



2024-004
February 29, 2024

Mr. Andrew Richlen, PE, MBA
Project Manager
Skilken Gold
Real Estate Development
4270 Morse Road
Columbus, OH 43230

Subject: **Gas Station & Store Community Impact Statement**
re: Sheetz Store – SWC Thirteen Mile Rd. & Dequindre Rd.
Novi, MI

Dear Mr. Richlen:

At your request and authorization, Kolano and Saha Engineers, Inc. (K&SE) has conducted an investigation to provide a community noise impact study for the proposed gas station and store. This investigation compares the current site configuration, with a Shopping Plaza, to the proposed Sheetz store. The current Shopping Plaza has a drive on the back side of the building for vehicle access, which is directly adjacent to residential properties. This evaluation compares the noise from various sources, including building mechanical equipment, passenger vehicles, and delivery trucks.

Proposed Site

The location of the proposed Sheetz Store is at the southwest corner of Thirteen Mile Road and Dequindre Road. Properties to the north and east of the proposed Sheetz location are commercial. The property to the south is zoned R-2 and is a church property. The property to the west is zoned R-C and is a residential property. **Exhibit 1** provides an aerial view of the current site with the proposed Shopping Plaza building, drives and parking lot, as well as the zoning of adjacent properties.

Sound level predictions were based on the location of property lines, mechanical equipment, and equipment manufacturer noise data. The following documents were utilized for the predictions:

- Stonefield Engineering & Design site plan, Sheetz – Madison Heights dated 2/9/2024.
- Convenience Architecture and Design PC – architectural plans, mechanical plans, plumbing plans, electrical plans – dated 10/2/2023
- Sound power data provided for the proposed rooftop air makeup units as provided to us by equipment manufacturers.

City of Madison Heights Noise Code

The City of Madison Heights has several sections of its code that address noise. The most relevant for the proposed Sheetz store appears to be Section 17-52 *Sensitive Noise Receiving Properties*. Under *General Provisions*, noise is restricted to 65 decibels from 7AM to 11PM, and 50 decibels from 11PM to 7AM at any residential property. These limits are expected to apply at the residential properties to the south and to the west.

Understanding Sound and How it is Measured

In order to have a good understanding of the results of this investigation it is best to start with some discussion of the basics of sound and sound measurement. Sound is a rapid fluctuation of air pressure that occurs in a range that is detectable by human hearing. Sound pressure can be measured in units of Pascals (Pa), though would range from 2×10^{-5} to over 10 million! In order to compress this tremendous scale to manageable numbers, as well to create a scale that reflects human perception of sound, the decibel sound scale was developed. The decibel sound scale is a unit of measure based on a logarithmic equation with specific reference to the human threshold of hearing. Because of the logarithmic nature, sound levels in decibels do not add, or subtract by simple arithmetic. Similarly, human response to sound is logarithmic rather than linear in nature.

The decibel sound scale generally ranges from 0 dB to 180 dB, where 0 dB is the threshold where we begin to hear and 180 dB is an approximate maximum audible level, though pain associated with hearing starts at 120-140 dB. Relative to human perception of sound, a 3-dB increase (or decrease) in level is the threshold at which people begin to notice a change. A change less than a 3 dB is generally undetectable to the normal populace. Additionally, a 3-dB increase is an actual doubling of sound energy, though it takes a 10 dB increase for humans to perceive a doubling of loudness. For reference, a quiet library typically has an ambient sound level of 20-30 dB. Normal speech at a 3-foot distance is approximately 60 to 65 dB.

Appendix A provides a chart of sound levels for some typical sound sources encountered in daily living.

Advanced Computer Modeling Noise Prediction

Sound is a physical phenomenon that can be readily projected and predicted with reasonable accuracy. To help evaluate the sounds created from the current Shopping Plaza and the proposed Sheetz store and determine what noise impact may occur at the site boundaries, we developed an advanced three-dimensional, outdoor acoustical model. This model allows accurate projection and prediction of sound levels created by the operation of known building mechanical systems, vehicle movements, and delivery operations. The computer program we use for this modeling relies on international standards (such as ISO 9613) to properly calculate and predict sound levels. The computer program relies on user inputs of terrain, structures, foliage, obstacles, sound reflective and absorptive surfaces, receiver positions, as well as the type of sound source, including point sources (small individual devices, such as small fans), line sources (numerous sources in a line, such as road traffic), and area sources (sources with large surface areas, such as transformers). By using this predictive tool, we have constructed virtual acoustic models of the current Shopping Plaza and the proposed Sheetz store and have developed sound level projections and predictions for them.

Sound Level Measurements

To assist with the modeling, sound level measurements were conducted at the current Shopping Plaza site. These sound level measurements captured mechanical equipment, delivery trucks, and vehicles operating on site. Sound levels were measured at the Shopping Plaza west property line, adjacent to the Willow Hill residential property.

The sound level measurements were captured with a Brüel & Kjær 2270 hand-held analyzer with a Brüel & Kjær type 4189 microphone and ZC-0032 preamplifier. This system provides performance which exceeds the minimum requirements of the American National Standards Institute (ANSI) S1.4 Specification for Type 1 (precision) instrumentation. Calibration was performed using a Brüel and Kjær type 4231 Acoustic Calibrator¹.

The results of these measurements were used to characterize the various sources of sound on the current site, and to validate the sound projections from these sources in our acoustic model.

Projections of the Current Shopping Plaza

Projections of the measured sound levels have been conducted for building mechanical equipment, vehicles driving on site, and delivery trucks. These elements are presented in the following groups.

