

CAR WASH SOUND STUDY

**TAKE 5 EXPRESS CAR WASH
BLOCK 2201, LOT 20
TOWNSHIP OF LAWRENCE
MERCER COUNTY, NEW JERSEY**

Prepared For:

Driven Brands
440 South Church Street, Suite 700
Charlotte, North Carolina 28202

Prepared By:

Pennoni
515 Grove Street, Suite 1b
Haddon Heights, New Jersey 08035
T: 856-547-0505
www.pennoni.com

A handwritten signature in black ink, appearing to read "Chad Gaulrapp", is written over a horizontal line.

Chad Gaulrapp, PE
New Jersey License No. 24GE041350

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PROJECT INTRODUCTION

Pennoni Associates, Inc. (PAI) was retained by Driven Brands to prepare a sound study for the prototype car wash facility to determine the sound level generated by mechanical equipment being used, and the impact that it has on the surrounding environment. The primary purpose of the study is to determine the distance from the sound sources associated with the car wash to the location of an acceptable residential sound level (65dBA), without the use of additional sound attenuation measures.

The study focused on the 15-hp dryers located at the tunnel exit, and the 40-hp vacuum turbine (which powers each of the vacuum stations). Typical sound levels of daily occurrences are noted below:

TYPICAL SOUND LEVELS			
Sound Source	Sound Level (dBA)	Sound Source	Sound Level (dBA)
Whisper, Quiet Room	20	Lawnmower, Hair Dryer	90
Soft Music	30	Motorcycle, Construction Site	100
Home Computer Fan	40	Rock Concert, Jackhammer	110
Home A/C, Light Traffic	50	Air Raid Siren	135
Normal Conversation	60	Pain Threshold, Jet Engine	140
Dishwasher, Toilet Flush	70	Handgun	150
Alarm Clock, Inside an Airplane	80	Rocket Launch	180

FIELD DATA COLLECTION

PAI performed field investigations at three active Take 5 Car Wash locations using a Latnex SM-130DB Sound Level Meter. The sound meter was calibrated to the “A”-weighted decibel range, giving more value to frequencies in the middle of human hearing range and less value to frequencies at the edges as compared to a flat audio decibel measurement.

Sound level readings were taken by Pennoni throughout each of the three locations during normal operation to evaluate the typical sound distribution within each site. Sound level measurements were taken relative to the car wash entrance, the car wash exit (dryer location), and vacuum turbine. The field data was evaluated in conjunction with the sound specifications provided by the equipment manufacturers. Sound level readings were also taken at the adjacent roadways when the car wash equipment was not running to determine typical ambient traffic sound levels.

Site characteristics of the three car wash locations are listed below:

Site A: Site A consists of a 125 ft tunnel with a 15 hp dryer with no exterior sound attenuation, and a 40 hp vacuum turbine with no enclosure for 17 vacuum stalls. The site is located at the corner of the intersection of an arterial road and a collector road, with a local road separating the site from residential properties toward the car wash exit.

Site B: Site B consisted of a 125 ft tunnel with a 15 hp dryer with no exterior attenuation, and a 40 hp vacuum turbine with no enclosure for 25 vacuum stalls. The site is located between two local roads, with commercial properties along each side.

Site C: Site C consisted of a 125 ft tunnel with a 15 hp dryer with no exterior attenuation, and an enclosed 40 hp vacuum turbine for 13 vacuum stalls. The site is located between a local road (toward car wash entrance) and an arterial road (toward the car wash exit), with commercial properties along each side.

Ambient traffic sound levels were found to be as follows while the car wash equipment was not in operation:

- Local Roads: 54 - 60 dBA
- Collector Roads: 60 - 65 dBA
- Arterial Roads: 65 – 71 dBA

RESULTS

The sound levels were collected at the car wash entrance and exit, and at the vacuum turbine, starting at each source, and at increasing horizontal intervals away from each sound source as shown on the figures in Appendix A. The sound levels at the car wash exit ranged from 91 dBA to 92.6 dBA. The sound levels measured at the vacuum turbines ranged from 74.1 to 79.5 at the source. The vacuum turbine at the Site C is located within an eight foot high concrete (CMU) enclosure. The sound level of 64.5 dBA was measured just outside of the vacuum equipment enclosure. The above data compares to the decibel levels provided by the equipment manufacturer as follows:

- 15 hp Dryer: 95.8 dBA measured 1 meter from source, 93.4 w/ baffle and max air flow, and 89.2 dBA w/ baffle and min air flow, all with no exterior sound attenuation.
- 40 hp Vacuum Turbine: 73 dBA measured at source w/o enclosure, and 58 dBA measured just outside enclosure.

ANALYSIS

The measured sound levels, and manufacturer sound data was used to determine a conservative distance from each noise source to reach the acceptable residential standard. Since the measured sound levels at the car wash exit at 3 sites were consistent (between 91 and 92.6 dBA) we may presume the dryer was baffled with a mid to high-range air flow. The sound levels at increasing distances from each noise source was calculated using the Inverse Square Law “Sound Attenuation Equation” below:

$$\text{SPL}_2 = \text{SPL}_1 - 20 \log (R_2 / R_1)$$

- SPL_1 – Sound pressure level at point 1
- SPL_2 – Sound pressure level at point 2
- R_1 – Distance from the sound source to point 1
- R_2 – Distance from the sound source to point 2

Vacuum Blower: The sound level measured at the vacuum turbine was 78 dBA. The data is not pertinent to this study as all new sites will include a block enclosure similar to that at Site C where the sound level was measured to be 64.6 dBA outside the enclosure. No additional sound attenuation is required as this sound level is less than the permissible level at the closest residential property boundary.

Car Wash Entrance: The sound levels measured at the car wash entrance were just below 85 dBA. Ambient sound (from other sources both on and off site) potentially interfere with the sound measurements readings as the distance from the source increases. However, the target sound level of 65 dBA was consistently found to be approximately 90 ft from the entrance. The Sound Attenuation Equation was used to check the field measured

data, with a calculated result of 83.2 ft from the car wash entrance to reach 65 dBA. This is consistent with the field measured results and the more conservative 90 ft will be used.

