Categorical Exclusion

Appendix I

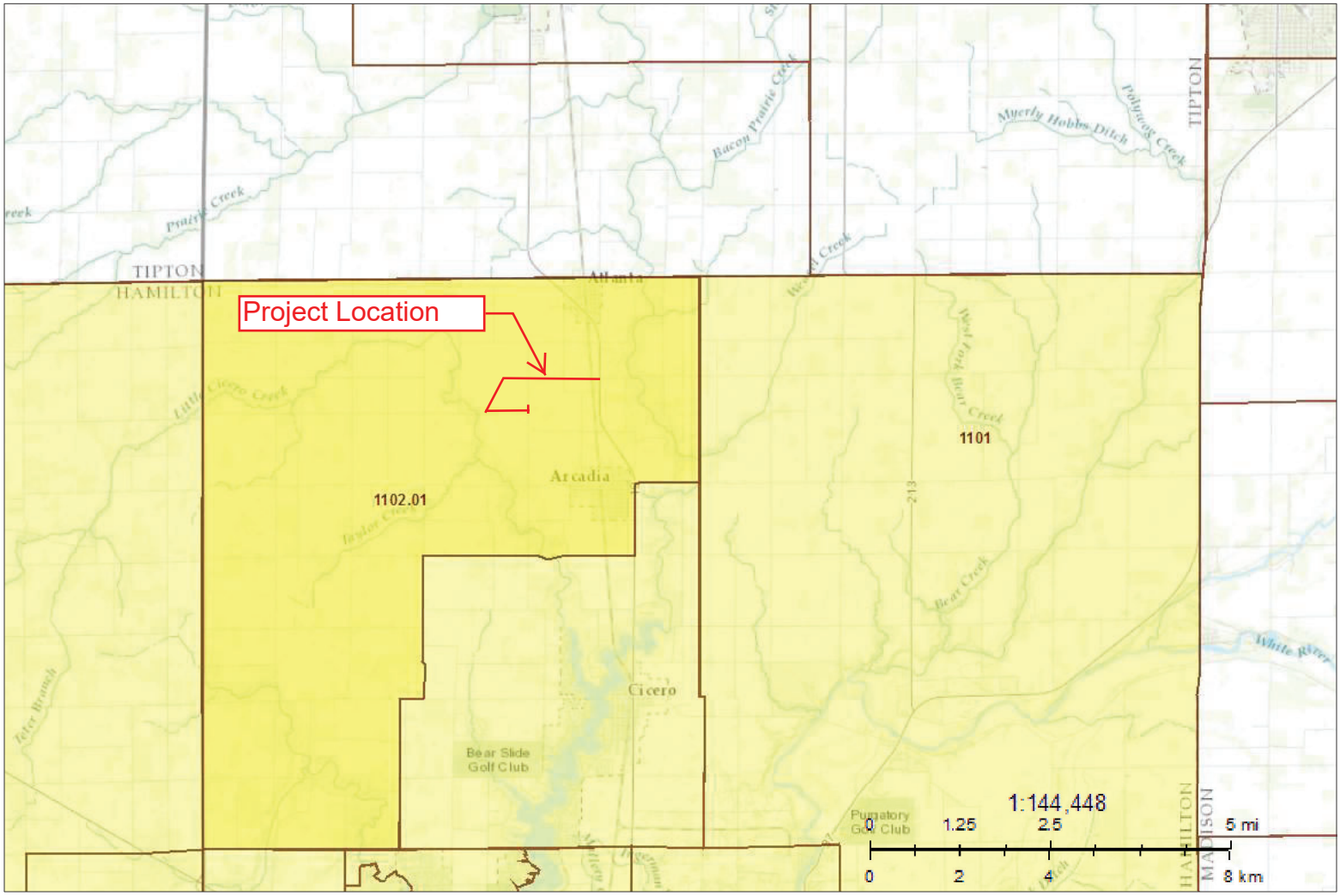
Additional Studies

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HAMILTON								
17 - XXX	D	FOREST PARK DEVELOPMENT	NOBLESVILLE PARK BOARD	$8,383.88	C	12/17/1969	12/31/1969	6
58 - XXX	A	FOREST PARK ADDITION	NOBLESVILLE PARK BOARD	$45,744.50	C	5/8/1969	12/31/1970	6
128 - XXX	C	MORSE PARK	HAMILTON COUNTY PARK BOARD	$142,332.00	C	12/6/1972	6/30/1975	6
198 - XXX	D	TRI-TOWN COMMUNITY PARK	CICERO PARK BOARD	$34,242.81	C	5/6/1975	12/31/1977	6
236 - XXX	D	FOREST PARK POOL	HAMILTON COUNTY PARK BOARD	$125,000.00	C	2/3/1976	6/30/1978	6
493 - XXX	C	FLOWING WELL PARK	CARMEL/CLAY TWP PARK BOARD	$75,000.00	C	4/23/1993	6/30/1998	6
502 - XXX	D	COOL CREEK PARK NATURE CENTER	HAMILTON COUNTY PARK BOARD	$75,000.00	C	5/20/1994	6/30/1999	6
519 - XXX	C	KOTEEWI PARK ACQUISITION & DEVELOPMENT	HAMILTON COUNTY PARK BOARD	$200,000.00	C	9/6/2000	12/31/2005	5
551 - XXX	C	D/MACGREGOR PARK	WASHINGTON TOWNSHIP PARK BOARD	$200,000.00	C	3/9/2005	12/31/2007	0
			Hamilton County Total:	**$905,703.19**		**County Count:**		**9**
HANCOCK								
350 - XXX	D	RILEY PARK AND POOL RENOVATION	GREENFIELD PARK BOARD	$220,000.00	C	1/30/1979	12/31/1983	6
552 - XXX	C	BECKENHOLDT PARK	GREENFIELD PARK BOARD	$200,000.00	C	4/19/2005	12/31/2009	5
561 - XXX	C	SUGAR CREEK TOWNSHIP PARK	SUGAR CREEK PARK BOARD	$200,000.00	C	9/7/2006	12/31/2009	5
575 - XXX	D	BECKENHOLDT PARK PHASE II	GREENFIELD PARK & RECREATION BOARD	$156,466.00	C	4/15/2011	12/31/2015	0
			Hancock County Total:	**$776,466.00**		**County Count:**		**4**

Analysis of One Census Tract in Hamilton County, Indiana
Completed on October 13, 2016

		COC	AC1
		Hamilton County, Indiana	Census Tract 1102.1, Hamilton County, Indiana
	LOW-INCOME		
B17001001	Population for whom poverty status is determined: Total	287,847	4,174
B17001002	Population for whom poverty status is determined: Income in past 12 months below poverty level	13,901	375
	Percent Low-income	**4.8%**	**9.0%**
	125 Percent of COC	**6.0%**	**AC ≥ 125% COC**
	Potential Low-income EJ Impact?		**Yes**
	MINORITY		
B03002001	Total population: Total	289722	4245
B03002002	Total population: Not Hispanic or Latino	279223	4162
B03002003	Total population: Not Hispanic or Latino; White alone	247571	4105
B03002004	Total population: Not Hispanic or Latino; Black or African American alone	9890	19
B03002005	Total population: Not Hispanic or Latino; American Indian and Alaska Native alone	325	0
B03002006	Total population: Not Hispanic or Latino; Asian alone	14834	13
B03002007	Total population: Not Hispanic or Latino; Native Hawaiian and Other Pacific Islander alone	39	0
B03002008	Total population: Not Hispanic or Latino; Some other race alone	579	5
B03002009	Total population: Not Hispanic or Latino; Two or more races	5985	20
B03002010	Total population: Hispanic or Latino	10499	83
B03002011	Total population: Hispanic or Latino; White alone	6994	58
B03002012	Total population: Hispanic or Latino; Black or African American alone	225	0
B03002013	Total population: Hispanic or Latino; American Indian and Alaska Native alone	18	0
B03002014	Total population: Hispanic or Latino; Asian alone	0	0
B03002015	Total population: Hispanic or Latino; Native Hawaiian and Other Pacific Islander alone	0	0
B03002016	Total population: Hispanic or Latino; Some other race alone	2227	19
B03002017	Total population: Hispanic or Latino; Two or more races	1035	6
	Number Non-white/minority (B03002001-B03002003)	**42,151**	**140**
	Percent Non-white/Minority	**14.5%**	**3.3%**
	125 Percent of COC	**18.2%**	**AC ≥ 125% COC**
	Potential Minority EJ Impact?		**No**