Building Mechanical Equipment

Building mechanical systems consist of various roof mounted air handling units, condenser units, and exhaust fans. Additionally, the grocery store located in the corner of the Shopping Plaza utilizes one or more refrigerated trucks for additional cold storage of food products. Two refrigerated trucks have been added to this model group as this is a stationary source of supplemental mechanical equipment noise. **Exhibit 2** provides the modeling projection sound level contours of mechanical equipment operating on the Shopping Plaza site. This exhibit shows that current mechanical equipment when operating, day or night, has sound levels of 65 dB(A) at the south property line and 64 to 70 dB(A) along the west property line.

Passenger Vehicles Driving on Site

Passenger vehicles access the Shopping Plaza site from both Thirteen Mile Road and Dequindre Road. To demonstrate passenger vehicle noise on the site of the Shopping Plaza site, passenger vehicle sound sources were modeled at various positions on the perimeter of the site along driving paths observed to have this vehicle traffic. **Exhibit 3** provides the modeling projections as sound level contours of passenger vehicles driving on the site. This exhibit shows that passenger vehicles traveling the perimeter of the current site have sound levels up to 65 dB(A) along the south residential property line, and up to 62 dB(A) along the west residential property line.

¹ Calibration traceable to the U.S. National Institute for Standards & Technology (NIST).

Delivery Trucks

Trucks frequently make deliveries to the stores and restaurants of the Shopping Plaza. These delivery trucks will access the site from both Thirteen Mile Road and Dequindre Road and travel primarily across the back of the Shopping Plaza. **Exhibit 4** provides the modeling projection sound level contours of the delivery trucks moving on the site. This exhibit shows that delivery trucks traveling along the back drive have sound levels up to 75 dB(A) along the south residential property line, and up to 70 dB(A) along the west residential property line.

Predictions of the Proposed Sheetz Store

The proposed Sheetz store will have similar sources of noise, though in a different site configuration. The primary difference is, the proposed Sheetz store will not have a drive way along the back of the building. This will limit the noise projected to the west of the proposed Sheetz store. Predictions of the proposed store include building mechanical equipment, vehicles driving on site, and delivery trucks. The modeled site plan for the proposed Sheetz store configuration is presented in **Exhibit 5**. These elements are presented in the following groups.

Building Mechanical Equipment

Building mechanical systems consist of three roof top air handling units, six refrigeration condenser units, and two exhaust fans. These mechanical units will be located on the roof the Sheetz store, and shielded by a screen wall. Sound level data used to model these mechanical systems comes from the unit manufacturers. **Exhibit 6** provides the modeling predicted sound level contours of mechanical equipment operating on the proposed Sheetz store site. This exhibit shows that mechanical equipment sound levels are expected to be up to 50 dB(A) along the south residential property line, and up to 49 dB(A) along the west residential property line.

Passenger Vehicles Driving on Site

Passenger vehicles access the proposed Sheetz store site from both Thirteen Mile Road and Dequindre Road. To demonstrate passenger vehicle noise on proposed store site, passenger vehicle sound sources were modeled at various positions along the typical driving paths anticipated. **Exhibit 7** provides the modeling projections as sound level contours of passenger vehicles driving on the site. This exhibit shows that passenger vehicles traveling the perimeter of the proposed site have sound levels up to 62 dB(A) along the south residential property line, and up to 59 dB(A) along the west residential property line.

Delivery Trucks

The Sheetz store is expected to receive deliveries on a regular basis. Store supplies and fuel are expected to be delivered by WB67 delivery trucks. Deliveries are expected on a weekly basis and will occur during daytime hours. Additional deliveries may come by box trucks or vans. Loading and unloading is expected to occur during normal daytime business hours. The delivery trucks will access the site from both Thirteen Mile Road and Dequindre Road and travel across the front of the site adjacent to the roadways, and in front of the building. **Exhibit 8** provides the

modeling predicted sound level contours of the delivery trucks moving on the site. This exhibit shows that delivery trucks traveling along the perimeter of the driving area have sound levels up to 71 dB(A) along the south residential property line, and up to 66 dB(A) along the west residential property line.

Conclusions

Comparing the current site configuration to that for the proposed Sheetz store, demonstrates a distinct difference in how traffic accesses and flows through each configuration. By removing the rear drive along the back of the building, much of the noise associated with this back drive goes away. Modeling results show significant reduction in vehicle sound levels with the proposed Sheetz store.

Additionally, a reduced number of mechanical equipment units, the addition of screening walls around the mechanical equipment, and the elimination of supplemental refrigeration storage (via refrigerated trucks), greatly diminishes the noise that will be produced on a 24-hour basis. This will provide significantly lower sound levels to the residents to the west, particularly during nighttime hours when people will be more sensitive to this noise.