Car Wash Exit: The sound levels measured at the car wash exit were just below 93dBA. Ambient sound (from other sources both on and off site) potentially interfere with the sound measurements readings as the distance from the source increases. As depicted In the Figures included in Appendix B, the lowest sound level measured from the car wash exit (dryer location) was approximately 70 dBA as consistent road noise interfered with the readings. Since the distance to which a decibel level of 65 dBA could not be measured at any of the three sites, the Sound Attenuation Equation was used to calculate the distance to be 120 ft from the source using the field data, and 114 ft using the manufacturer's data.

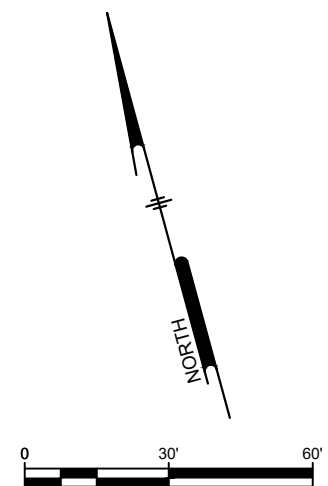
CONCLUSION

In summary, the distance required to reach the acceptable residential sound levels was found to be:

- Vacuum Blower: The field measure and manufacturer data both indicate a decibel level less than 65 dBA adjacent to the block enclosure. No additional attenuation is needed.
- Car Wash Entrance: 90 ft from entrance door. Additional attenuation should be provided if a residential property boundary is located closer than 90' to this noise source.
- Car Wash Exit: 120 ft from exit door (dryer location). Additional attenuation is available from the manufacturer and should be provided if a residential property boundary is located closer than 120' to this noise source.

APPENDIX A – FIELD INVESTIGATION FIGURES

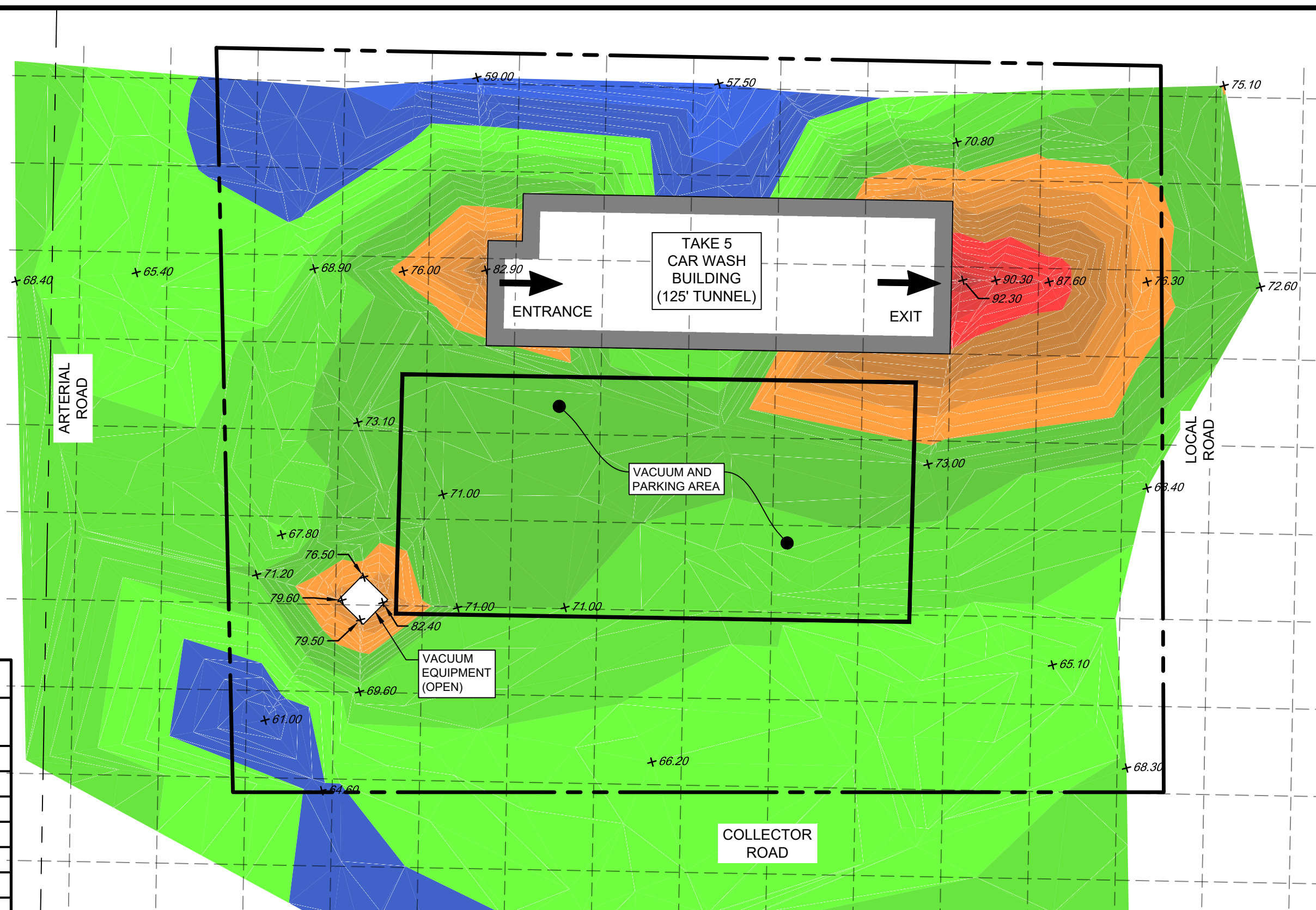
U:\ACCOUNTS\DRIVER\DRVBR22050 - TAKE 5 CAR WASH SOUND STUDY\DESIGN\SHEETS\FIG-1-2 SOUND MAP.DWG
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PROPOSED LEGEND

