TRAFFIC NOISE TECHNICAL REPORT
for the
Proposed Improvements of Illinois Route 31
From Illinois Route 176 to Illinois Route 120
McHenry County, Illinois

Prepared for:

Illinois Department of Transportation

Prepared by:
Huff & Huff, Inc.
May 2017

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1. INTRODUCTION

Improvements to Illinois Route 31 in McHenry County, Illinois, are proposed by the Illinois Department of Transportation. The study area, shown in Figure 1, is from just north of Illinois Route 176 to Illinois Route 120. Improvements to the Illinois Route 176 and IL Route 31 intersection have already been completed. Improvements to the Bull Valley Road intersection with IL Route 31 are being analyzed under a different, concurrent project. The project area is within unincorporated McHenry County, the Cities of McHenry and Crystal Lake, and the Village of Prairie Grove. Existing IL Route 31 is one lane in each direction with certain sections having a center turn-lane. Proposed improvements include adding a second lane to IL Route 31 in both directions.

This report presents a background on noise and the Federal and state noise regulations (Section 2), a discussion of noise sensitive receptors (Section 3), field noise monitoring (Section 4), a description of the noise analysis methodology (Section 5), the analysis of the existing and future noise levels (Section 6), the noise abatement analysis (Section 7), coordination with local officials for undeveloped lands (Section 8), construction noise (Section 9), and the noise analysis conclusion (Section 10).

Hill St
Willow Ln
Oak Dr
Prestwick St
Ramble Rd
Orleans St
Home Ave
Draper Rd
Bonner Dr
120
Scully Dr
North Dr
Freund Ave
1st Ave
Court St
Riverside Dr
Broad St
Park St
Mary Ln
Emily Ln
Hillside Ln
Lincoln Rd
Chapel Hill Rd
Sussex Dr
Ashley Dr
Mill St
Hanley St
3rd St
Venice Ln
Lake St
Adams Dr
Country Ln
John St
Center St
River Rd
Oakwood Dr
Royal Dr
Callista Ave
Lillian St
Kane Ave
Crescent Ave
Curran Rd
Green St
Country Club Dr
Anne St
High St
Timothy Ln
Fairway Dr
Private Dr
Midoak Ln
Dartmoor Dr
Highbridge Trl
Newport Trl
Augusta Dr
Crystal Lake Rd
Loyola Dr
Bauer Rd
Valley Rd
Ronda Rd
Elmkirk Park
Sutton Ct
Creekside Trl
Malibu Ct
Abbey Dr
Driftwood Trl
Veretta Ct
Village Trl
Glenbrook Trl
Loch Glen Ln
Charles J Miller Rd
Bull Valley Rd
Bally Rd
Lawrence Pky
Ellen Rd
Miller Dr
Still Hill Dr
Emerald Dr
Amberwood Pl
Beach Dr
Hilltop Blvd
Broadway St
Sauk Dr
Biscayne Rd
Mchenry Dam Rd
Ridgeview Dr
Corporate Dr
Paxton St
Dayton St
Forest Rd
Albany St
Prime Pky
Lock Ln
State Park Rd
Hi Point Rd
Russett Rd
Riverside Dr
Orchard Ln
Fernview Ln
Raintree Dr
31
Stilling Ln
Colby Dr
Anvil Rd
Barreville Rd
Colby Point Rd
Gracy Rd
Skyline Dr
Garden Ln
Jenny Jae Ln
Justen Rd
Hi Line Ave
Edgewood Rd
Kristen Trl
Rogers Rd
Wright Rd
Larkspur Dr
Shadowood Dr
Ames Rd
Grant St
Wisteria Dr
Bay Rd
Lakewood Dr
Timber Trail Dr
Pleasant Hill Rd
Nish Rd
Fawn Trl
Crystal Way
Crystal Cir
Niblick Ct
Half Mile Trail
Rockspur Trl
Dvorak Dr
Carlisle Dr
Valley View Rd
Fox Trl
Brighton Ln
Arbor Ln
Terra Cotta Rd
Hillside Rd
Stratford Ln
Oak Crest Rd
Buhl Rd
Shady Oaks Ln
Stanford St
Behan Rd
Saddle Ridge
Drake Dr
Tamarack Trl
Erin Ct
Indian Hill Trl
Glenbrook Rd
Behan Rd
Deer Run
176
Nunda Trl
Providence Ln
Ray St
Park Dr
View St
Knaack Blvd
Reiland Dr
Rita Ave
Smith Rd
Gerry Ln
Jay Dr
Terra Cotta Ave
Illinois St
Glen Ave
Silk Oak Ln
Monica Trl
Main St
Erick St
Strong Rd
Marietta Dr
Primrose Ln
Tilche Ln
Poplar St

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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Legend

Project Limits

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Figure 1
Project Location Map
Illinois Route 31
Illinois Route 176 to Illinois Route 120
McHenry County, Illinois

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2. NOISE BACKGROUND AND REGULATIONS

2.1 Noise Background

Sound is caused by the vibration of air molecules, and loudness is measured on a logarithmic scale using units of decibels (dB). Sound is composed of a wide range of frequencies; however, the human ear is not uniformly sensitive to all frequencies. Therefore, the "A" weighted scale was devised to correspond with the sensitivity of the human ear. Decibels reported using the A-weighted scale are noted as dBA.

The equivalent sound level is the steady-state, A-weighted sound level, which contains the same amount of acoustic energy as the actual time-varying, A-weighted sound level over a specified period of time. If the time period is one hour, the descriptor is the hourly equivalent sound level or $L_{eq}(h)$, which is widely used by state highway agencies as a descriptor of traffic noise. The A-weighted unit is used because:

1) it is easily measured,
2) it approximates the sensitivity of the human ear to sounds of different frequencies,
3) it matches attitudinal surveys of noise annoyance better than other noise measurements, and
4) it has been adopted as the basic unit of environmental noise by many agencies around the world in dealing with community noise issues.