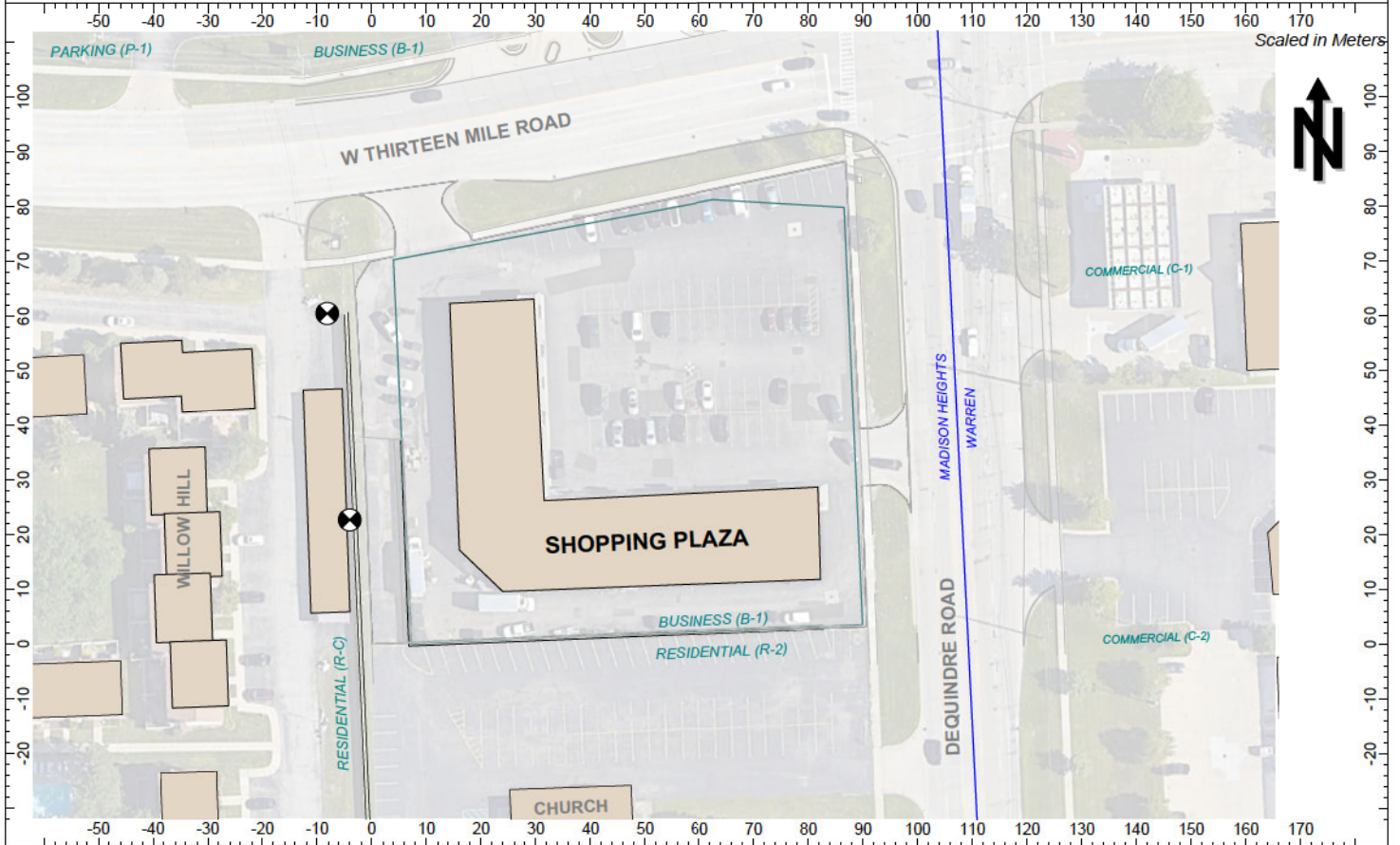
Mr. Richlen, we hope this summary of our investigation is informative and helpful. Should you need additional information regarding this work or additional assistance, don't hesitate to ask.

Sincerely,
K & S ENGINEERS, LLC



Darren Brown, P.E.
INCE Board Certified
Principal Consultant

EXHIBIT 1
ACOUSTIC MODEL SITE PLAN DETAILING THE EXISTING CONFIGURATION OF
THE SHOPPING PLAZA ON THE SOUTHWEST CORNER OF THIRTEEN MILE ROAD AND DEQUINDRE ROAD