- PROPERTY LINE
- SOUND LEVEL READING (dBA)
- BUILDING OUTLINE
- OVERHANG
- 25' GRID LINE

Elevations Table			
NUMBER	COLOR	ELEVATION (min)	ELEVATION (max)
1		55.00	58.00
2		58.00	61.00
3		61.00	65.00
4		65.00	68.00
5		68.00	71.00
6		71.00	75.00
7		75.00	78.00
8		78.00	81.00
9		81.00	85.00
10		85.00	88.00
11		88.00	91.00
12		91.00	95.00



- NOTE:**
1. TRAFFIC SOUND LEVEL READINGS WERE TAKEN WHEN NEITHER THE CAR WASH OR VACUUM EQUIPMENT WAS RUNNING.
 2. VACUUM EQUIPMENT IS NOT CONTAINED WITHIN AN ENCLOSURE AT THIS LOCATION
 3. ± 1.3 ACRE SITE

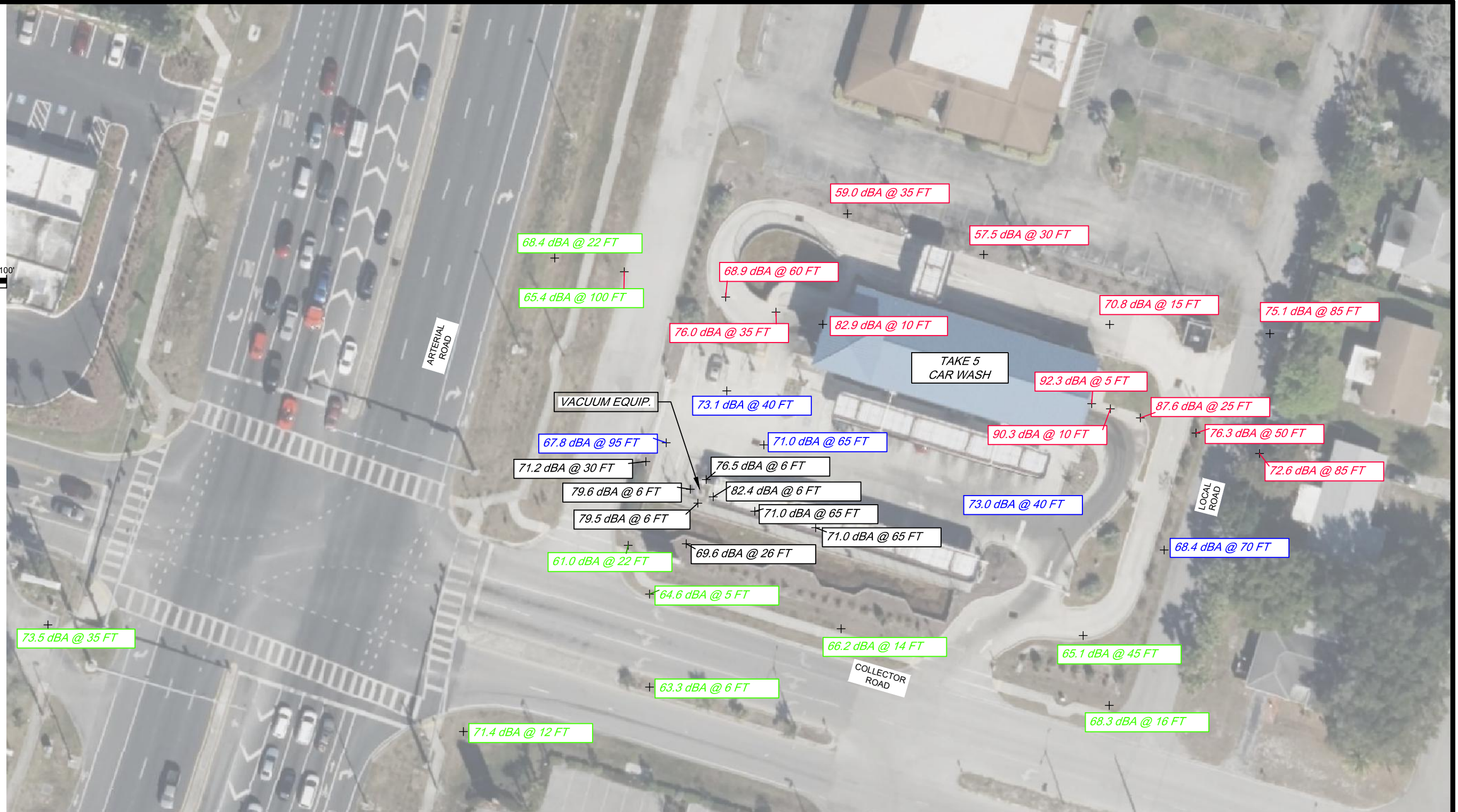
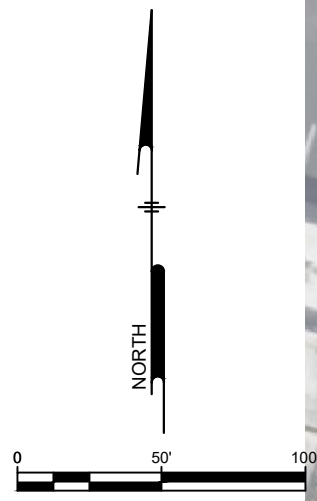
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 Landscape Architects
FLORIDA COA 7819
 5755 Rio Vista Drive • Clearwater, FL 33760
 T 727.536.8772

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SCALE: 1"=50'	DATE: 2022-12-13	DRVBR22050

SOUND STUDY
 TAKE 5 CARWASH - SITE A

DRAWING NO.	FIG-1.0

U:\ACCOUNTS\DRIVER\DRVBR22050 - TAKE 5 CAR WASH SOUND STUDY\DESIGN\SHEETS\FIG-1-2.DWG
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LEGEND

- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH (MIXED SOUND SOURCE)
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM VACUUM ENCLOSURE
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM ROADWAY

NOTE:

1. TRAFFIC SOUND LEVEL READINGS WERE TAKEN WHEN NEITHER THE CAR WASH OR VACUUM EQUIPMENT WAS RUNNING.
2. VACUUM EQUIPMENT IS NOT CONTAINED WITHIN AN ENCLOSURE AT THIS LOCATION
3. ± 1.3 ACRE SITE