Environmental Justice



Legend:

Your Selections	Selection Results	Boundaries
☐ 2014 boundaries were used to map 'Your Selections'	No Legend	☐ Census Tract

B03002 | HISPANIC OR LATINO ORIGIN BY RACE

Universe: Total population
2010-2014 American Community Survey 5-Year Estimates

Note: This is a modified view of the original table.

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Data and Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

	Hamilton County, Indiana	Census Tract 1102.01, Hamilton County, Indiana
	Estimate	Estimate
Total:	289,722	4,245
Not Hispanic or Latino:	279,223	4,162
White alone	247,571	4,105
Black or African American alone	9,890	19
American Indian and Alaska Native alone	325	0
Asian alone	14,834	13
Native Hawaiian and Other Pacific Islander alone	39	0
Some other race alone	579	5
Two or more races:	5,985	20
Two races excluding Some other race, and three or more races	5,594	20
Hispanic or Latino:	10,499	83
White alone	6,994	58
Black or African American alone	225	0
American Indian and Alaska Native alone	18	0
Asian alone	0	0
Native Hawaiian and Other Pacific Islander alone	0	0
Some other race alone	2,227	19
Two or more races:	1,035	6
Two races excluding Some other race, and three or more races	524	0

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

While the 2010-2014 American Community Survey (ACS) data generally reflect the February 2013 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census

B17001 | POVERTY STATUS IN THE PAST 12 MONTHS BY SEX BY AGE

Universe: Population for whom poverty status is determined
2010-2014 American Community Survey 5-Year Estimates

Note: This is a modified view of the original table.

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Data and Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

	Hamilton County, Indiana	Census Tract 1102.01, Hamilton County, Indiana
	Estimate	Estimate
Total:	287,847	4,174
Income in the past 12 months below poverty level:	13,901	375
Female:	8,087	219
Income in the past 12 months at or above poverty level:	273,946	3,799
Female:	139,076	1,864

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

While the 2010-2014 American Community Survey (ACS) data generally reflect the February 2013 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2010 data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Explanation of Symbols:

1. An '**' entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
3. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
4. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
5. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
6. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.

276th Street Extension Phase II
276th Street to SR 19
Millersburg, Hamilton County, Indiana

Highway Noise Analysis

DES No. 1600597

Prepared for:

RQAW
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And

Hamilton County Commissioners
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May 6, 2017

Table of Contents

Tables

Figures

Note: The alignment shown in Figures 1, 2 and 3A-3G has been modified. Please see Appendix B, page 3 for the Refinement of Original Alignment to Preferred Alignment.

Appendices

Appendix A through F have been omitted to reduce the overall size of the CE document.

1. Introduction

The Indiana Department of Transportation (INDOT) *Traffic Noise Analysis Procedure* (2011) became effective July 13, 2011 and applies to all Type I Federal highway projects (as defined by 23 CFR 772) in the State of Indiana, which encompasses all Federal or Federal-aid Highway Projects authorized under title 23, United States Code, including: any highway project or multimodal project that requires Federal Highway Administration (FHWA) approval regardless of funding sources; any Federal-aid projects that are administered by INDOT or Local Public Agencies (LPAs); and any project on roadways leased from the State of Indiana to the private sector. The 276th Street Extension Phase II Project qualifies as a Type I project because it involves construction of a roadway on new terrain.

This highway traffic noise analysis has been conducted in accordance with 23 CFR 772 (as amended) as implemented through the INDOT *Traffic Noise Analysis Procedure* (INDOT 2011).

2. Project Description

The project will begin at a point on 276th Street 0.60 mile west of Gwinn Road and extends to the community of Millersburg at the intersection of SR 19 and 281st Street/Railroad Street. 276th Street Extension Phase II, new construction roadway, will begin at the same location, run in a northeasterly direction for 3,000 feet and then head east for 7,000 feet terminating at the intersection of SR 19 and Railroad Street/281st Street for a total length of approximately 1.9 miles. The majority of the alignment is along new terrain; however a portion of the alignment will follow existing 281st Street and Railroad Street. Intersecting roads include Gwinn Road and Whetston Road. The proposed alignment would also cross the Hoosier Heritage Port Authority railroad tracks just west of Millersburg. The roadway design classification through the majority of the corridor will be a New Construction (Non-Freeway) Rural Collector, Local Agency Route and will be designed in accordance with Indiana Design Manual (IDM) Figure 53-4. The roadway will consist of two 12-foot wide travel lanes with 4-foot wide useable (3 feet paved) shoulder in each direction. The design classification of the roadway from the railroad crossing to the intersection with SR 19 is New Construction (Non-Freeway) Urban (Suburban) Collector and will be designed in accordance with IDM Figure 53-8. The roadway will consist of two 12-foot wide travel lanes with curb and a 2-foot offset in each direction. Typical sections are provided in Appendix A.

Beginning at the paving exception located just east of the Bridge over Little Cicero Creek, Bridge No. 54, the existing 276th Street cross section will be perpetuated as 10.5-foot travel lanes and 1 to 2-foot unpaved useable shoulders and will be milled and resurfaced to 200 feet west of Gwinn Road. This cross section will require a level one design exception for shoulder width both paved and useable. The roadway's pavement will be reconstructed from 200 feet west of Gwinn Road to Gwinn Road to meet the reconstructed profile grade of Gwinn Road. The design classification of the section of 276th Street that will receive the milling and resurfacing and full depth pavement reconstruction will be 3R (Non-Freeway) Rural Local Agency Collector and designed in accordance with IDM Figure 55-3C.

All public road approaches within the project limits will be reconstructed to a standard Public Road Approach Type B except for the approach to 281st Street within Millersburg. Main Street will be reconstructed with a modified Street Approach due to the nature of the adjacent area and need to limit impacts. In addition, Gwinn Road will be reconstructed 500 feet north and 200 feet south of 276th Street in order to provide adequate intersection sight distance from 276th Street looking north onto Gwinn Road. The design classification for Gwinn Road will be Reconstruction (Non-Freeway) Rural Local Agency Collector with a 55 mph design speed. Gwinn Road will be designed in accordance with IDM Figure 53-4.

The intersection treatment of the 276th Street Extension Phase II new construction roadway and existing 276th Street will be a single lane roundabout as identified in the 276th Street Corridor Study prepared by United Consulting for the Hamilton County Highway Department.