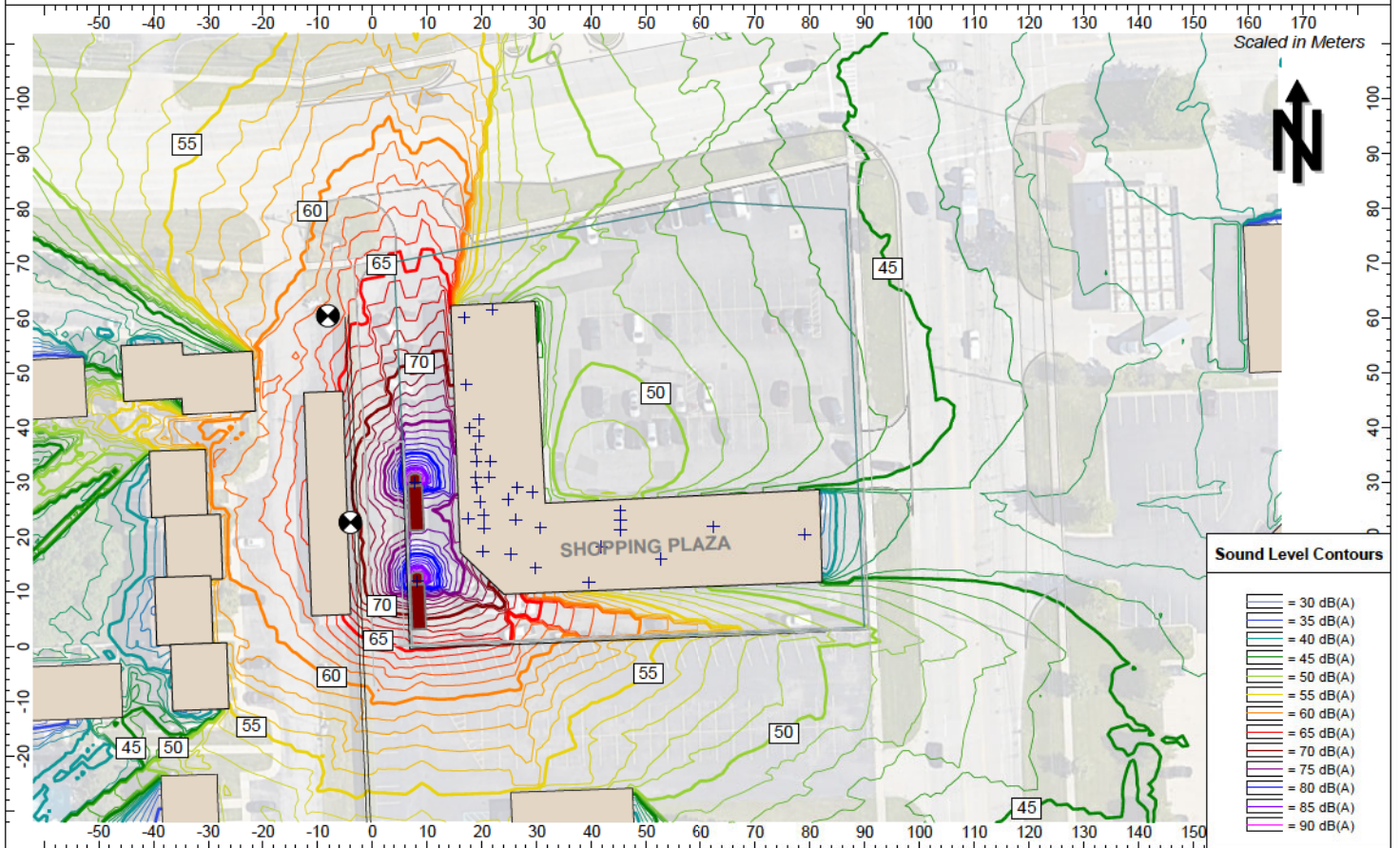


K & S Engineers, LLC
Wixom, MI 48393
248-674-4100 www.kandse.com

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Project No. : 2024-004

Analysis Date (day.mo.yr): 29.02.24

EXHIBIT 2
SOUND LEVEL CONTOUR PLOT OF THE CURRENT SHOPPING PLAZA
MECHANICAL EQUIPMENT NOISE, INCLUDING STATIONARY REFRIGERATION TRUCKS



Sound Level Contours

- = 30 dB(A)
- = 35 dB(A)
- = 40 dB(A)
- = 45 dB(A)
- = 50 dB(A)
- = 55 dB(A)
- = 60 dB(A)
- = 65 dB(A)
- = 70 dB(A)
- = 75 dB(A)
- = 80 dB(A)
- = 85 dB(A)
- = 90 dB(A)

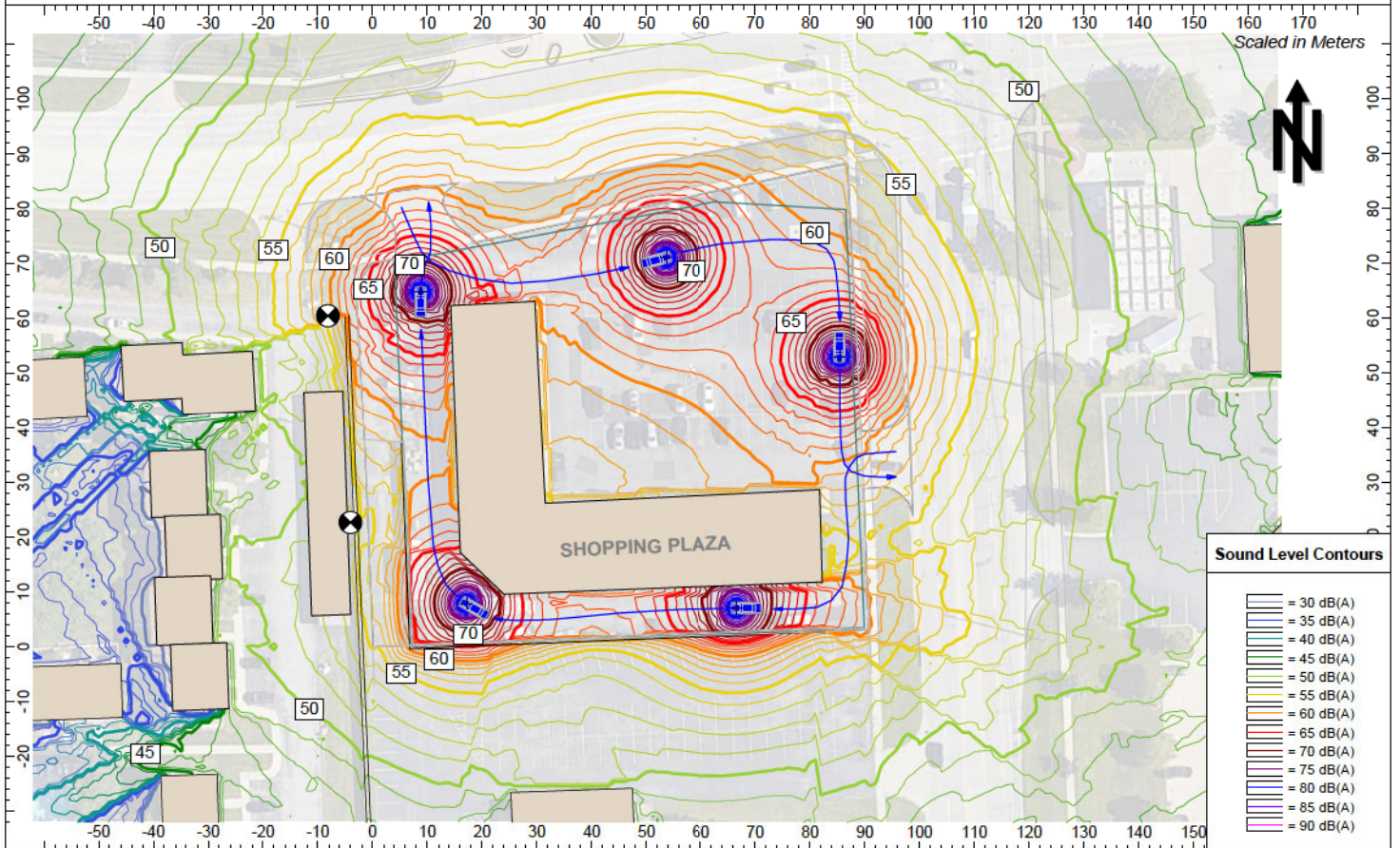


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EXHIBIT 3
SOUND LEVEL CONTOUR PLOT OF THE CURRENT SHOPPING PLAZA
PASSENGER VEHICLE NOISE AT VARIOUS POSITIONS ON THE PERIMETER OF DRIVING AREAS