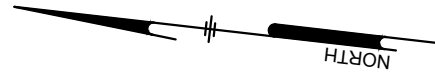
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SCALE: 1"=50'	DATE: 2022-12-13	DRVBR22050

SOUND STUDY
 TAKE 5 CARWASH - SITE A

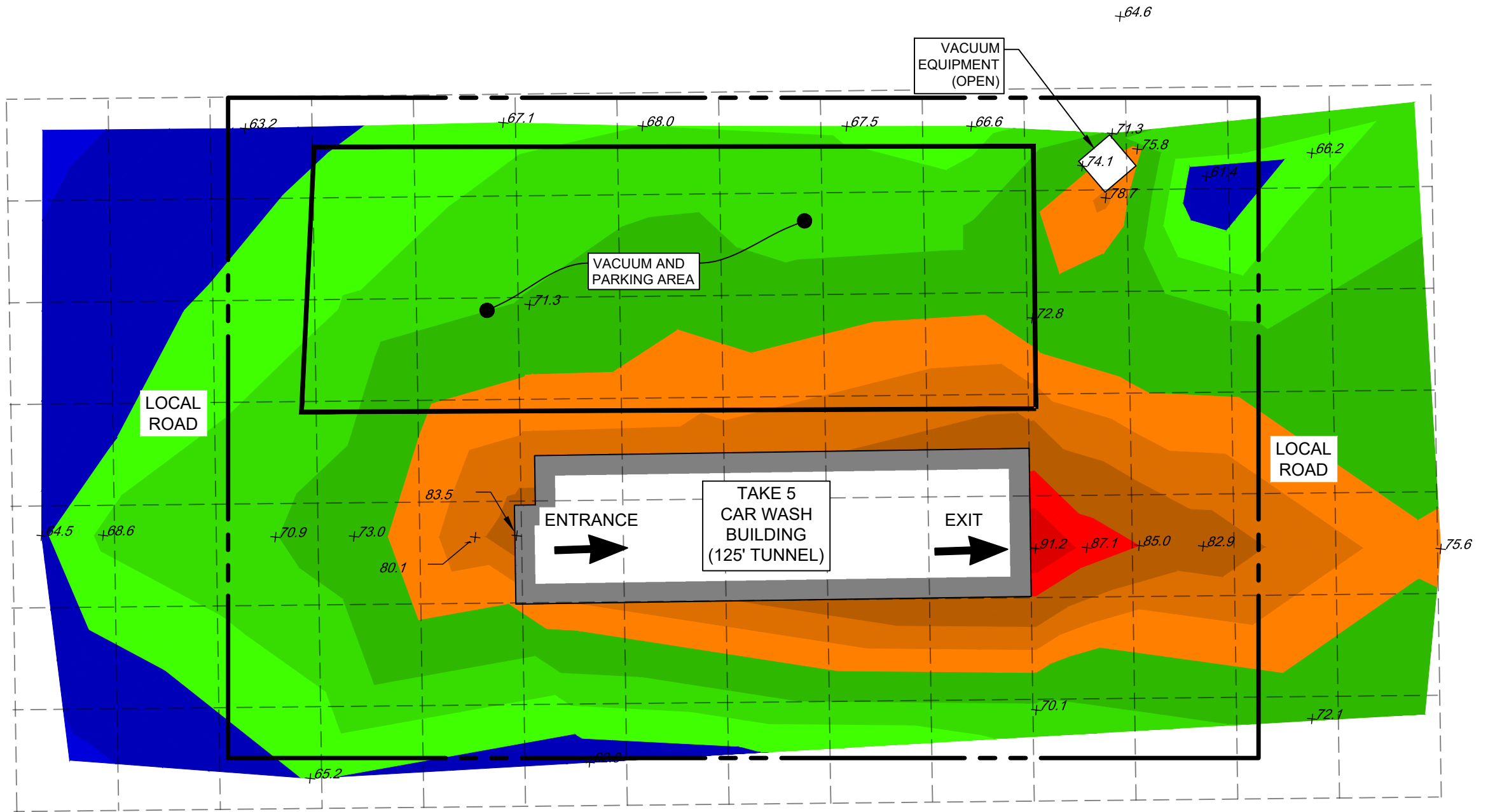
DRAWING NO.	
FIG-1.1	

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PROPOSED LEGEND

- PROPERTY LINE
- SOUND LEVEL READING (dBA)
- BUILDING OUTLINE
- OVERHANG
- 25' GRID LINE



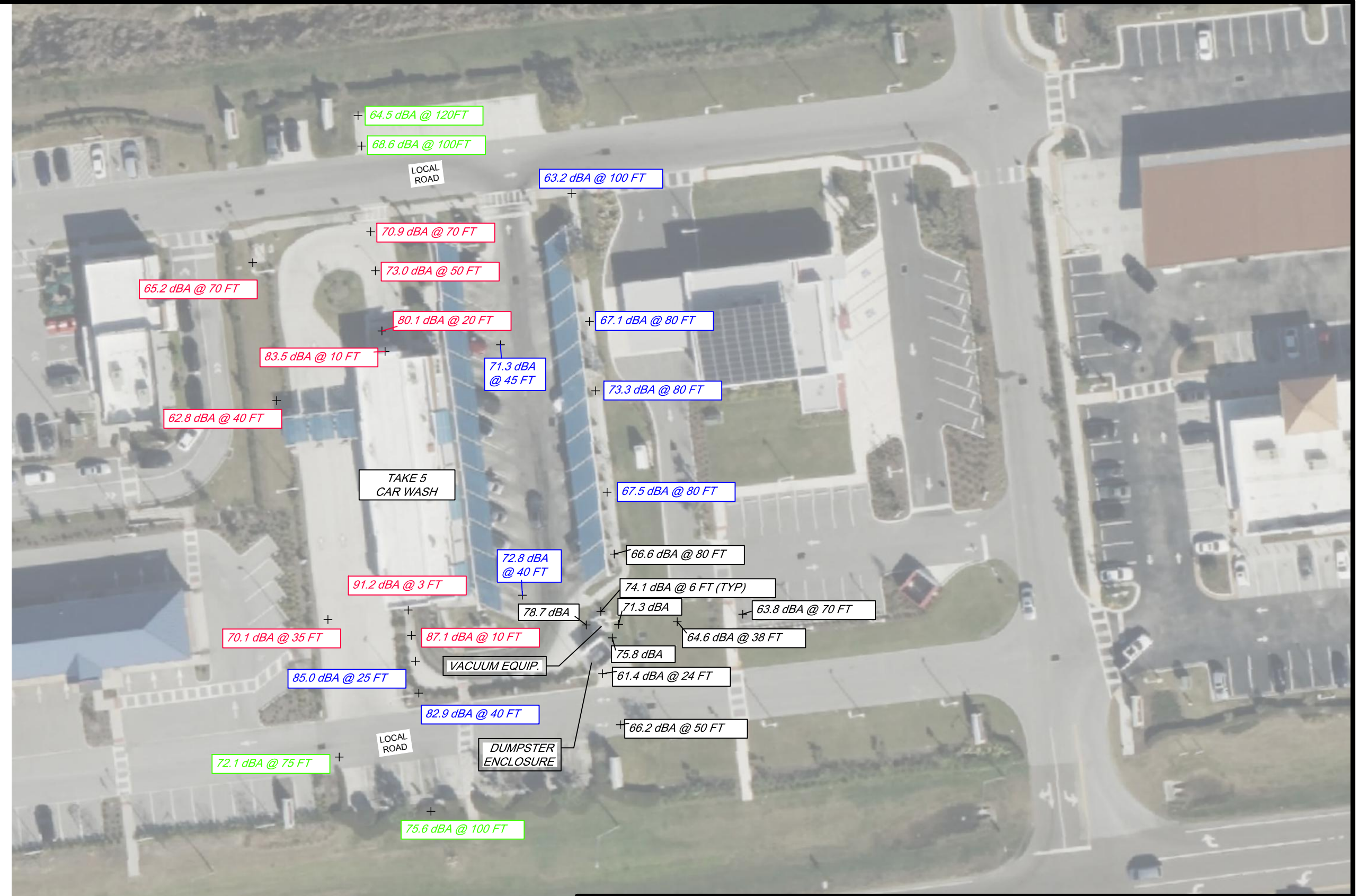
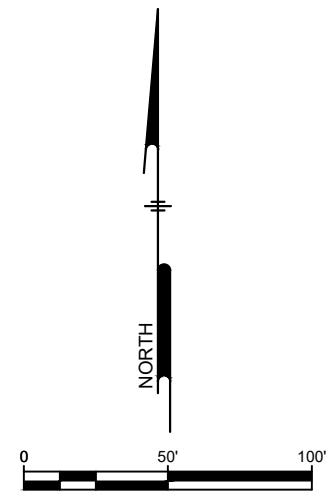
Elevations Table			
NUMBER	COLOR	ELEVATION (min)	ELEVATION (max)
1		55.00	58.00
2		58.00	61.00
3		61.00	65.00
4		65.00	68.00
5		68.00	71.00
6		71.00	75.00
7		75.00	78.00
8		78.00	81.00
9		81.00	85.00
10		85.00	88.00
11		88.00	91.00
12		91.00	95.00

NOTE:

1. VACUUM EQUIPMENT IS NOT CONTAINED WITHIN AN ENCLOSURE AT THIS LOCATION
2. ± 0.94 ACRE SITE

<p style="font-size: small; margin: 0;"> Pennoni Associates Inc. Engineers Surveyors Planners Landscape Architects FLORIDA COA 7819 5755 Rio Vista Drive • Clearwater, FL 33760 T 727.536.8772 </p>	<p style="font-size: large; margin: 0;">FIG-2.0</p>		<p style="font-size: small; margin: 0;">DRAWING NO.</p>											