3. Identification of Noise Sensitive Areas

In 23 CFR 772 (as amended) FHWA has established seven Activity Categories to define Noise Abatement Criteria (NAC) for conducting highway noise analyses. Table 1 includes a listing of the

Activity Categories with descriptions and the NAC threshold level. These Activity Categories have been adopted by INDOT in their current *Traffic Noise Analysis Procedure* (INDOT 2011). Each Activity Category is defined in terms of the type of land use that occurs on the property. Because there are differing expectations for acceptable noise levels based on land use, each Activity Category has a unique NAC $L_{eq}(h)$ threshold that determines the level at which highway noise is considered to result in an impact to its designated use.

Land use within 500 feet of the outside lanes along the 276th Street Extension Phase II alignment is largely agriculture with scattered residential properties. The small crossroad community of Millersburg along the west side of SR 19 consists of less than 20 single family residences east of SR 19 at the project terminus. The Beck's Superior Hybrids, Inc. plant located north and south of 276th Street to the west of Gwinn Road is the only industrial/commercial facility in the project area. Figure 2 and Figures 3A through 3G provide an illustration of land use by Activity Category within the 276th Street Extension project area.

There are 21 single family residences (Category B) within 500 feet of the 276th Street Extension and associated intersecting roads: three along 276th Street, four at the intersection of 276th Street and Gwinn Road, one along Gwinn Road midway between 276th Street and 281st Street, three along Whetston Road, and ten within the Millersburg community along SR 19. Two of the residences along 276th Street (6800 E. 276th Street and 6767 E. 276th Street) are homes located on Beck's Superior Hybrid, Inc. property. Although currently occupied by tenants, coordination with a representative from Beck's indicated that the company has plans to repurpose both of these homes in the not too distant future and they would no longer be used for residential occupation. These plans might even include removing the structures.

There are no Category C land uses in the project area. The Beck's Superior Hybrids, Inc. offices along 276th Street have been classified as Category E, whereas the remainder of the facility property is regarded as Category F (manufacturing, maintenance facility, and agriculture). With the exception of a few small undeveloped Category G parcels in the Millersburg area, the remainder of the project area (agricultural fields) is considered Category E (agriculture).

4. Ambient Noise Measurements

In accordance with the INDOT *Traffic Noise Analysis Procedure* (INDOT 2011), ambient noise measurements are required to establish the existing levels resulting from current traffic conditions and for use in validating the TNM 2.5 program set-up in situations where highway traffic is the predominant contributing noise source. Sound pressure levels are typically measured in decibels (dB) which are based on a logarithmic scale. INDOT has adopted the equivalent hourly sound level descriptor ($L_{eq}(h)$) for measurement and use in analysis for highway noise studies in Indiana. The L_{eq} is defined as the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with $L_{eq}(h)$ being the hourly value of L_{eq}. Additionally, because the human ear is differentially sensitive to varying sound frequencies, an A-weighted response curve is used to mimic our response to the range of frequencies that emanate from highway traffic sources. A-weighted decibels are expressed as dBA.

Ambient measurements were taken to represent noise sensitive areas throughout the study area and were conducted in accordance with the FHWA Report FHWA-PD-96-046 Measurement of Highway-Related Noise (Lee and Fleming 1996). These measurements are to be taken during the worst (noisiest) traffic hour under conditions that would yield the greatest $L_{eq}(h)$. This is typically during the greatest traffic volume periods, providing traffic is free-flowing (i.e., LOS of C or better). AM and PM peak periods for the roadways in the project area are generally 7:00am and 4:00 to 5:00pm. Because this data is principally being used to validate the existing condition model, conducting measurements outside of peak hour periods is considered acceptable.

Ambient $L_{eq}(h)$ measurements were obtained from five locations in the study area on March 16, 2017 using a Larson-Davis DSP82 Type 1 Integrating sound level meter (SLM). The Certificate of Calibration and Conformance for both the DSP82 and the CAL200 Acoustic Calibrator from Larson-Davis Laboratories is included in Appendix B. The SLM was calibrated with the acoustic calibrator at

94 dBA at the beginning of each of the three measurement sessions (morning, afternoon, and early evening) and after battery changes. Additionally, the unit was checked using the calibrator at the end of the day to confirm that it was still reading correctly. Each measurement period was 15 minutes in duration. Three measurements were taken at each of the locations. During each measurement period, traffic volumes were manually counted using a Microsoft Access database counter program on a tablet by vehicle class (automobiles, medium trucks, and heavy trucks) for later use in validation of the TNM 2.5 set-up. General weather conditions (i.e., temperature, humidity, wind speed/direction, and cloud cover) were documented for each session. Due to a malfunctioning thermometer, temperature and humidity were obtained from 5 minute interval data for the KINARCAD2 Arcadia, Indiana weather station (Wunderground.com). Additionally, non-highway related sources of sound (i.e., wind, barking dogs, farm machinery, etc.) in the immediate vicinity of the monitoring station were also documented.

Field measurement data sheets are included in Appendix C. The traffic data and $L_{eq}(h)$ measurements for the five locations are presented in Table 2 and on Figure 2. Measured sound levels ranged from 40.3 dBA at the 28090 Whetston Road residence (Site 12) to 60.2 dBA at the 6767 E 276th Street residence (Site 3) within the Beck's Superior Hybrid, Inc. property. Many of the field measurements were affected by sound generated from moderate wind conditions of up to 5 mph.

5. TNM 2.5 Existing Condition Set-Up

The 276th Street Extension Phase II noise analysis used the latest FHWA TNM Version 2.5 software. Roadways, receptors, terrain lines, and barriers were constructed in TNM 2.5 to replicate the 3D relationship between the proposed 276th Street extension and potential noise sensitive receptors in the study area. A variety of data sources (i.e., CAD base layers, Hamilton County Digital Elevation Model (DEM) data, Google Earth, GoogleMaps, and aerial photographs) were utilized to obtain the information required to set-up the current condition noise analysis. The model was constructed in the Indiana state plane east (NAD 83 feet) coordinate system. Roadway, terrain line, and receptor features were generated from ArcGIS Desktop 10.1 attribute table files and imported into TNM 2.5 as tabular point files.

a. Roadways

Existing 276th Street and associated roadways (Beck's access road, Gwinn Road, Whetston Road, 281st Street, and SR 19) were included in the model. All roadways were modeled with two lanes to represent bi-directional travel. No separate turn lanes were required or included. Construction of the TNM 2.5 existing condition model included 10-foot, 12-foot, and 14-foot lane widths as appropriate. The default average pavement type was used for all model runs. Elevations for the segments that comprised the roadways were based on elevations derived from the Hamilton County DEM (1 foot resolution).

276th Street has a posted speed limit of 35 mph in the vicinity of the Beck's Superior Hybrid, Inc. facility and this is generally the average speed of traffic for this area under free flow conditions. Just east of Cicero Creek the posted limit is increased to 45 mph heading westward. The access road to Beck's Superior Hybrid, Inc. south of 276th Street was modeled at 30 mph to reflect the slowest speed possible for TNM 2.5. Whetston Road was modeled at 35 mph throughout. 281st Street east of SR 19 was modeled at 35 mph to reflect slower traffic approaching and coming off of SR 19. 281st Street (Railroad Street) west of SR 19 was modeled at 30 mph to reflect the slowest speed possible for this short road in Millersburg. Gwinn Road is unsigned in the project area and was modeled at 45 mph. SR 19 is signed and was modeled at 55 mph.