2.2 Federal Regulations

Traffic noise analyses are required for all projects considered a Type I project. The federal regulations define Type I projects as any of the following:

- The construction of a highway on new location,
- The physical alteration of an existing highway where there is either:
  - *Substantial Horizontal Alteration.* A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition or
  - *Substantial Vertical Alteration.* A project that removes shielding therefore, exposing the line-of-sight between the receptor and the traffic noise source. (This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor.)
- The addition of a through-traffic lane(s). (This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane.)
- The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane,
- The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange,
- Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane, or,

- The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

This proposed improvement to IL Route 31 would be characterized as a Type I noise project as it includes the addition of a through-lane.

The Federal regulations establish noise abatement criteria to establish noise levels where noise abatement should be evaluated. Five separate noise abatement criteria (NAC) based upon land use are used by the FHWA to assess potential noise impacts. A traffic noise impact occurs when noise levels approach or exceed the NAC listed in Table 1.[1] In determining the applicable noise activity category for the study area, existing land use was reviewed. The applicable NAC for all residential noise receptors evaluated is 67 dB(A).

TABLE 1
NOISE ABATEMENT CRITERIA - HOURLY WEIGHTED SOUND LEVEL

Activity Category[1]	$L_{eq}(h)$	Evaluation Location	Activity Description
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 nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/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.

[1] Based on 23 Code of Federal Regulations Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. (adopted 2010).

2.3 IDOT Policy

Based on the FHWA regulations, State Highway Authorities are allowed to define the noise impacts as 1) the noise level determined to approach the NAC and 2) the increase in noise levels determined to be a substantial increase. The Illinois Department of Transportation (IDOT) defines noise impacts as follows:

- Design-year traffic noise levels approach, meet or exceed the NAC, with approach defined as 66 dB(A) for the residential NAC of 67 dB(A).

- Design-year traffic noise levels are a substantial increase over existing traffic generated noise levels, defined as an increase greater than 14 dB(A).

3. NOISE RECEPTOR SELECTION

The land use within the study limits consists of residences, a library, a recreation area, a park, a school, medical facilities, offices, hotels, restaurants, light industrial, retail, and agricultural use. Figure 2 depicts existing land use based on field reviews and available aerial photography.

Receptor locations were selected based on land use adjacent to the project corridor to represent the land uses with established NAC. For this project, this includes Activity Categories B (residences), C (a library, a cemetery, a recreational area, a park, a school, and medical facilities) and E (offices and a restaurant). The remaining land uses along the project corridor either do not have outdoor use areas or are industrial and agricultural areas characterized as land use Activity Categories F or G, which do not have an established NAC.

The traffic noise study evaluates the study area using common noise environments (CNEs). A CNE is a group of receptors within the same activity category that are exposed to similar noise sources and levels. Within each of the CNEs, the closest receptor was selected to represent the CNE, thereby representing the worst-case traffic noise condition. The represented receptors within the CNEs will have similar traffic noise levels as the selected receptor.

Forty-three receptors were selected to represent the study area; one of the receptors was later removed from the analysis as the Preferred Alternative ended south of the receptor. Each receptor represents a CNE. Receptor types include residences, a library, a recreation area, a park, a school, medical facilities, offices, and a restaurant. According to IDOT policy, when determining traffic noise impacts, primary consideration shall be given to exterior areas where frequent human use occurs for Activity Categories A, B, C and E. Traffic noise impacts for land uses within Activity Category D shall be predicted for interior areas only if no exterior use areas are identified. Therefore, receptor locations were selected at outdoor locations of frequent human use. This includes front yards or back yards of the residential receptors; the front entrance of the school, medical facilities, offices, library, and hotel; a green of the golf course; the open field of the recreational area; and a bench in the cemetery. Because exterior areas of frequent human use were identified for all receptors, no interior noise monitoring or prediction occurred.

Table 2 lists the receptor number, the land use category and associated NAC, and the receptor type. Figure 3 depicts the aerial photograph of the study area with the receptors and CNEs depicted.

The vacant and undeveloped areas within the project area, shown as land use activity category G in Figure 2, were reviewed along to determine if any were permitted for development. Based on the information available from the governing agencies with permitting jurisdiction, there are no existing permits for development within the project limits.

TABLE 2
SUMMARY OF NOISE RECEPTORS

Receptor/ CNE No.	NAC Activity Category / NAC	Type
R1	C / 67	Medical Facility (Chiropractic Center)
R2	E / 72	Offices
R3	B / 67	SFR
R4	C / 67	Medical Facility (Orthopedic Center)
R5	B / 67	SFR
R6	B / 67	SFR
R7	C / 67	School (Columbia College)
R8	C / 67	Medical Facility (Immediate Care Facility)
R9	C / 67	Day School
R10	C / 67	Medical Facility (Dentist & Orthodontist office)
R11	B / 67	SFR
R12	B / 67	SFR
R13	B / 67	SFR
R14	B / 67	SFR
R15	B / 67	SFR
R16	B / 67	SFR
R17	B / 67	SFR
R18	C / 67	Cemetery
R19	B / 67	SFR
R20	B / 67	SFR
R21	B / 67	SFR
R22	E / 72	Restaurant
R23	C / 67	Recreational Area (Soccer Field)
R24	B / 67	SFR
R25	E / 72	Offices
R26	C / 67	Medical Facility (Medical Complex)
R27	C / 67	Medical Facility (Medical Center)
R28	C / 67	Medical Facility (Health System Center)
R29	C / 67	Medical Facility (Health Services)

Receptor/ CNE No.	NAC Activity Category / NAC	Type
R30	B / 67	SFR
R31	C / 67	Medical Facility (Physical Therapy Center)
R32	B / 67	SFR
R33	B / 67	MFR
R34	B / 67	SFR
R35	C / 67	Medical Facility (Dentist office)
R36	C / 67	Library
R37	B / 67	SFR
R38	B / 67	SFR
R39	B / 67	SFR
R40	B / 67	SFR
R41	B / 67	SFR
R42	C / 67	Park
R43*	B / 67	SFR