	<p style="font-size: large; margin: 0;">SOUND STUDY</p> <p style="font-size: large; margin: 0;">TAKE 5 CAR WASH - SITE B</p>		<table border="1" style="width: 100%; height: 40px; border-collapse: collapse;"> <tr><td style="width: 25%;"></td><td style="width: 25%;"></td><td style="width: 25%;"></td><td style="width: 25%;"></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table>											
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SCALE: 1"=50'	DATE: 2022-12-13													

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LEGEND

- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH (MIXED SOUND SOURCE)
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM VACUUM ENCLOSURE
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM ROADWAY

NOTE:

1. VACUUM EQUIPMENT IS NOT CONTAINED WITHIN AN ENCLOSURE AT THIS LOCATION
2. ± 0.94 ACRE SITE

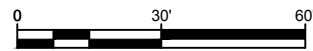
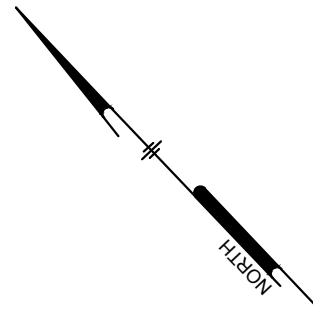
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SCALE: 1"=50'	DATE: 2022-12-13	DRVBR22050