The 276th Street Extension Phase II – Traffic Forecast and Roundabout Capacity Analysis (EMCS, Inc. 2017) includes 2018, 2028 and 2038 AM and PM peak hour turning movement data and heavy truck percentages for the proposed roundabout. This analysis also includes 2015 and 2016 AM and PM peak data and heavy truck percentages for SR 19 and several of the county roads in the area. An annual growth rate of 1.5% was applied to the 2015 and 2016 hourly volumes for the existing roads to generate 2017 base year traffic volumes for use as TNM 2.5 model input. The 2015 and 2016 percent heavy truck volumes were applied to the calculated 2017 volumes. Given the relatively low volume of hourly volumes and the rural nature of the

project area, all of the truck traffic input into the TNM 2.5 model was considered heavy trucks. The remainder of the vehicle volume was assigned to the car classification with no medium trucks. This assumption represents a worst case scenario for predicting traffic noise levels.

The PM peak hour data was used because it exhibited the greatest volume of overall traffic and the greatest percentage of truck volumes. The peak hour traffic volume was split into bi-directional volumes based on the directional percentage split value provided in the 2015 and 2016 data. Table 3 includes a general breakdown of the hourly traffic volumes used as input in the existing condition 2017 base year TNM 2.5 analysis.

Gwinn Road northbound and southbound flow control was set at 100 percent for the Gwinn Road intersection, and westbound flow control on 276th Street was similarly set at 100 percent. 281st Street eastbound and westbound flow control was also set at 100 percent for the SR 19 intersection.

b. Receptors

For the 2017 existing condition noise analysis, potential noise sensitive receptors were identified within and just beyond 500 feet from the edge of pavement for the proposed 276th Street Extension (Figures 3A through 3G). In the event that impacts were occurring at locations beyond the 500-foot limit, the study area would have been extended to no more than 800 feet. To generate $L_{eq}(h)$ levels for all noise sensitive receptors within the study area, 23 receptor data points were included in the TNM 2.5 set-up (Figures 3A through 3G). The receptor position was determined by assessing the most likely area of exterior human occupancy at each location using aerial photographs. The elevations of the receptors were obtained using the Hamilton County DEM data with ArcGIS 10.1. The TNM 2.5 default receptor height elevation of 4.92 feet was used for all ground level receptors.

Category B residential receptors for the project area included 21 single family dwelling units along 276th Street, Gwinn Road, Whetston Road, 281st Street, and SR 19. One Category E receptor representing the office facilities at Beck's Superior Hybrids, Inc. and one Category F receptor representing the Beck's maintenance facility off of Gwinn Road were the only non-residential receptors included.

The majority of the parcels within the project area represent Category F (agriculture and manufacturing) and Category G (undeveloped properties). Representatives from the Town of Cicero Planning (March 15), Arcadia Building and Zoning (March 16), and Atlanta Building and Zoning (March 16) were contacted to determine if building permits had been filed for any of undeveloped parcels in the project area, or if there are any firm commitments to develop on these properties in the immediate future (i.e., prior to finalization of the environmental document). Each of these offices indicated that there have not been any building permits submitted for this area and they are not aware of any intentions for near future development. Much of the agricultural land within the project area is owned by Beck's.

c. Barriers

No barrier features were used in the 2017 base year TNM 2.5 model to represent building structures or other obstacles to sound propagation between the roadway and receptors.

d. Terrain Lines

Terrain lines define where vertical topographic break line features influence the propagation of sound across the landscape. The terrain of the immediate 276th Street Extension Phase II project landscape is relatively level with only gradual changes of 10± feet in elevation. Terrain lines were included in the TNM 2.5 set-up to represent features such as roadside ditches and break points along existing roads. Terrain lines representing these topographic features were generated using the Hamilton County DEM aerial data. Terrain lines were generally only utilized where abrupt changes in slope occurred between the roadway and the receptors of concern. Gradual slope features between the edge of the right-of-way and the receptors were not modeled using terrain

lines. Elevations in the project area range from 839 feet within the Cicero Creek tributary north of Millersburg to peaks of 879 feet west of Gwinn Road and the 281st Street intersection.

e. Building Rows
Building row features were not needed in TNM 2.5 to replicate conditions that occur for second row receptors.

f. Ground Zones and Tree Zones
The default ground type set for all of the TNM 2.5 runs was lawn. Although hard surface parking lots are present at Beck's Superior Hybrids, Inc., these were not included in the model since in most cases the receptor location was positioned close enough to the roadway that the influence of the hard surface on sound propagation was negligible. Similarly, no water surface or tree zones were included in the model.

6. TNM 2.5 Validation of Model Based on Field Measurements

The validation process attempts to check the predicted results from TNM 2.5 against field measurements to determine if the program appears to accurately represent the 3D acoustic conditions that exist within the noise assessment analysis area.

A total of five Category B receptors (see Table 1 for Category descriptions) were utilized to validate the existing condition TNM 2.5 set-up (Table 2 and Figure 2). The Category B receptors included two residences along 276th Street (west of Cicero Creek and at Beck's Superior Hybrid, Inc.), one residence along Gwinn Road near the 276th Street intersection, one residence at the corner of Whetston Road and 281st Street, and one residence at Millersburg near the corner of SR 19 and 281st Street (Railroad Street).

For each of the five field measurement sites, the 15 minute bi-directional traffic count data for the roadways closest to the receptor was adjusted to an hourly volume for automobiles, medium trucks, and heavy trucks based on the duration of the field measurement period (i.e., 15 minute traffic counts were multiplied by four). Three measurements were taken at each of the locations (morning, afternoon, and early evening). Appendix D includes the TNM 2.5 output for the validation runs. Table 2 and Figure 2 include the results of the validation process based on the predicted $L_{eq}(h)$ levels from TNM 2.5 and the field measurements collected.

For the five ambient field sites, the TNM predicted $L_{eq}(h)$ levels were within ±3 dBA of the respective $L_{eq}(h)$ recorded with the SLM at five of the fifteen measurements collected (Sites 3, 9, 12, and 17). An additional three measurements at Sites 9, 12, and 17 were slightly beyond the ±3 dBA validation criteria with 3.7 to 3.9 dBA variation. This lack of validation between field measured levels and TNM 2.5 predicted levels is not unexpected given the light volume of traffic experienced on the rural roads of the project area and the predominance of non-traffic sounds caused by wind and other miscellaneous acoustic influences.

For Site 1 at the 6401 E 276th Street residence, the three field measurements were between 4.7 and 9.4 dBA greater than the TNM 2.5 $L_{eq}(h)$ level predicted for the traffic counted during the respective survey sessions. This lack of agreement is attributed primarily to very low traffic volumes with few trucks, a distance of approximately 135 feet from the residence to the roadway, and a moderate wind out of the west which likely affected sound propagation from the roadway, as well as additional non-traffic wind derived sounds.

For Site 3 at the 6767 E. 276th Street residence at the Beck's facility, the afternoon measurement was within 1.1 dBA of the TNM 2.5 predicted level. This is primarily due to a slightly larger volume of heavy trucks that passed through the area during the survey period. The recorded levels for the morning and early evening sessions were 5.3 and 7.1 dBA, respectively, above the TNM 2.5 predicted levels primarily due to non-traffic related sounds emanating from the Beck's plant (i.e., idling trucks, plant machinery) and wind generated noise.