**R43 was later removed from analysis, as the Preferred Alternative ends south of R43.*
SFR = Single family residence
MFR = Multi family residence

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Kelly Ln
Ray St
31
Reiland Dr
Amway Dr
Rita Ave
176
Alex Ln
Terra Cotta Ave
Mistwood Ln
Savannah Ln
Silk Oak Ln
Prairie Ridge Rd
Weatherstone Dr
Annette Ave
Orchard Ln
Ethel Ave
Strong Rd
Marietta Dr
White Ash Rd
Crystal Lake Ave
Amy Dr

0 300 600
Feet

N
W E
S

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Legend

Primary Land Use Activity Category		Secondary Land Use Activity Category
B	F	E
C	G	F
E		

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Figure 2
Land Use Map
Illinois Route 31
Illinois Route 176 to Illinois Route 120
McHenry County, Illinois

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Brighton Ln
Stratford Ln
Oak Crest Rd
31
Shady Oaks Ln
Deering Oaks Ln
Old Westbury Rd
Glenbrook Rd
Providence Ln
Stanford St
Stanford Ct
Wyoming Way
Ripon Rd
Carthage Ct
Drake Dr
Purdue Pl

0 300 600
Feet

N
W E
S

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Legend

Primary Land Use Activity Category	Secondary Land Use Activity Category
B	F
C	G
E	
	E
	F

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Rogers Rd
Mcmillan Ln
Ames Rd
Braberry Ln
Lakewood Dr
Oakleaf Dr
31
Half Mile Trail

0 300 600
Feet

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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Legend

Primary Land Use Activity Category	Secondary Land Use Activity Category
B	E
F	F
C	
G	
E	

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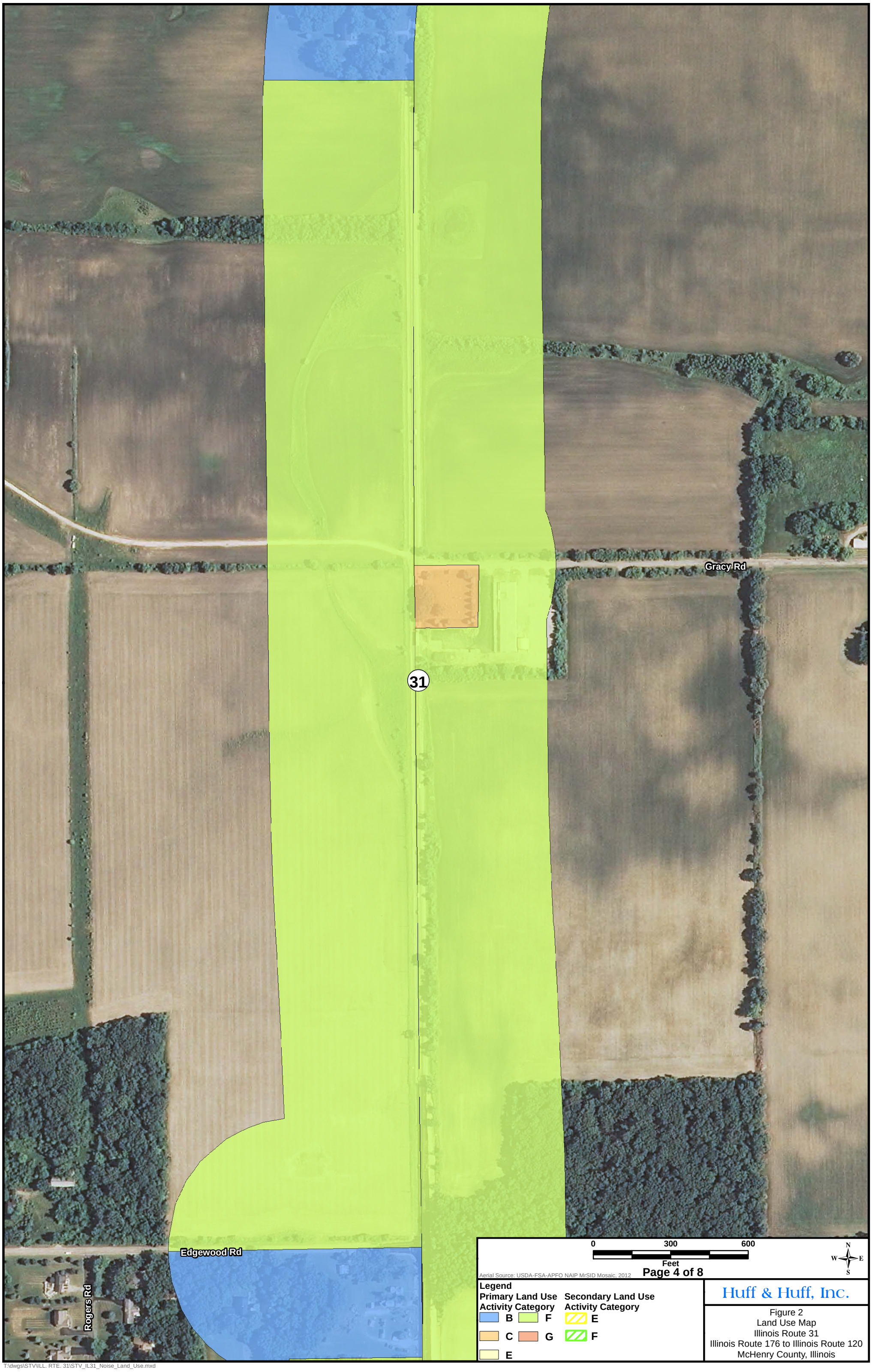