SOUND STUDY
 TAKE 5 CAR WASH - SITE B

DRAWING NO.	
FIG-2.1	

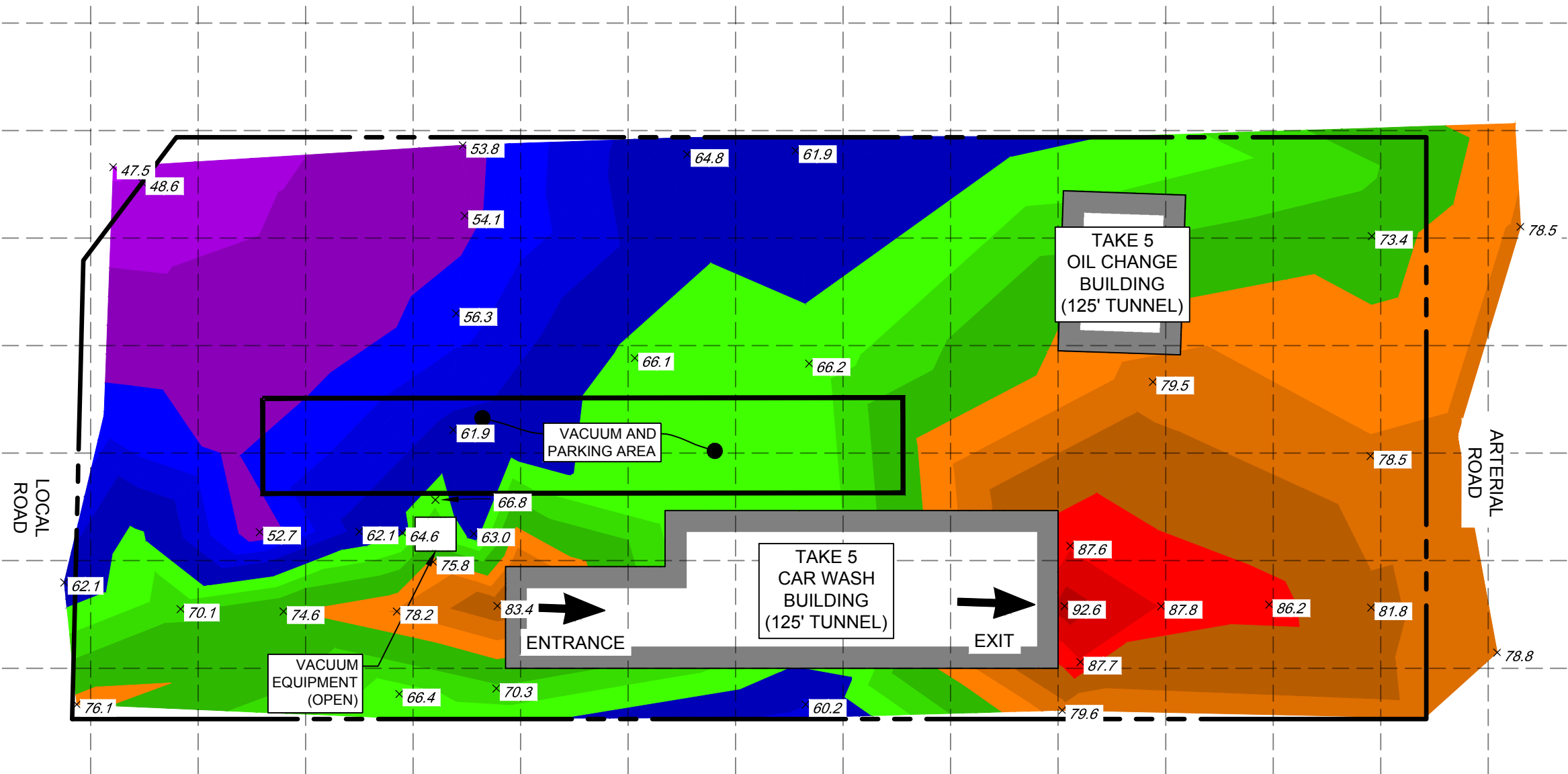
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PROPOSED LEGEND

- PROPERTY LINE
- SOUND LEVEL READING (dBA)
- BUILDING OUTLINE
- OVERHANG
- 25' GRID LINE

Elevations Table			
NUMBER	COLOR	ELEVATION (min)	ELEVATION (max)
1		45.00	48.00
2		48.00	51.00
3		51.00	55.00
4		55.00	58.00
5		58.00	61.00
6		61.00	65.00
7		65.00	68.00
8		68.00	71.00
9		71.00	75.00
10		75.00	78.00
11		78.00	81.00
12		81.00	85.00
13		85.00	88.00
14		88.00	91.00
15		91.00	95.00

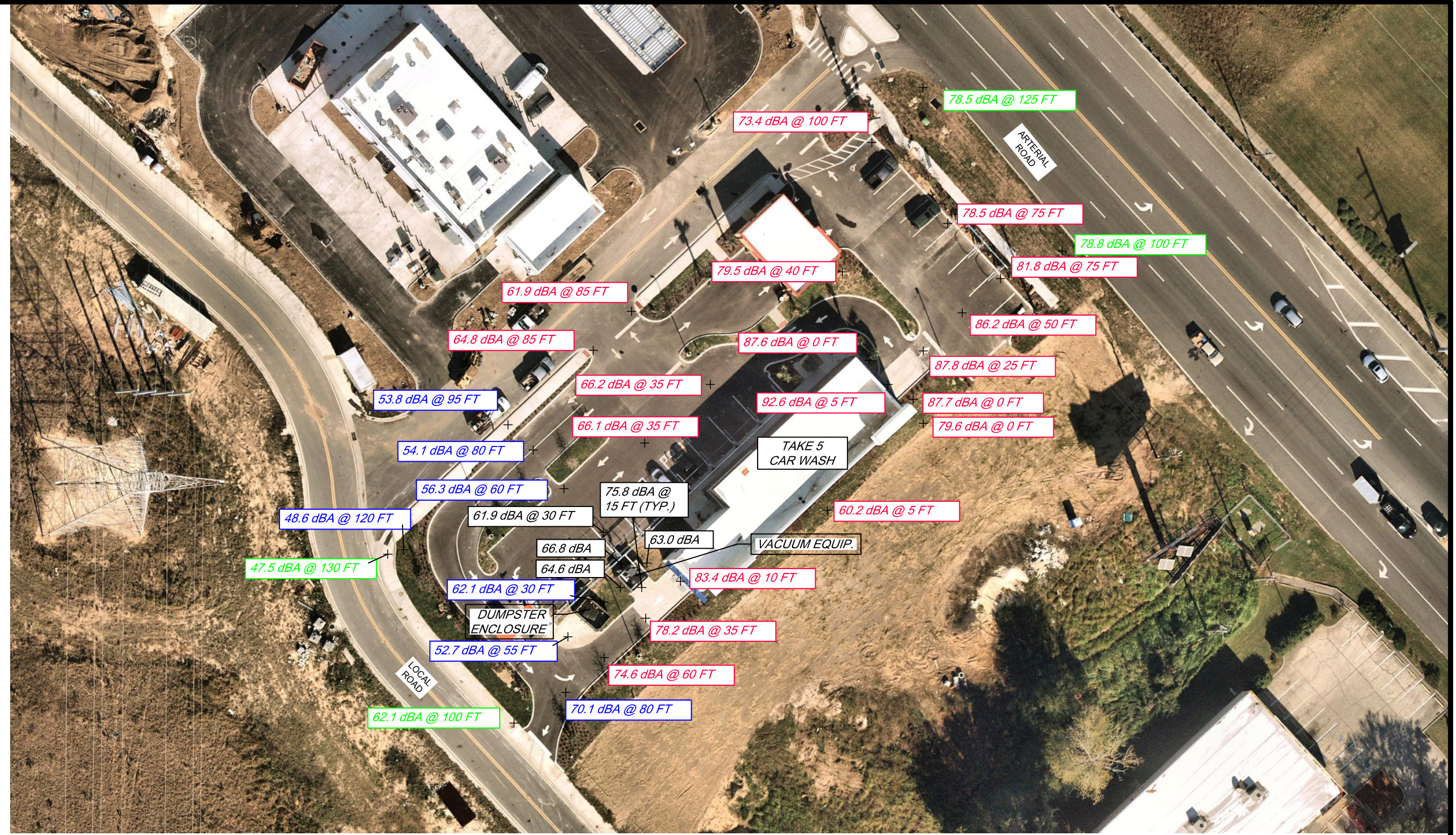
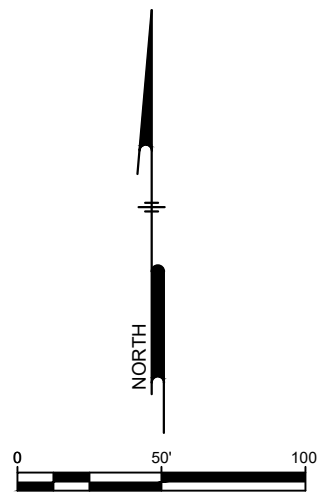