For Site 9 at the 27649 Gwinn Road residence, the morning measurement was 0.9 dBA lower than the TNM 2.5 predicted level. Conversely, the early evening recorded level was 3.9 dBA greater than that predicted by TNM 2.5. This early evening sample was purposely taken at a time when Beck's employees were getting off work and represented the highest traffic volume passing through the 276th Street and Gwinn Road intersection (57 vehicles in 15 minutes). This survey period did not however have any medium or heavy trucks present. Considering the 100 foot distance from the sample point to the roadway and the influence of wind out of the west at this location, this discrepancy is understandable. The afternoon survey period consisted of traffic volumes comparable to the morning session, but in this instance the field measurement was 6.2 dBA lower than that predicted by TNM 2.5 for the traffic volume recorded. This over-prediction of $L_{eq}(h)$ levels can only be explained by actual traffic speeds possibly being lower than that used in the model.

For Site 12 at 28090 Whetston Road, in the southwest corner of the 281st Street intersection, each 15 minute monitoring session only had a single vehicle (car classification) turning from 281st Street onto Whetston Road, or vice versa. Such low volumes resulted in TNM 2.5 predicted levels of 39.1 to 39.2 dBA compared to field measurements of 40.3 to 49.7 dBA. Despite this negligible volume, the predicted model level for the afternoon session was only 1.1 dBA above the field measurement. Although not within the ±3 dBA variance criteria, the morning session model prediction was within 3.9 dBA of the field measurements. Conversely, the early evening session yielded a field measurement of 49.7 dBA, 10.6 dBA greater than the TNM 2.5 prediction. This variation is attributed solely to increased wind effects during this time of day.

For Site 17 at 28079 Millersburg Road, just west of SR 19, the field measurement for the morning session was 1.2 dBA greater than the TNM 2.5 predicted level, while the early evening session measurement was 1.4 dBA lower than the TNM 2.5 predicted level. This location is approximately 185 feet from SR 19 and was partially shielded from winds out of the west by the residence, garage, and other outbuildings. For the afternoon session, the field measurement was actually 3.7 dBA less than the TNM 2.5 predicted level of 55.7 dBA. Although heavy truck volume was minimal during these three sessions, the roadway noise generated by the larger volume of light vehicle traffic on the highway was considered to be relatively more prominent than at the other locations.

7. 2010 Existing Condition TNM 2.5 Results

For the 23 modeled receptors within the project area, the existing base condition 2017 traffic volumes yielded $L_{eq}(h)$ highway noise levels that ranged from 36.6 dBA to 66.7 dBA. The 36.6 dBA level was predicted for the northernmost 28210 Whetston Road residence (Category B). The 66.7 dBA level was predicted for the 28040 SR 19 residence along the west side of SR 19 closest to highway at Millersburg. The TNM 2.5 2017 base year analysis indicates that under the current conditions there is one Category B residential dwelling unit (28040 SR 19) that has a predicted $L_{eq}(h)$ level which approaches the 67 dBA NAC. The base year $L_{eq}(h)$ highway noise levels determined for the Beck's Superior Hybrid, Inc. facility do not approach or exceed the 72 dBA Category E NAC. Table 5 provides a complete listing of the 2017 TNM 2.5 $L_{eq}(h)$ results for each receptor. The TNM 2.5 output for the 2017 base year is included in Appendix E.

8. TNM 2.5 2036 Design Year Set-Up

The TNM 2.5 set-up for the proposed 276th Street Extension Phase II was conducted in a similar manner as that discussed in Section 5 for the current condition. The geometric design for the 276th Street Extension roadway was based on current available CAD files (plan sheets, profiles, cross sections, and typical sections) provided by the designer.

a. Roadways

For the TNM 2.5 model set-up, the plan view alignment and cross sections from the design plans for the 276th Street Extension and local improvements at Gwinn Road were used to construct the 3D model as two bi-directional 12-foot lanes. The roundabout lanes were constructed from plan view designs and roadway segments elevations were interpolated from available cross section data.

The 2038 design year traffic data for use as TNM 2.5 input was derived from PM peak hourly turning movement data available in the Traffic Forecast and Roundabout Capacity Analysis (EMCS, Inc. 2017). The turning movement data for the 276th Street roundabout was converted into total traffic volume for each roadway segment. Respective truck volumes were based on truck percentages provided for each turning movement. As with the base year 2017 TNM 2.5 model, all trucks were considered heavy trucks to represent a worst case scenario. 2038 traffic volumes for SR 19, Gwinn Road, Whetston Road, and 281st Street were calculated using a 1.5 percent annual increase applied over 21 years to the 2017 traffic volume data. Through consultation with the EMCS, Inc. traffic engineer it was determined that the new 276th Street Extension would result in an estimated 70 percent reduction in traffic volumes on Gwinn Road since traffic from Beck's Superior Hybrid, Inc. would access SR 19 from the new road as opposed to the existing 276th Street, to Gwinn Road, to 274th Street route currently used. As such, the Gwinn Road traffic volumes, both north and south of 276th Street were reduced by 70 percent before applying the annual 1.5 percent annual growth factor.

b. Receptors
The same 23 receptor locations used for the 2017 base condition were utilized for the 2038 design year analysis. There were no anticipated residential, business, or non-profit displacements identified at the time this analysis was conducted.

c. Barriers
No barrier features were used in the 2038 design year TNM 2.5 model to represent building structures or other obstacles to sound propagation between the roadway and receptors.

d. Terrain Lines
All terrain lines used in the existing condition were retained or modified in the design year set-up. Breaklines along the proposed 276th Street Extension were modeled in the vicinity of receptors when warranted based on 100-foot interval cross sections.

e. Building Rows
Building row features were not needed in design year TNM 2.5 to replicate conditions that occur for second row receptors.

f. Ground Zones and Tree Zones
As with the base year analysis, no ground zone or tree zone features were included in the 2038 design year model.

9. 2038 Design Year Identification of Predicted Impacted Receptors

In 23 CFR 772, FHWA establishes two conditions under which highway traffic noise impacts can occur.

1. The predicted future noise levels approach or exceed the appropriate NAC for the land use. INDOT defines "approach" to be within 1.0 dBA of the appropriate noise abatement category.
2. The predicted future traffic noise levels substantially exceed the existing noise levels. INDOT defines substantial increase as an increase in noise levels for which the future nose levels exceed the existing noise levels (as predicted by FHWA TNM version 2.5) by 15.0 dBA.

The results of the 2038 design year $L_{eq}(h)$ level prediction for the receptors within the noise sensitive areas of the 276th Street Extension Phase II project area are included in Table 5 and illustrated on Figures 3A through 3G. TNM 2.5 output of the design year model run are included in Appendix F. 2038 $L_{eq}(h)$ predicted levels range from 46.4 dBA at the 27710 Gwinn Road Beck's maintenance facility to 68.3 dBA at the 28040 SR 19 residence.

One Category B residential receptor (28040 SR 19) has a predicted 2038 design year $L_{eq}(h)$ level of 68.3 dBA that exceeds the 67 NAC threshold and therefore constitutes an impact under the first condition noted above. However, this impact is more a function of the current and predicted increase in traffic volumes on SR 19 at 55 mph than it is the result of the new 276th Street alignment. As such,

this NAC impact is not perceived as an impact associated with the proposed action. A second Category B residential receptor at 28090 Whetston Road has a predicted 2038 $L_{eq}(h)$ of 60.5 dBA which represents a 19.7 dBA increase over the 40.8 dBA TNM 2.5 calculated $L_{eq}(h)$ for 2017. This residence is located at the southwest corner of the Whetston Road and 281st Street intersection, both of which are very low volume rural roads. The new proposed roadway with its greater traffic volumes (including heavy trucks) would be approximately 80 feet north of the residence, and therefore is predicted to result in a substantial increase of more than 15 dBA above the base year predicted level of 40.8 dBA.