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Charles J. Miller Rd
Ellen Rd
Bull Valley Rd
Barreville Rd
Saint Patricks Cemetery
Dorchester Pl
Donnelly Pl
Pebble Creek
Lawrence Pky
Medical Center Dr
Westminster Pl
Geneva Pl
Amberwood Pl
Brighton Pl
Biscayne Rd
Shamrock Ln
31
Paxton St
Belden St
Dayton St
Belden St
Corporate Dr

0 300 600
Feet

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Legend

Primary Land Use Activity Category		Secondary Land Use Activity Category	
B	F	E	
C	G	F	
E			

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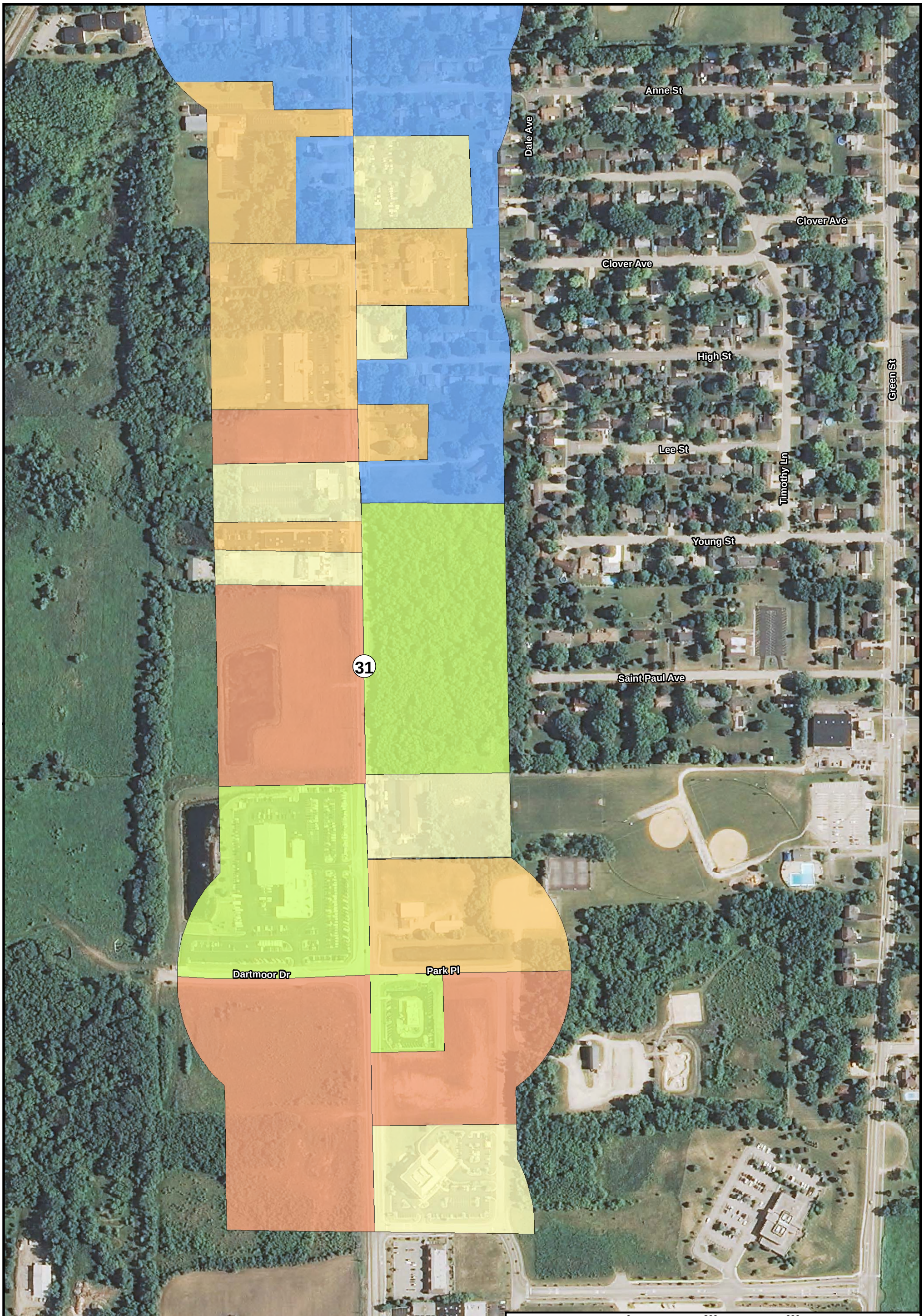

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

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B	F	E
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E		