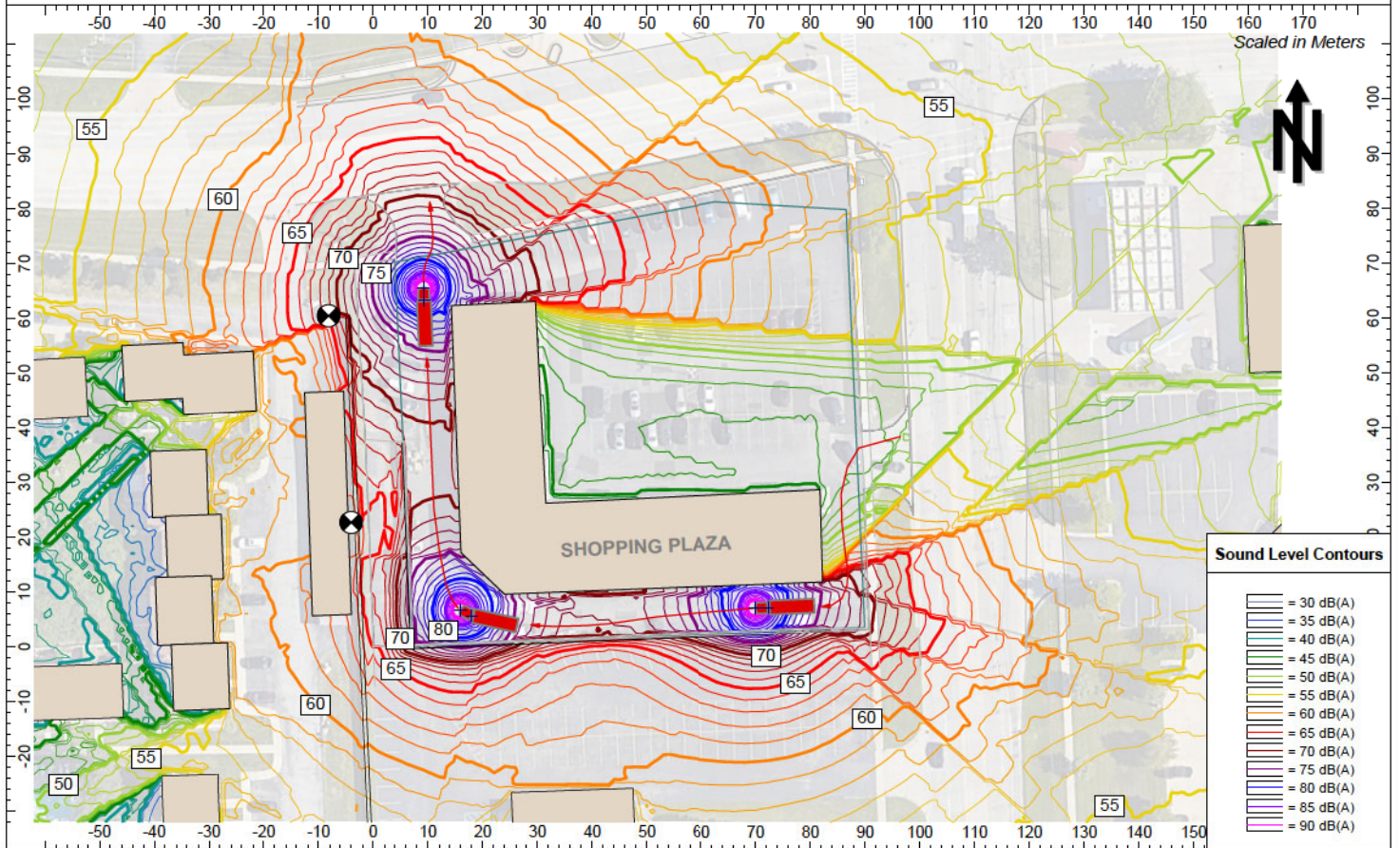


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EXHIBIT 4
SOUND LEVEL CONTOUR PLOT OF THE CURRENT SHOPPING PLAZA
DELIVERY TRUCK NOISE AT VARIOUS POSITIONS ALONG THE REAR BUILDING DRIVE



Sound Level Contours

- = 30 dB(A)
- = 35 dB(A)
- = 40 dB(A)
- = 45 dB(A)
- = 50 dB(A)
- = 55 dB(A)
- = 60 dB(A)
- = 65 dB(A)
- = 70 dB(A)
- = 75 dB(A)
- = 80 dB(A)
- = 85 dB(A)
- = 90 dB(A)