NOTE:

1. TRAFFIC SOUND LEVEL READINGS WERE TAKEN WHEN NEITHER THE CAR WASH OR VACUUM EQUIPMENT WAS RUNNING.
2. VACUUM EQUIPMENT IS CONTAINED WITHIN AN 8-FT HIGH CMU WALL ENCLOSURE AT THIS LOCATION.
3. 0.97 ACRE SITE.

 Pennoni Associates Inc. Engineers Surveyors Planners Landscape Architects <small>FLORIDA COA 7819</small> 5755 Rio Vista Drive • Clearwater, FL 33760 T 727.536.8772	SOUND STUDY TAKE 5 CARWASH - SITE C	DRAWING NO. <h2 style="margin: 0;">FIG-3.0</h2>
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LEGEND

- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM CAR WASH (MIXED SOUND SOURCE)
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM VACUUM ENCLOSURE
- + 68.9 dBA @ 50FT SOUND LEVEL AT DISTANCE FROM ROADWAY

NOTE:

1. TRAFFIC SOUND LEVEL READINGS WERE TAKEN WHEN NEITHER THE CAR WASH OR VACUUM EQUIPMENT WAS RUNNING.
2. VACUUM EQUIPMENT IS CONTAINED WITHIN AN 8-FT HIGH CMU WALL ENCLOSURE AT THIS LOCATION.
3. 0.97 ACRE SITE.

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SCALE: 1"=50'	DATE: 2023-01-18	DRVBR22050

SOUND STUDY
 TAKE 5 CARWASH - SITE C

DRAWING NO.	FIG-3.1

APPENDIX B – MANUFACTURER SPECIFICATIONS



VACUTECH

SOUND LEVEL METER READINGS

MODEL: FT-DD-T440HP3 (40hp T4 VACSTAR TURBINE VACUUM PRODUCER)