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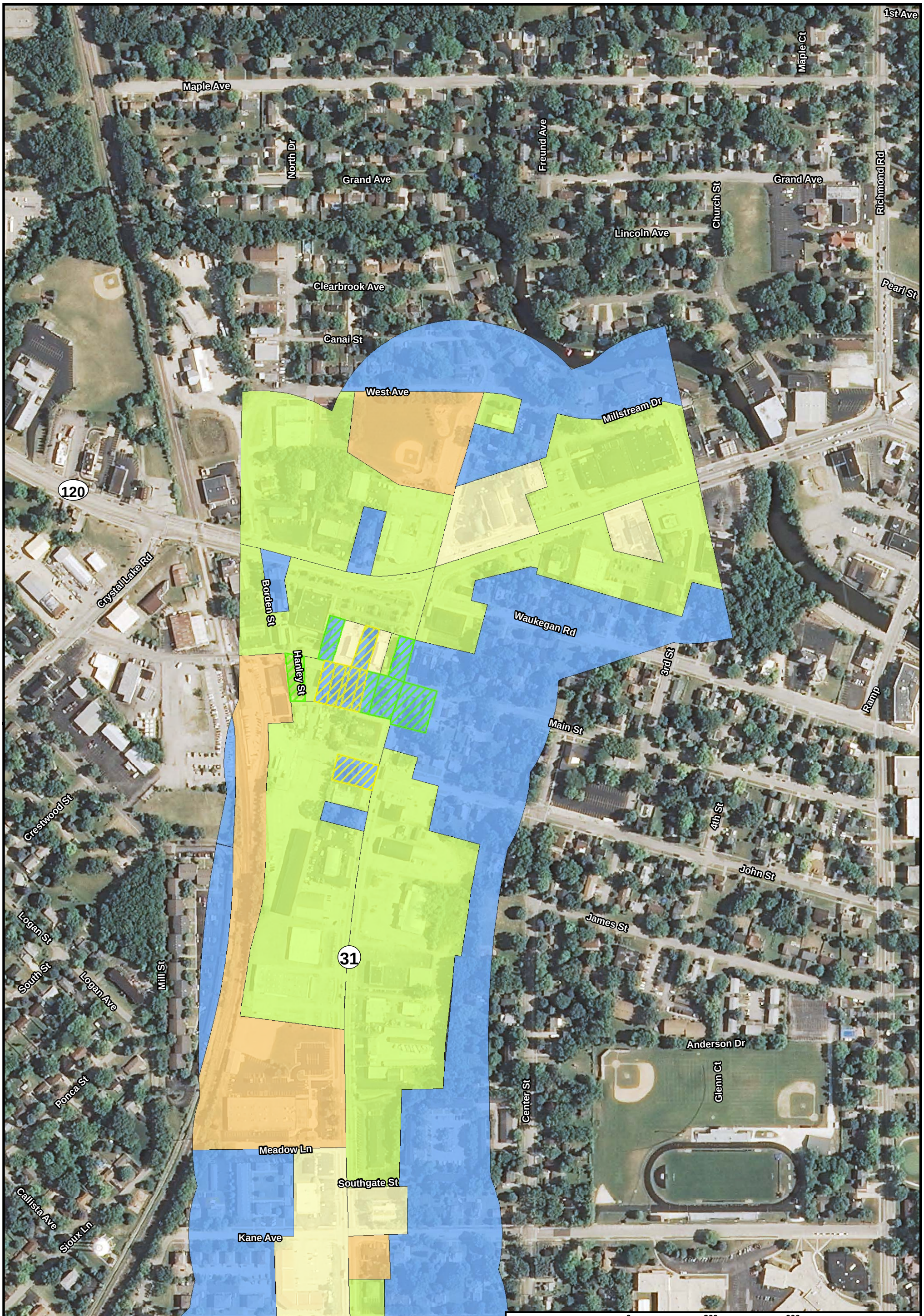
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North Dr
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Grand Ave
Grand Ave
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Richmond Rd
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Pearl St
Canai St
West Ave
Millstream Dr
120
Crystal Lake Rd
Borden St
Waukegan Rd
Hanley St
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Main St
Crestwood St
4th St
John St
Logan St
James St
South St
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Anderson Dr
Glenn Ct
Center St
Ponca St
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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012
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Legend
Primary Land Use Activity Category
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Secondary Land Use Activity Category
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Huff & Huff, Inc.
Figure 2
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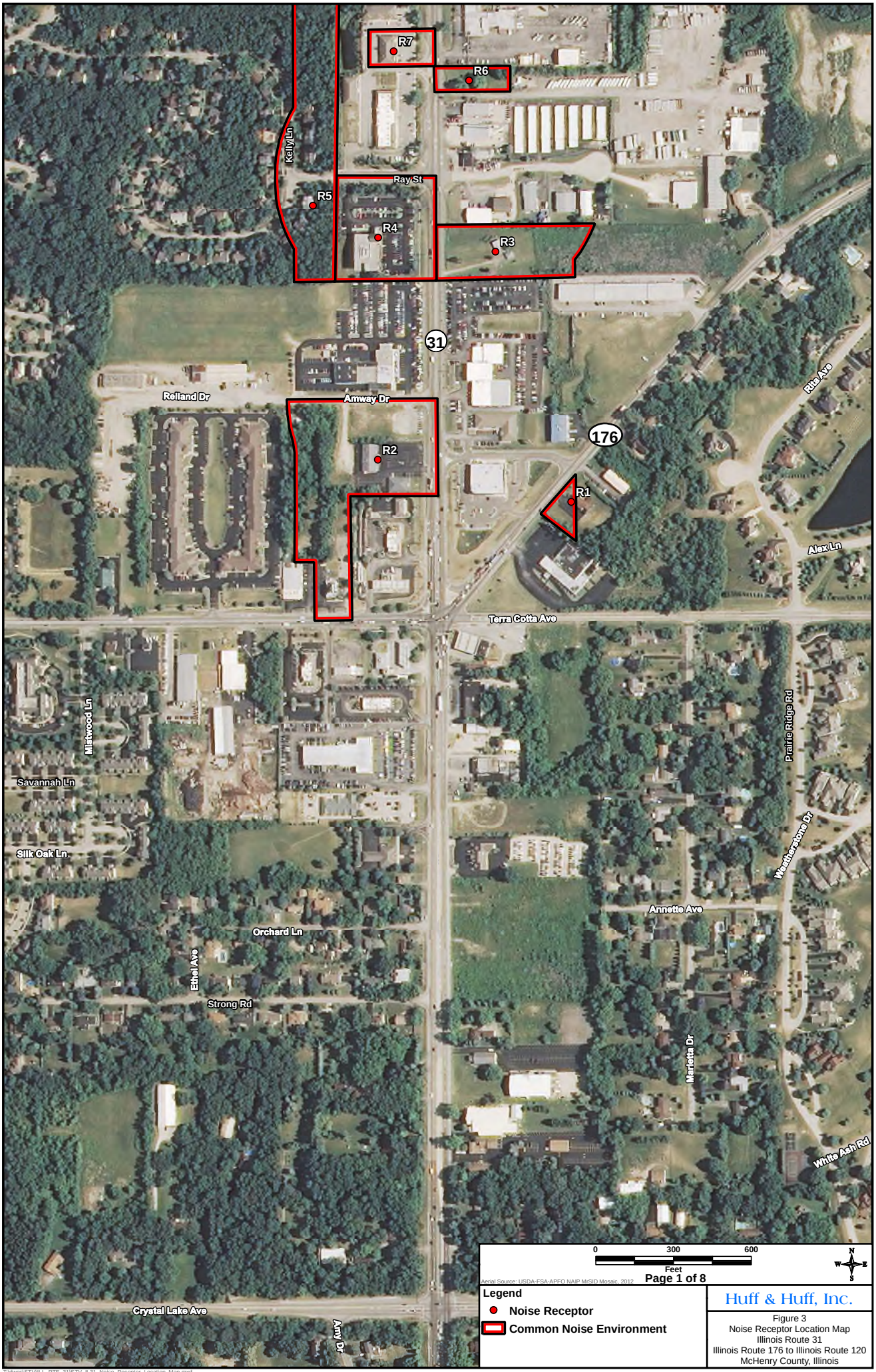