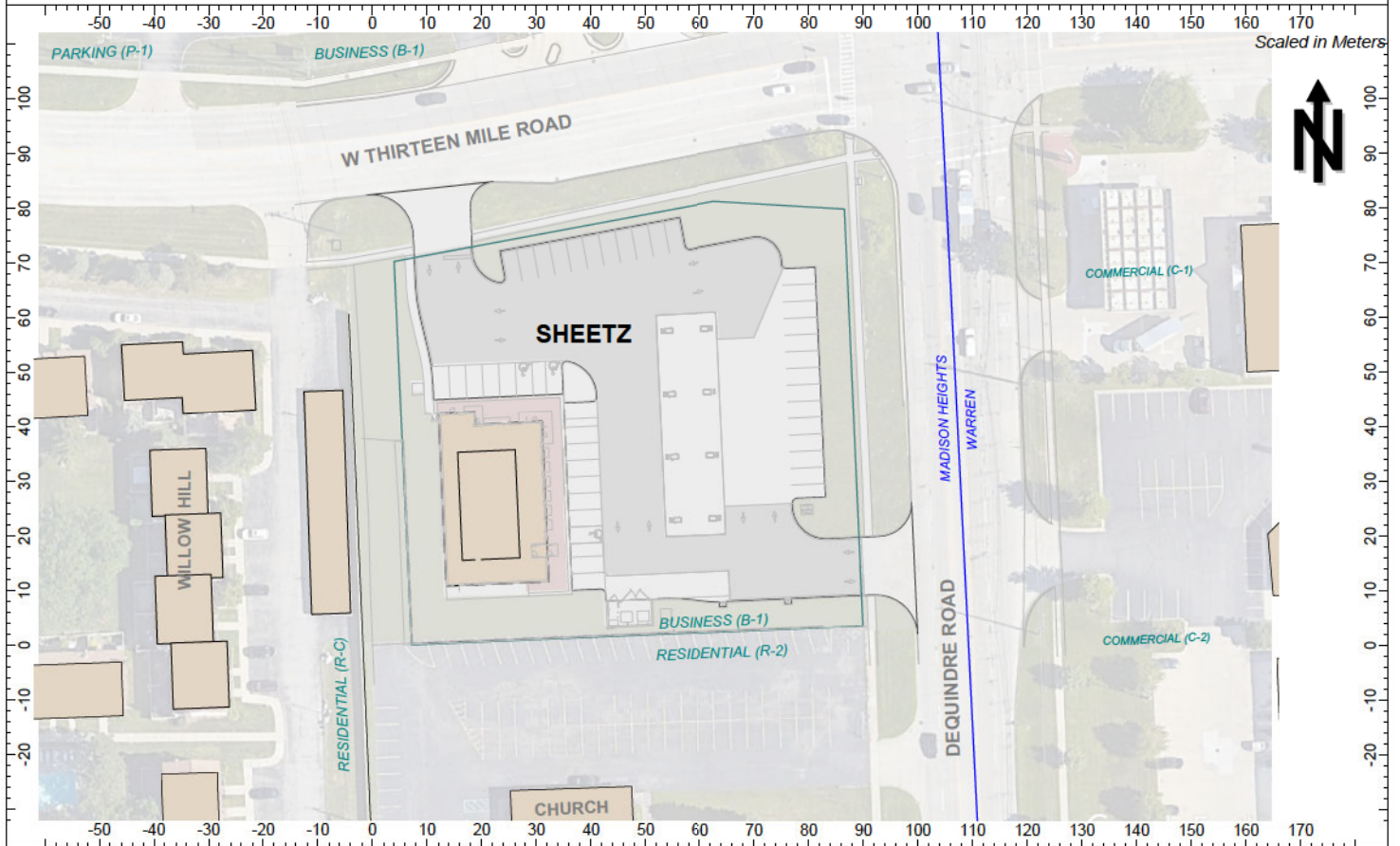


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EXHIBIT 5
ACOUSTIC MODEL SITE PLAN DETAILING THE PROPOSED SHEETZ STORE
ON THE SOUTHWEST CORNER OF THIRTEEN MILE ROAD AND DEQUINDRE ROAD

