is dependent on use, which can decrease throughout the course of a day. During the 4:30 PM, 10:00 PM, and 1:00 AM noise levels at Site B were less than noise levels recorded at Site C. There were two vehicles recorded using the pumps at 4:30 PM and no recorded vehicles using the pumps at 10:00PM and 1 AM; therefore, for these time periods, there is no additional contribution of noise to the ambient noise environment from an operating diesel pump station. This can be attributed to the decrease in overall traffic along nearby highways and an increase in noise from insects and wildlife. There would be no additional decibels added to the noise levels recorded at Site A, and the measured ambient sound levels would remain relatively the same. These results demonstrate that for this noise environment, comprised of a heavily traveled roadway and existing commercial operations, that there is little variation in the noise level throughout the day.

- The construction of an 8-foot barrier along the eastern boundary of the proposed RaceTrac site would be ineffective mitigating noise in the existing noise environment. It provides an average noise reduction of 0.7 dB(A) and a maximum noise reduction of 1.5 dB(A), which is not considered perceptible to the human ear. This is due to the fact that the noise wall would be too short to mitigate sound from the major noise generator in the area, the US 31W/Dixie Highway facility. The noise wall modeling cannot determine how much sound that is generated by the RaceTrac would be mitigated but as previously shown, a facility of this type, in this noise environment, only adds to the sound levels during high travel times.

- The existing location is along a highly traveled US Highway with existing commercial operations of a similar type to the proposed RaceTrac facility. Data from the surrogate site indicates that the additive sound from the proposed RaceTrac would only increase the overall noise level of the area by 5-6 dB(A) during higher traffic times and that the levels at the residences would not exceed the levels of conversational speech at any measured time.

This study measured sound levels, determined the noise contribution of an operational gas station on the adjacent ambient noise environment, and calculated the potential increase of noise a new facility at the proposed site would create, all demonstrating that the proposed RaceTrac, while it may be audible, it will not meaningfully affect the sound levels of the surrounding residential properties.