The 2038 design year traffic volumes for 276th Street through the Beck's Superior Hybrid, Inc. facility are not predicted to result in Category E NAC impacts. Since much of the current truck traffic on this section of 276th Street will be diverted to the new extension, $L_{eq}(h)$ traffic sound levels are actually expected to be reduced by -2.5 to -2.6 dBA at the exterior areas near the facility office and at the two residences on the property. Table 5 also indicates that predicted decreases of -3.9 to -7.2 dBA can be expected at the residences near the 276th Street and Gwinn Road intersection resulting from traffic diversion to the new roadway.

10. 2038 Design Year Noise Abatement Evaluation

In instances where highway noise impacts are predicted as a result of a Type I project action, FHWA and INDOT require that consideration be given to noise abatement measures. This process involves an evaluation of the feasibility (both acoustic and engineering feasibility) of implementing abatement that can achieve a 5 dBA reduction in predicted $L_{eq}(h)$ levels at the majority of the impacted receptors and do so without compromises to public safety and engineering standards. In situations where mitigation appears to be feasible, this process also requires an evaluation of the reasonableness of being able to implement specific abatement measures based on the views of residents and property owners, the cost-effectiveness of the abatement measure and the ability to achieve INDOT's substantial noise reduction goal of 7.0 dBA at the majority of impacted first row receptors through implementation of the abatement measure.

a. Consideration of Abatement

Noise abatement measures typically considered for mitigating impacted receptors include, but are not necessarily limited to, traffic control measures, alteration of vertical or horizontal alignment of the roadway(s), acquisition of buffering land, noise insulation of public use or non-profit institutional structures, and/or construction of traffic noise barriers (i.e., berms or walls). The use of traffic control measures such as traffic signals or reduced operating speeds to reduce noise emissions in the project area is contrary to the project objective which is to provide a facility for free-flow traffic from 276th Street west of Beck's Superior Hybrid, Inc. to SR 19.

Changes in the vertical and horizontal alignment of a highway can result in reduced noise levels at specific receptors. In the case of the 28090 Whetston Road residence, the extent of vertical alignment alteration to achieve a noise reduction which would keep the predicted levels under the substantial increase criteria is not practical. An estimated horizontal alignment shift to the north of at least 120 feet would be required to reduce the predicted level more than the 5 dBA needed to avoid the substantial increase impact. To reduce the predicted $L_{eq}(h)$ by 7 dBA or more in accordance with the 2011 *Traffic Noise Analysis Procedure*, the shift would need to be at least 190 feet. Such a shift would place the roadway closer to the 28210 Whetston Road residence and increase the impact level at this residence. A similar shift in the horizontal alignment to the south would increase the level of impact to the 27790 Whetston Road residence and potentially compromise the engineering geometrics of the roadway for the approach to SR 19.

Acquisition of the 28090 Whetston Road property would resolve the impact. However, such a resolution is dependent on additional consideration by Hamilton County and coordination with the property owner.

Consideration for additional noise insulation of the residential structure is not regarded as warranted since this does not address the exterior noise impacts identified at the residence.

Considering the landscape circumstances associated with the 276th Street Extension project area, the use of barriers (berms or walls) is considered to be the most practical and potentially feasible measure to use for abatement purposes at the 28090 Whetston Road residence.

b. Feasibility and Reasonableness Assessment of Barrier Walls

In accordance with the INDOT *Traffic Noise Analysis Procedure* (INDOT 2011), the feasibility of noise abatement at impacted receptors must be analyzed. If a barrier cannot be shown to be feasible, then it does not warrant further considered. Feasibility must be analyzed from an acoustic and engineering perspective. INDOT requires that abatement measures achieve a 5 dBA reduction at a majority (greater than 50%) of the impacted receptors in order to be considered acoustically feasible. For the purposes of estimating design barrier cost a rate of $30/square foot was used as per INDOT coordination on December 22, 2016.

Noise abatement in the form of a barrier wall or earthen berm was investigated for the 28090 Whetston Road residence where the predicted $L_{eq}(h)$ level represents a substantial increase above the 2017 base year level. The location of the residence in the southwest corner of the Whetston Road and proposed 276th Street Extension intersection precludes placement of a barrier along the new 276th Street roadway both east and west of the residence, as this would require Whetston Road to be closed. A partial length barrier wall along the southern edge of the new 276th Street Extension to the west of Whetston Road would not provide sufficient acoustic attenuation to reduce sound levels resulting from line-of-sight traffic noise emanating from the east. Additionally, a partial barrier wall would compromise sight distance between Whetston Road and 281st Street in the southwest quadrant. Therefore, the use of a barrier wall to provide abatement at this location is not considered to be feasible based on engineering and acoustic grounds. The use of an earthen berm instead of a structural wall was not considered to be feasible for the same reasons. No TNM 2.5 barrier analysis was conducted at this location to assess noise reduction feasibility and cost-effective reasonableness since such an abatement measure has been demonstrated to not be feasible due to engineering constraints.

c. Statement of Likelihood

Based on the studies thus far accomplished, Hamilton County has not identified any locations where noise abatement is likely. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement has not been found to be feasible based on the inability to achieve a 5 dBA reduction with a partial width barrier along 276th Street at the Whetston Road intersection. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is feasible and reasonable, the abatement measures might be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement process.

11. Construction Noise

Construction of the 276th Street Extension Phase II project will result in unavoidable construction noise from equipment such as excavators, backhoes, pavement saws, graders, pavers, concrete trucks, compressors and other miscellaneous equipment. When and where possible, construction noise for this project should be controlled or minimized by measures including, but not limited to:

- Contractors should adhere to all federal, state and local noise abatement and control requirements.
- Limit construction activities in the vicinity of residences to the hours between 7:00 am and 7:00 pm, or as directed by local ordinances.
- Establish a responsive communication process with local residents that provides a contact number where inquiries concerning construction activities can be addressed.
- Enclose equipment such as generators when in operation during periods of residential occupancy in the immediate vicinity.
- Maintain construction equipment in good working order with manufacturer recommended mufflers.

- Coordinate the location of staging areas and other noise generating activities away from residential areas whenever possible.

These measures should be included in the National Environmental Policy Act (NEPA) document as For Further Consideration Commitments.

12. Noise Compatible Future Development

The highway traffic noise environment along busy thoroughfares is an important element for consideration in the planning of development within travel corridors. Information concerning the anticipated noise levels adjacent to roadways can assist local governments, planners and developers in the appropriate type, location and layout of future development on land that is currently undeveloped. With this information available, less noise sensitive uses such as commercial, industrial, recreational, or green space development can be targeted for areas immediately adjacent to roadways, while future noise impacts to more sensitive development such as housing areas can be avoided.

Currently, the study area is largely undeveloped agricultural row crop farmland. It is not foreseeable, that over the next 20 years any of this property will be developed for industrial, commercial or residential purposes, with the possible exception of construction of isolated scattered residences on existing farmland parcels. To plan for any such development, it will be useful to have a basic understanding of where potential noise impacts are predicted along the corridor. In an effort to provide assistance to Hamilton County planners in understanding where such impacts can be expected, TNM 2.5 was utilized to generate data for development of a 66 dBA zone along the 276th Street Extension. The 66 dBA zone identifies an area within which $L_{eq}(h)$ levels are expected to be at 66 dBA or higher. This was accomplished using a 20 foot by 20 foot grid of receptor data points placed between 20 feet and 200 feet from the centerline of the 276th Street Extension as input in the TNM 2.5 design year model. The resulting TNM 2.5 $L_{eq}(h)$ data was reviewed to determine the distance from the roadway at which the design year $L_{eq}(h)$ is anticipated to be equal to or greater than 66 dBA based on 2038 traffic volumes. From this data an approximate 66 dBA zone was generated and is depicted on Figures 3A through 3G.