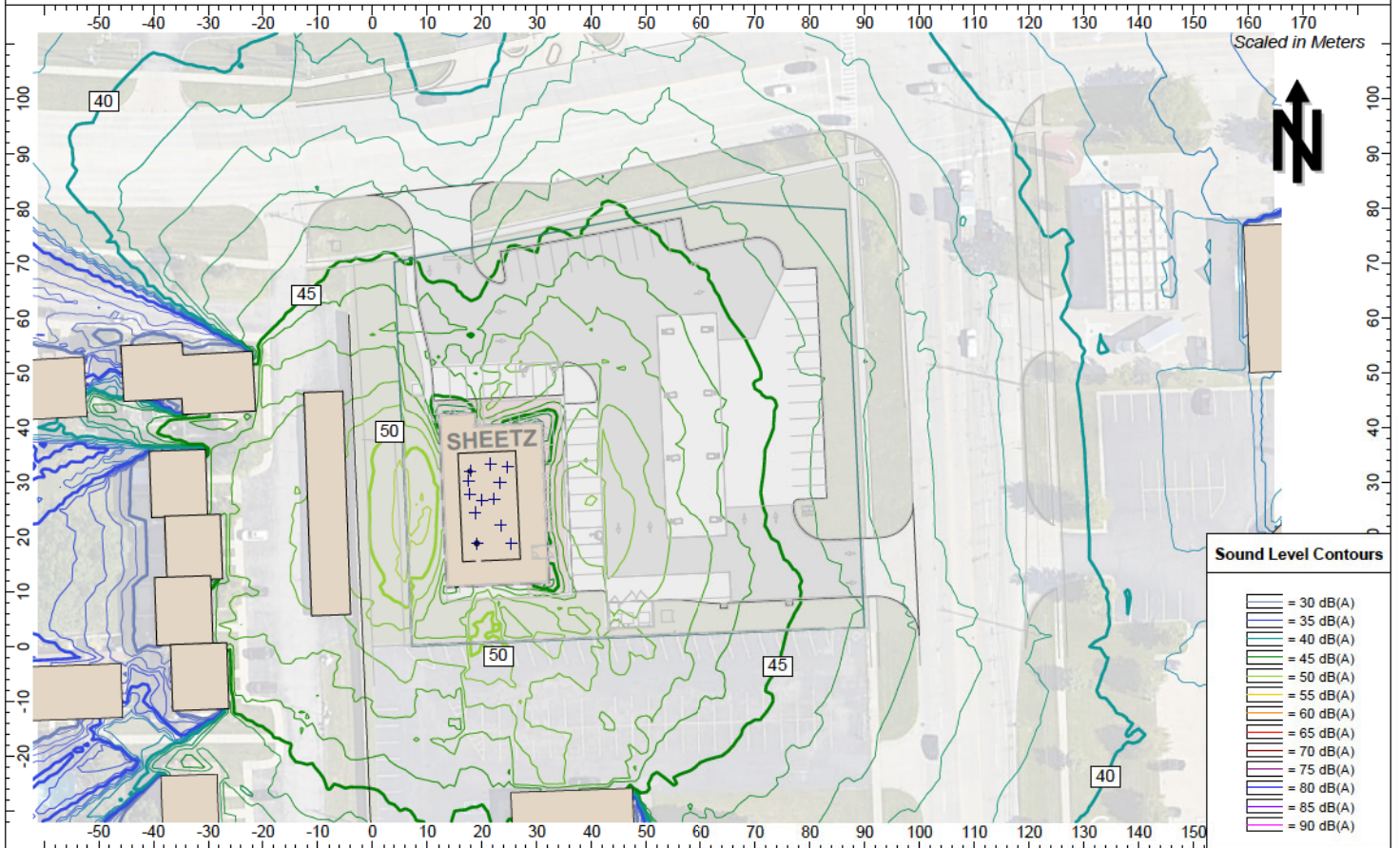


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EXHIBIT 6
SOUND LEVEL CONTOUR PLOT OF THE PROPOSED SHEETZ STORE
MECHANICAL EQUIPMENT NOISE

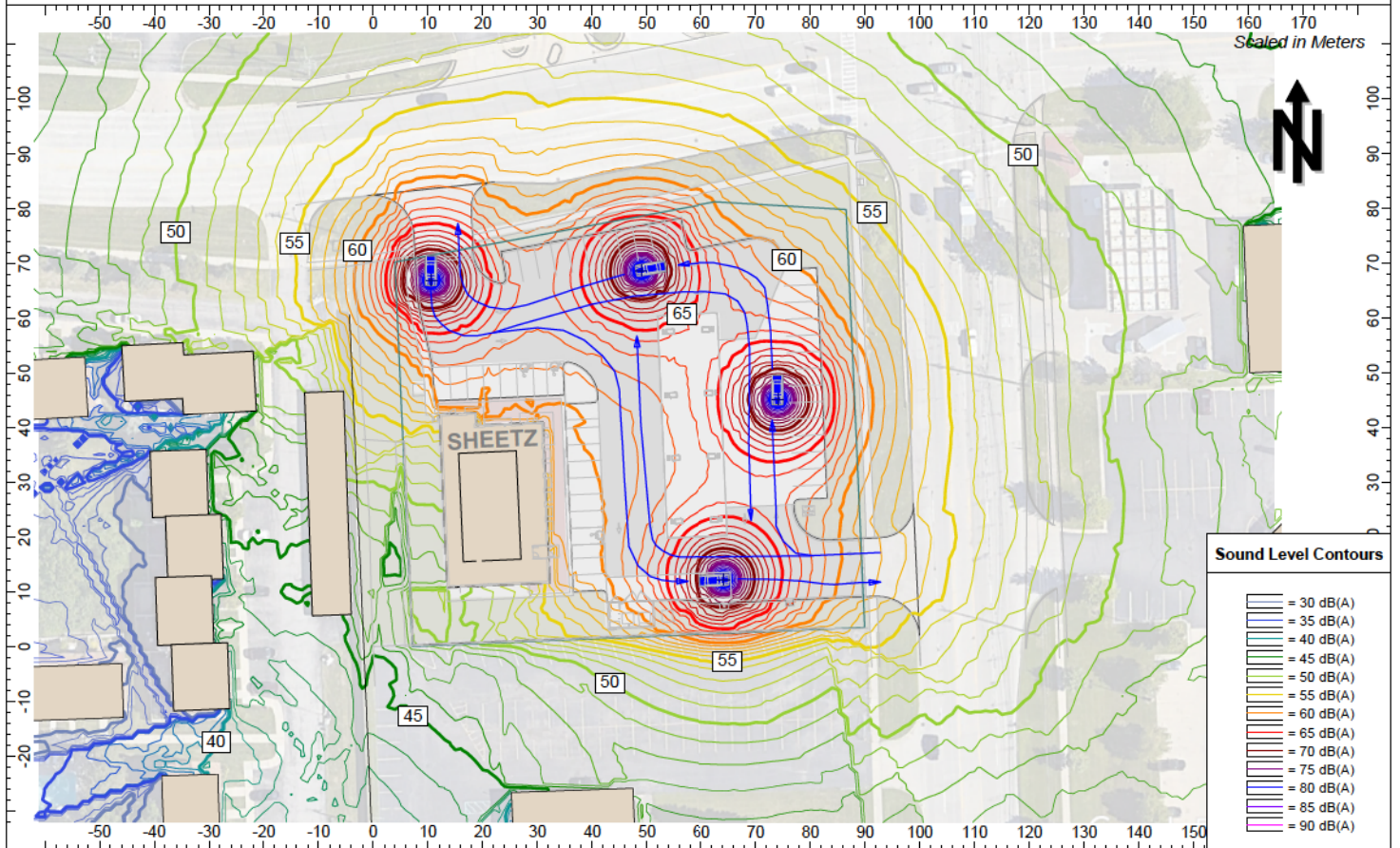


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EXHIBIT 7
SOUND LEVEL CONTOUR PLOT OF THE PROPOSED SHEETZ STORE
PASSENGER VEHICLE NOISE AT VARIOUS POSITIONS ON THE PERIMETER OF DRIVING AREAS