READING ONE: 73 DB-A, 3 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

READING TWO: 69 DB-A, 10 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

READING THREE: 54 DB-A, 20 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

READING FOUR: 38 DB-A, 30 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

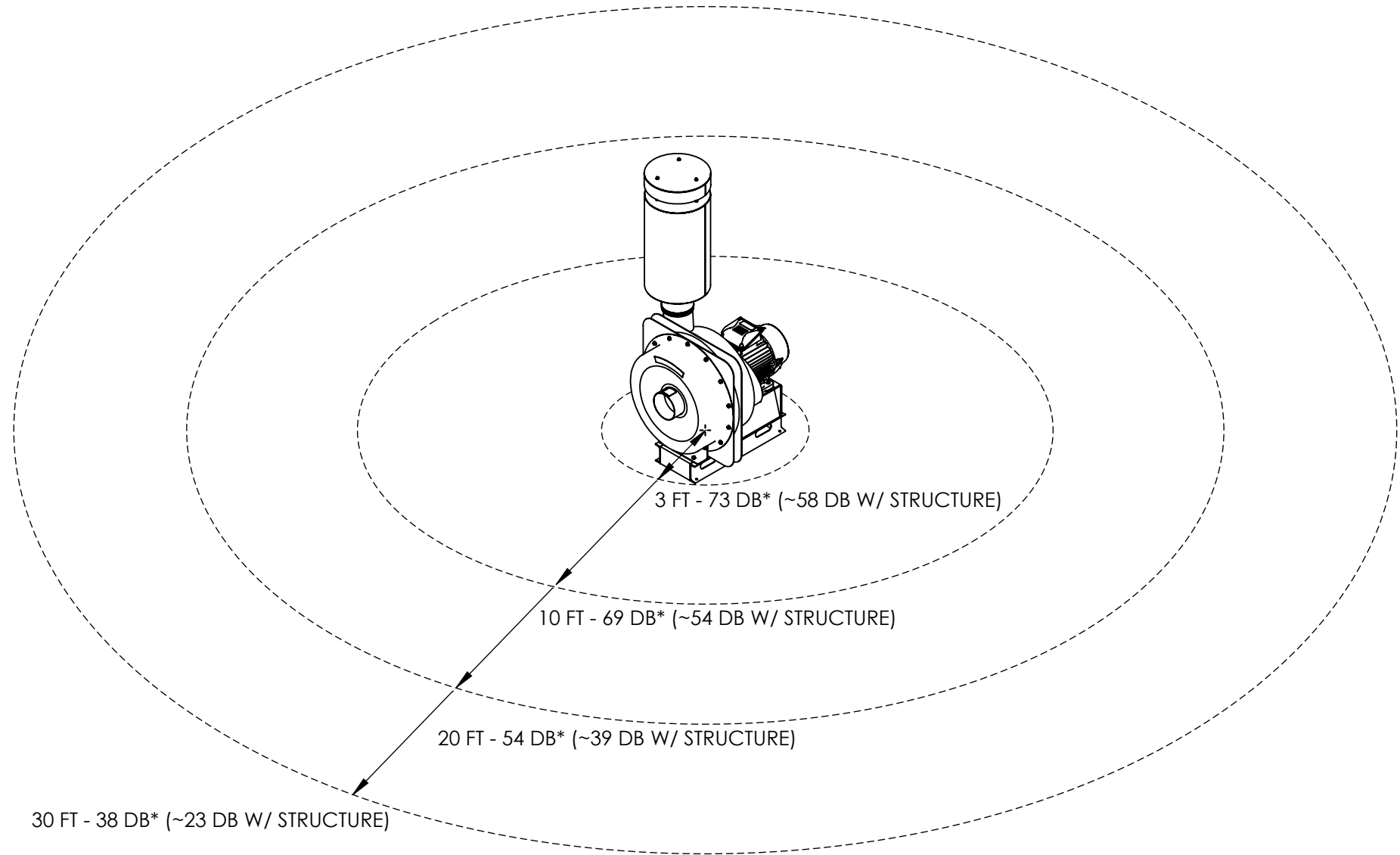
NOTE: THESE READINGS WERE TAKEN OUTSIDE OF 8'x10'x8' CINDER BLOCK ENCLOSURE WITH CONCRETE SLAB AND NO ROOF.

SOUND LEVEL METER USED:

SIMPSON MODEL #40003 – MSHA APPROVED.
MEETS OSHA & WALSH-HEALY REQUIREMENTS FOR NOISE CONTROL.
CONFORMS TO ANSI S1.4-1983, IEC 651 SPECS FOR METER TYPE.

Vacutech
1350 Hi-Tech Drive, Sheridan WY, 82801
PHONE: (800) 917-9444 FAX: (303) 675-1988
EMAIL: info@vacutechllc.com
WEB SITE: vacutechllc.com

SOUND INTENSITY VACUTECH T4, 40HP, DD TURBINE



TYPICAL VEHICULAR TRAFFIC
MEASURES 60-75 DB ON MOST
CITY STREETS

*SOUND LEVELS REPORTED ARE FROM ACTUAL FIELD MEASUREMENTS
AND WILL VARY BASED ON ACTUAL CONDITIONS



TECH BULLETIN

TECHNICAL BULLETIN #: 02-11-19

TO: MacNeil Distributors
FROM: Barb McCutcheon, Engineering Manager
DATE: February 11, 2019
SUBJECT: Tech 21 Dryer Decibel Levels

Dear Distributors,

Recently we have had a number of inquiries from customers seeking information on the noise levels of our dryers, as they require this information for permitting. Therefore, please find decibel data for both the 10HP and 15HP Tech 21 producers below.

15 HP Data (1m):

	SPL (dBA)	SPL (Pa)
Data at Measurement Location 1 (Directly in Front of Fan)		
No valve (loc 1)	95.8	1.23
Max Air (valve + foam)	92.2	0.81
Min Air (valve + foam)	87.1	0.45
Averaged Data (in Front of Fan)		
No valve (front fan)	94.4	1.04
Max Air (valve + foam)	92.0	0.80
Min Air (valve + foam)	88.0	0.50

10 HP Data (1m):

	SPL (dBA)	SPL (Pa)
Data at Measurement Location 1 (Directly in Front of Fan)		
No valve (loc 1)	92.2	0.81
Max Air (valve + foam)	87.9	0.50
Min Air (valve + foam)	84.9	0.35
Averaged Data (in Front of Fan)		
No valve (front fan)	89.4	0.59
Max Air (valve + foam)	88.0	0.50
Min Air (valve + foam)	85.2	0.36

APPENDIX C – SOUND ATTENUATION CALCULATIONS



PENNONI ASSOCIATES INC.
CONSULTING ENGINEERS

PROJECT:	Take 5 Car Wash Sound Study		
SUBJECT:	Sound Attenuation Equation		
SHEET:	1	OF	1
DATE:	February 2023		
BY:	J. Sheridan		
CHK'D:			

SOUND ATTENUATION EQUATION

$$SPL_2 = SPL_1 - 20 \log (R_2 / R_1)$$

SPL₁ = Sound pressure level at point 1

SPL₂ = Sound pressure level at point 2

R₁ = Distance from the sound source to point 1

R₂ = Distance from the sound source to point 2

CAR WASH ENTRANCE

$$SPL_1 = 83.4 \text{ dBA}$$

$$R_1 = 10 \text{ ft}$$

$$R_2 = 83.2 \text{ ft from Entrance}$$

$$\log (R_2 / R_1) = 0.92$$

$$SPL_2 = 65.0 \text{ dBA}$$

CAR WASH EXIT (FIELD DATA)

$$SPL_1 = 92.6 \text{ dBA}$$

$$R_1 = 5.0 \text{ ft}$$

$$R_2 = 120 \text{ ft from Exit}$$

$$\log (R_2 / R_1) = 1.38$$

$$SPL_2 = 65.0 \text{ dBA}$$

CAR WASH EXIT (MANUFACTURER SPECS)

$$SPL_1 = 95.8 \text{ dBA}$$

$$R_1 = 3.28 \text{ ft}$$

$$R_2 = 114 \text{ ft from Exit}$$

$$\log (R_2 / R_1) = 1.54$$

$$SPL_2 = 65.0 \text{ dBA}$$