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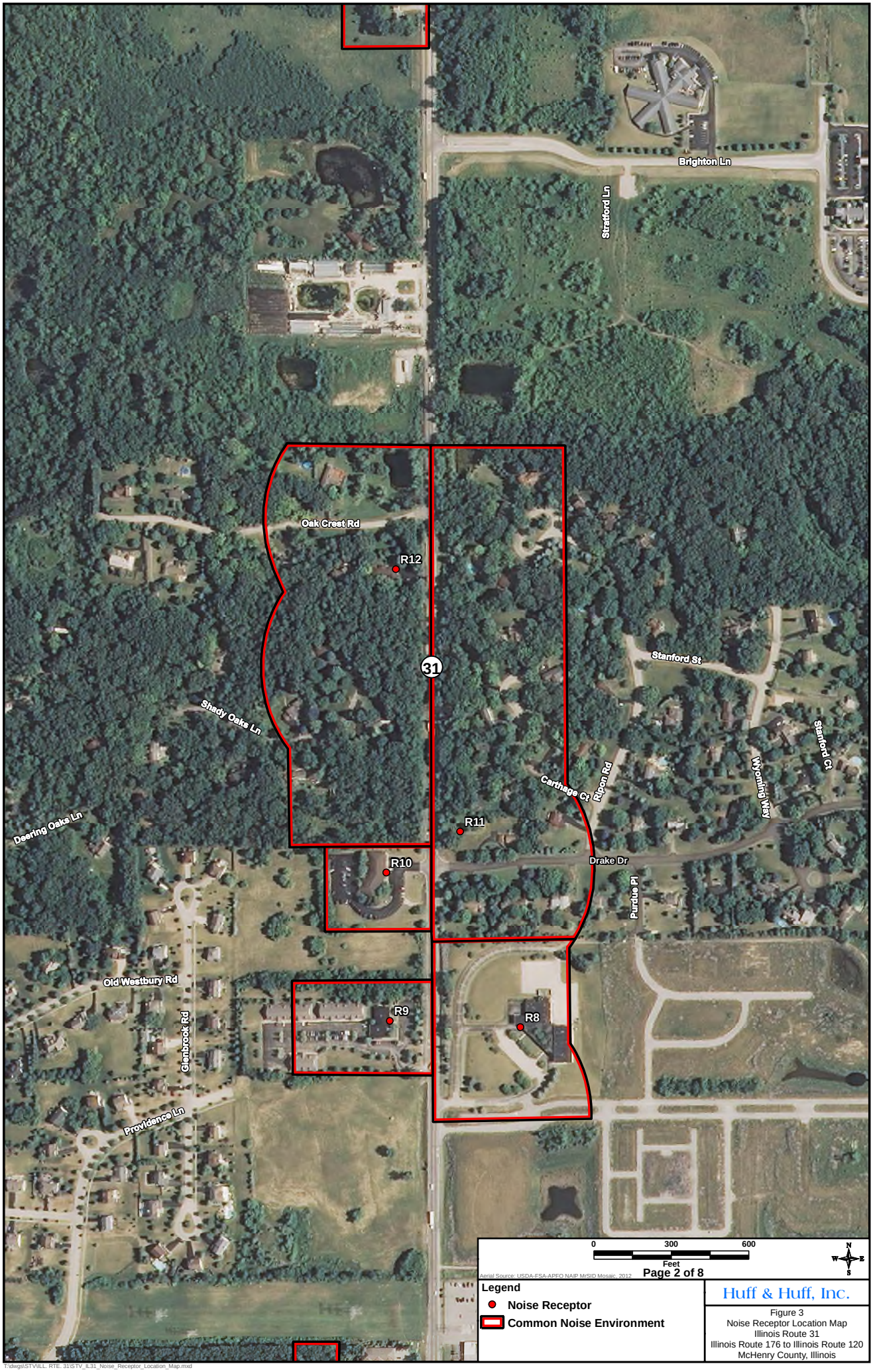
Brighton Ln
Stratford Ln
Oak Creet Rd
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Stanford St
Shady Oaks Ln
Carthage Ct
Ripon Rd
Wyoming Way
Stanford Ct
Deering Oaks Ln
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Drake Dr
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Old Westbury Rd
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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012
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Noise Receptor
Common Noise Environment
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Figure 3
Noise Receptor Location Map