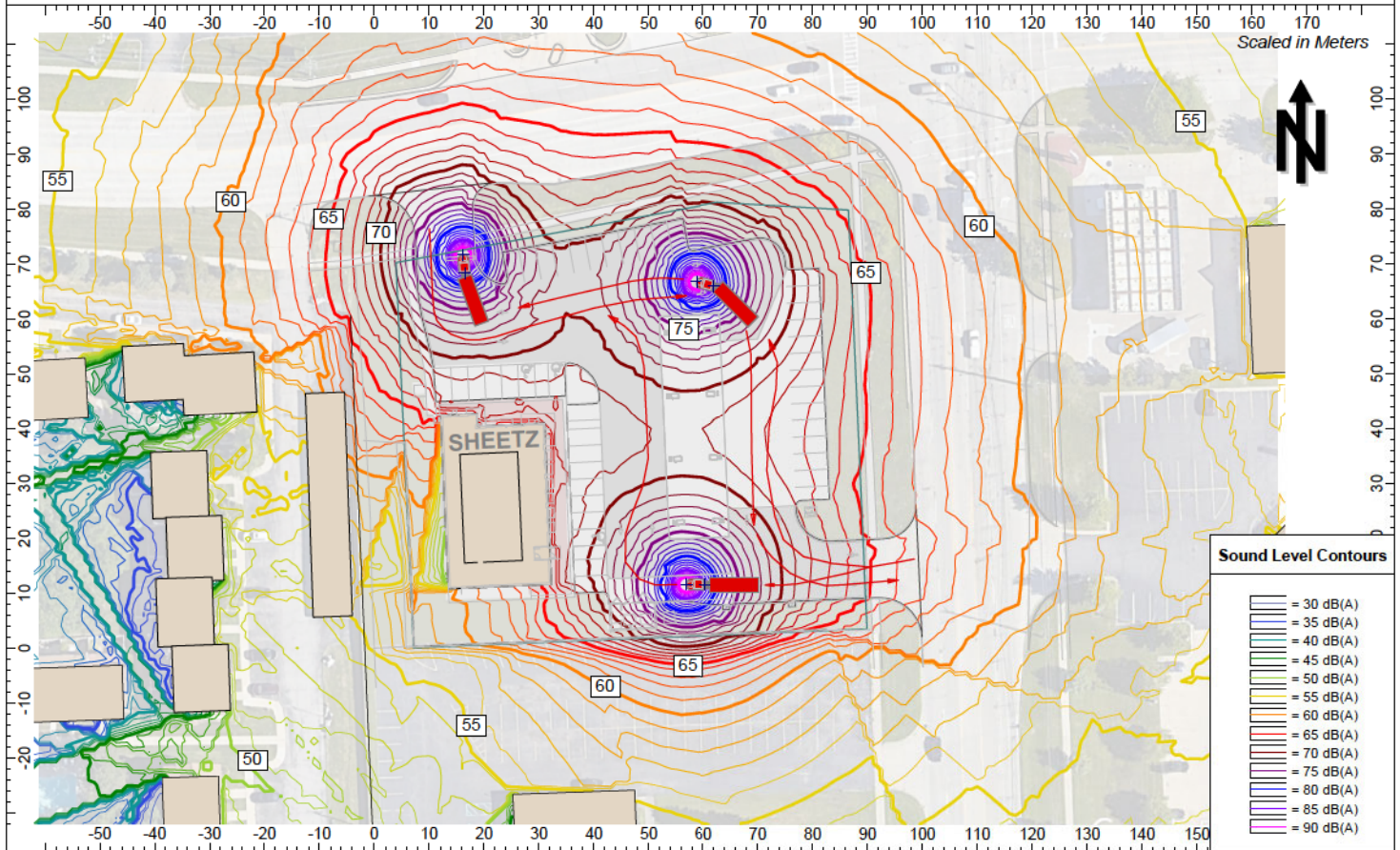


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EXHIBIT 8
SOUND LEVEL CONTOUR PLOT OF THE PROPOSED SHEETZ STORE
DELIVERY TRUCK NOISE AT VARIOUS POSITIONS ON THE PERIMETER OF DRIVING AREAS



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APPENDIX A

Sound Level of Typical Sources			
Sound Level dB(A)	Subjective Impression	Outdoor	Indoor
180		Rocket Launch, Artillery Fire	
160	Extremely Loud	Rifle Shot at Shooters Ear	
130	Pain	Fire Cracker at 30 Feet	
120	Uncomfortable	Jet Plane Taking Off at 200 Feet	
110		Jet Flyover at 1000 Feet	Rock Concert, Dance Club
100	Very Loud	Motorcycle pass-by at 25 Feet	
90		Lawn Mower at 5 Feet	Food Blender at 3ft.
80	Moderately Loud	Diesel Truck Pass-by (50mph) at 50 Feet	Vacuum Cleaner at 4ft.
70		Car pass-by (50mph) at 50 Feet	
60		Residential Air Cond. Condenser at 15 Feet	Normal Conversation at 5ft.
50	Quiet	Large transformer at 100 Feet	
40		Bird Calls at 100 Feet	Open office with low activity
30	Very Quiet		Soft Whisper at 5ft.
20		Tree Leaves Rustling In Wind	Quiet Bedroom
10	Just Audible		Normal Breathing
0	Hearing Threshold		

It should be noted that sound level is a function of sound power and distance from the source.
 The examples given are approximate and show the general range where they are normally heard.