$L_{eq}(h)$ levels at or above 66 dBA are only predicted to occur at distances of approximately 35-40 feet from the proposed centerline. Throughout much of the new proposed 276th Street Extension length, the predicted 66 dBA boundary would be contained within the proposed right-of-way. Since noise levels of 66 dBA are not expected much beyond the proposed right-of-way, any potential future residential or commercial/industrial development of the agricultural farmland parcels along the 276th Street Extension would be compatible with anticipated highway generated sound levels.

13. Summary

The proposed 276th Street Extension Phase II project includes construction of a new 2-lane roadway (12 foot lanes) and single lane roundabout intersection from 276th Street to the west of Beck's Superior Hybrid, Inc. to SR 19 at Millersburg, approximately 1.9 miles. Within 500 feet of the new proposed roadway, the project area consists primarily of agricultural fields with scattered single-family residences. Becks' Superior Hybrid, Inc. is a large manufacturing plant along both the south and north sides of 276th Street west of Gwinn Road. The project will require the acquisition of new right-of-way; however, no residential or business displacements are currently anticipated.

Ambient highway traffic noise was monitored at five locations and utilized to attempt validation of the TNM 2.5 models that were developed for the study analysis. The existing condition model could not be validated at all of the ambient monitoring sites because roadway traffic is not the predominant source of noise in this rural landscape. A total of 23 receptors were included in the existing condition model to represent Category B residential dwellings (n=21), Category E location (n=1; offices at Beck's Superior Hybrid, Inc.), and Category F location (n=1; Beck's Superior Hybrid, Inc. maintenance facility). Using 2017 base condition traffic data from the *276th Street Extension Phase II – Traffic Forecast and Roundabout Capacity Analysis* (EMCS, Inc. 2017), the existing condition TNM 2.5 model results indicate that a single residential property along SR 19 (28040 SR 19) currently experiences traffic based $L_{eq}(h)$ levels that approach the 67 dBA Category C NAC threshold.

The proposed roadway and roundabout were modeled using TNM 2.5 and 2038 peak hour traffic volumes derived from the *Traffic Forecast and Roundabout Capacity Analysis* (EMCS, Inc. 2017) to predict the $L_{eq}(h)$ levels for the project in the design year. The analysis predicted that Category B impacts (approach or greater than the 67 dBA NAC threshold) can be expected at the 28040 SR 19 residence. However, this impact is more a function of traffic on SR 19 that the proposed traffic on the new 276th Street extension. A second residence at the corner of Whetston Road and 281st Street (28090 Whetston Road) is predicted to have a 2038 design year $L_{eq}(h)$ traffic based sound level of 60.5 dBA, which is 19.7 dBA above its 2017 base year 40.8 dBA level, and therefore represents a substantial increase impact. No Category E impacts (approach or greater than the 72 dBA NAC threshold) are predicted at the offices for the Beck's Superior Hybrid, Inc. facility.

Installation of a noise barrier wall as an abatement measure at the 28090 Whetston Road residence was discounted as feasible because the proposed Whetston Road intersection would preclude placement of a barrier to the east of the residence along the south side of the 276th Street Extension, and a partial barrier (half width) would be ineffective at reducing design year $L_{eq}(h)$ levels by 5 dBA. Additionally, such a barrier this close to the intersection would compromise sight distance between the new 276th Street Extension roadway and Whetston Road. As such, barrier wall abatement at this location is not deemed feasible.

A final determination on noise abatement for the 276th Street Extension Phase II project will be made during the final design phase. At such time, if design elements have changed that warrant a re-evaluation of the predicted noise levels, additional noise analysis will be performed to determine if impacts are anticipated, and if so, noise abatement measures will be further evaluated.

14. References

23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, August 11, 1997.

EMCS, Inc. 2017. *276th Street Extension Phase II – Traffic Forecast and Roundabout Capacity Analysis*.

FHWA Policy Memorandum *Highway Traffic Noise Analysis and Abatement – Policy and Guidance*, June 12, 1995.

Indiana Department of Transportation. 2011. *Traffic Noise Analysis Procedure*.

Lee, Cynthia S.Y., and Gregg G. Fleming. 1996. *Measurement of Highway-Related Noise*, FHWA-PD-96-046.

15. Investigators

Lochmueller Group, Inc. Staff	Position	Contributing Effort
Rusty Yeager	Environmental Biologist III	Field Data Collection TNM 2.5 Modeling Report Preparation Mapping QA/QC

Table 1. FHWA Activity Categories, Descriptions and Noise Abatement Criteria (NAC)

Activity Category	$L_{eq}(h)$	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Residential
C	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or not profit institutional structures, radio studios, television studios, trails and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public and not profit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (Exterior)	Hotels, motels, offices, restaurant/bars and other developed lands, properties, or activities not included in A-D or F.
F	---	Agriculture, airports, bus yards, emergency services, industrial logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	---	Undeveloped lands that are not permitted.

Table 2. 276th Street Ambient Field Measurements and TNM 2.5 Validation Comparison

Location	Date/ Time	Lane Direction	15 Minute Traffic Count			Hourly Adjusted Traffic Count			Field Measurement ($L_{eq}(h)$)	TNM Prediction ($L_{eq}(h)$)	Field Measurement Minus TNM Predicted ($L_{eq}(h)$)
			Auto	MT	HT	Auto	MT	HT			
Site 1 6401 E 276th Street residence	3/16/17 7:44am	276th eastbound	4	0	0	16	0	0	51.0	41.6	+9.4
		276th westbound	2	0	0	8	0	0			
	3/16/17 11:52am	276th eastbound	4	1	0	16	4	0	51.2	46.3	+4.9
		276th westbound	2	1	0	8	4	0			
	3/16/17 4:00pm	276th eastbound	4	0	0	16	0	0	53.8	49.1	+4.7
		276th westbound	5	0	1	20	0	4			
Site 3 6767 E 276th Street residence at Beck's	3/16/17 8:06am	276th eastbound	2	0	2	8	0	4	56.1	50.8	+5.3
		276th westbound	3	0	0	12	0	0			
	3/16/17 12:14pm	276th eastbound	3	0	3	12	0	12	57.7	56.6	+1.1
		276th westbound	2	0	0	8	0	8			
	3/16/17 4:51pm	276th eastbound	7	0	0	28	0	0	60.2	53.1	+7.1
		276th westbound	22	0	1	88	0	4			
Site 9 27649 Gwinn Road residence	3/16/17 8:28am	276th eastbound	3	0	0	12	0	0	47.5	48.4	-0.9
		276th westbound	7	0	1	28	0	4			
		Gwinn N. northbound	3	0	0	12	0	0			
		Gwinn N. southbound	2	0	0	8	0	0			
		Gwinn S. northbound	6	0	1	24	0	4			
		Gwinn S. southbound	1	0	0	4	0	0			
	3/16/17 12:37pm	276th eastbound	7	0	0	28	0	0	43.8	50.0	-6.2
		276th westbound	4	0	1	16	0	4			
		Gwinn N. northbound	7	0	1	28	0	4			
		Gwinn N. southbound	3	0	0	12	0	0			
		Gwinn S. northbound	4	0	2	16	0	8			
		Gwinn S. southbound	3	0	0	12	0	0			
	3/16/17 4:30pm	276th eastbound	44	0	0	176	0	0	56.7	52.8	+3.9
		276th westbound	3	0	0	12	0	0			
		Gwinn N. northbound	21	0	0	84	0	0			
		Gwinn N. southbound	10	0	0	40	0	0			
		Gwinn S. northbound	3	0	0	12	0	0			
		Gwinn S. southbound	33	0	0	132	0	0			
Site 12 28090 Whetston Road residence	3/16/17 8:52am	Whetston N. northbound	0	0	0	0	0	0	43.1	39.2	+3.9
		Whetston N. southbound	1	0	0	4	0	0			
		Whetston S. northbound	0	0	0	0	0	0			
		Whetston S. southbound	0	0	0	0	0	0			
		281st eastbound	0	0	0	0	0	0			
		281st westbound	1	0	0	4	0	0			
	3/16/17 1:01pm	Whetston N. northbound	0	0	0	0	0	0	40.3	39.2	+1.1
		Whetston N. southbound	1	0	0	4	0	0			
		Whetston S. northbound	0	0	0	0	0	0			
		Whetston S. southbound	0	0	0	0	0	0			
		281st eastbound	0	0	0	0	0	0			
		281st westbound	1	0	0	4	0	0			
	3/16/17 5:15pm	Whetston N. northbound	1	0	0	4	0	0	49.7	39.1	+10.6
		Whetston N. southbound	0	0	0	0	0	0			
		Whetston S. northbound	0	0	0	0	0	0			
		Whetston S. southbound	0	0	0	0	0	0			
		281st eastbound	1	0	0	4	0	0			
		281st westbound	0	0	0	0	0	0			