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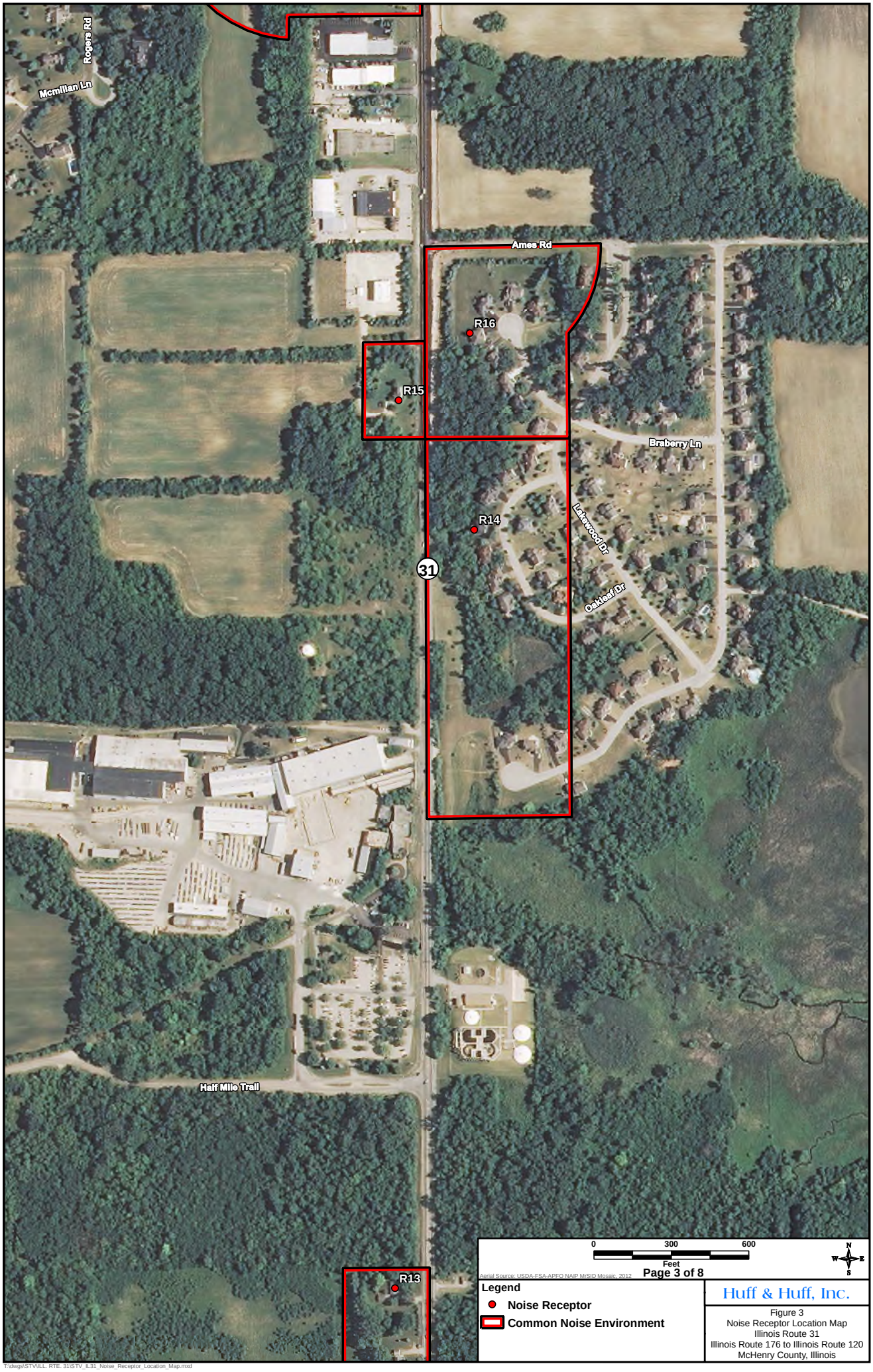
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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012
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Legend
Noise Receptor
Common Noise Environment
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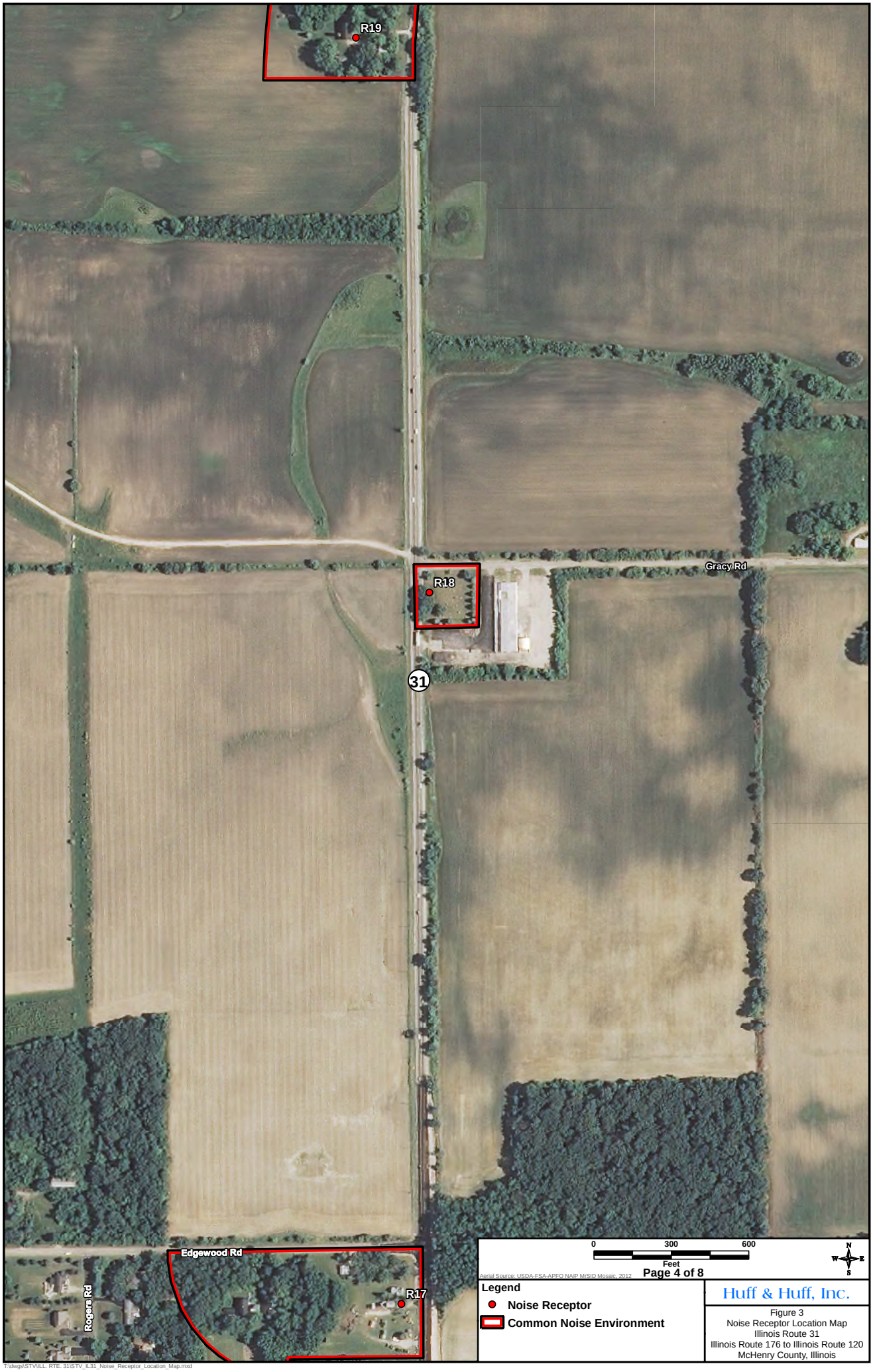
R19
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Gracy Rd
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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012
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Noise Receptor
Common Noise Environment