Location	Date/ Time	Lane Direction	15 Minute Traffic Count			Hourly Adjusted Traffic Count			Field Measurement ($L_{eq}(h)$)	TNM Prediction ($L_{eq}(h)$)	Field Measurement Minus TNM Predicted ($L_{eq}(h)$)
			Auto	MT	HT	Auto	MT	HT			
Site 17 28079 Millersburg Road residence	3/16/17 9:14am	SR 19 N. northbound	26	1	0	104	4	0	56.0	54.8	+1.2
		SR 19 N. southbound	50	0	2	200	0	8			
		SR 19 S. northbound	29	1	0	116	4	0			
		SR 19 S. southbound	50	0	2	200	0	8			
		281st W. eastbound	0	0	0	0	0	0			
		281st W. westbound	0	0	0	0	0	0			
		281st E. eastbound	3	0	0	12	0	0			
		281st E. westbound	0	0	0	0	0	0			
	3/16/17 1:22pm	SR 19 N. northbound	33	2	1	132	8	4	52.0	55.7	-3.7
		SR 19 N. southbound	34	4	1	136	16	4			
		SR 19 S. northbound	35	2	1	140	8	4			
		SR 19 S. southbound	34	4	1	136	16	4			
		281st W. eastbound	0	0	0	0	0	0			
		281st W. westbound	1	0	0	4	0	0			
		281st E. eastbound	3	0	0	12	0	0			
		281st E. westbound	2	0	0	8	0	0			
	3/16/17 5:36pm	SR 19 N. northbound	57	0	0	228	0	0	54.3	55.7	-1.4
		SR 19 N. southbound	46	1	0	184	4	0			
		SR 19 S. northbound	61	0	0	244	0	0			
		SR 19 S. southbound	52	1	0	208	4	0			
		281st W. eastbound	1	0	0	4	0	0			
		281st W. westbound	0	0	0	0	0	0			
		281st E. eastbound	5	0	0	20	0	0			
		281st E. westbound	6	0	0	24	0	0			

Green shaded cells indicate monitoring periods where the TNM 2.5 model result was within ±3 dBA of the field measurement

Yellow shaded cells indicate monitoring periods where the TNM 2.5 model result was just beyond ±3 dBA of the field measurement

Red shaded cells indicate monitoring periods where the TNM 2.5 model result was not within or near ±3 dBA of the field measurement

Table 3. 276th Street Base Year 2017 Traffic Data for TNM 2.5

Roadway Section	Lane Direction and Inclusive Movements	Hourly Traffic Volumes			Speed (mph)	
		Cars	Medium Truck	Heavy Truck	Posted	Model
276th Street	eastbound west of Gwinn	43	*	11	35-45	35-45
	westbound west of Gwinn	53	*	13	35-45	35-45
Beck's entrance	northbound south of 276th	1	*	15	NA	30
	southbound south of 276th	1	*	18	NA	30
Gwinn Road	northbound south of 276th	36	*	9	NA	45
	southbound south of 276th	29	*	7	NA	45
	northbound north of 276th	28	*	7	NA	45
	southbound north of 276th	34	*	9	NA	45
	northbound north of 281st	28	*	7	NA	45
	southbound north of 281st	34	*	9	NA	45
Whetston Road	northbound south of 281st	1	*	0	NA	35
	southbound south of 281st	1	*	0	NA	35
	northbound north of 281st	1	*	0	NA	35
	southbound north of 281st	1	*	0	NA	35
SR19	northbound south of 281st	266	*	16	55	45
	southbound south of 281st	218	*	13	55	45
	northbound north of 281st	123	*	28	55	45
	southbound north of 281st	185	*	42	55	45
281st Street	eastbound west of SR19	1	*	0	NA	30
	westbound west of SR19	1	*	0	NA	30
	eastbound east of SR19	20	*	3	NA	35
	westbound east of SR19	9	*	2	NA	35
	eastbound west of Whetston	1	*	0	NA	35
	westbound west of Whetston	1	*	0	NA	35

Source: 2017 existing condition traffic data for TNM 2.5 was derived from the 276th Street Extension Phase II – Traffic Forecast and Roundabout Capacity Analysis (EMCS, Inc. 2017).
*All trucks were included as heavy trucks in TNM 2.5.

Table 4. 276th Street Design Year 2038 Traffic Data for TNM 2.5

Roadway Section	Lane Direction and Inclusive Movements	Hourly Traffic Volumes			Model Speed (mph)
		Cars	Medium Truck	Heavy Truck	
276th Street	eastbound west of roundabout	42	*	18	35-45
	westbound west of roundabout	47	*	10	35-45
	eastbound east of roundabout	81	*	3	35
	westbound east of roundabout	84	*	3	35
276th Street Extension	eastbound roundabout to SR19	52	*	11	35-45
	westbound roundabout to SR19	56	*	22	35-45
Beck's entrance	northbound south of roundabout	1	*	20	30
	southbound south of roundabout	2	*	43	30
Gwinn Road	northbound south of 276th	15	*	4	45
	southbound south of 276th	12	*	3	45
	northbound north of 276th	12	*	3	45
	southbound north of 276th	14	*	4	45
	northbound north of 281st	12	*	3	45
	southbound north of 281st	14	*	4	45
Whetston Road	northbound south of 281st	2	*	1	35
	southbound south of 281st	2	*	1	35
	northbound north of 281st	2	*	1	35
	southbound north of 281st	2	*	1	35
SR19	northbound south of 281st	363	*	22	45
	southbound south of 281st	297	*	18	45
	northbound north of 281st	168	*	38	45
	southbound north of 281st	252	*	57	45
281st Street	eastbound east of SR19	27	*	5	35
	westbound east of SR19	13	*	2	35

2038 existing condition traffic data for TNM 2.5 was derived from the 276th Street Extension Phase II – Traffic Forecast and Roundabout Capacity Analysis (EMCS, Inc. 2017).
*All trucks were included as heavy trucks in TNM 2.5.