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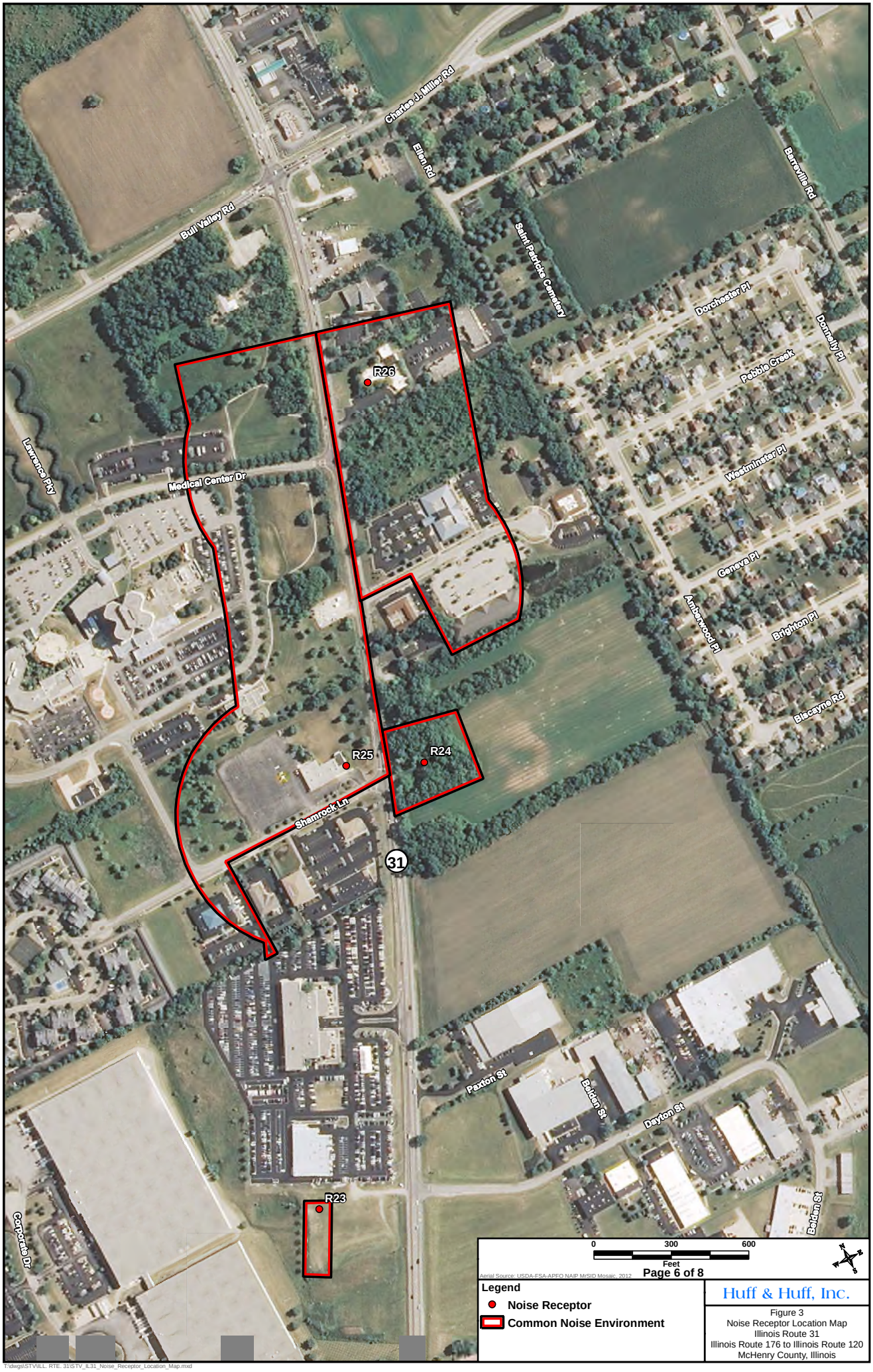
Charles J. Miller Rd
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Saint Patricks Cemetery
Dorchester Pl
Donnelly Pl
Pebble Creek
Lawrence Pky
Medical Center Dr
Westminster Pl
Geneva Pl
Ambassador Pl
Brighton Pl
Biscayne Rd
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Shamrock Ln
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Bolden St
Dayton St
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Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012
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Common Noise Environment
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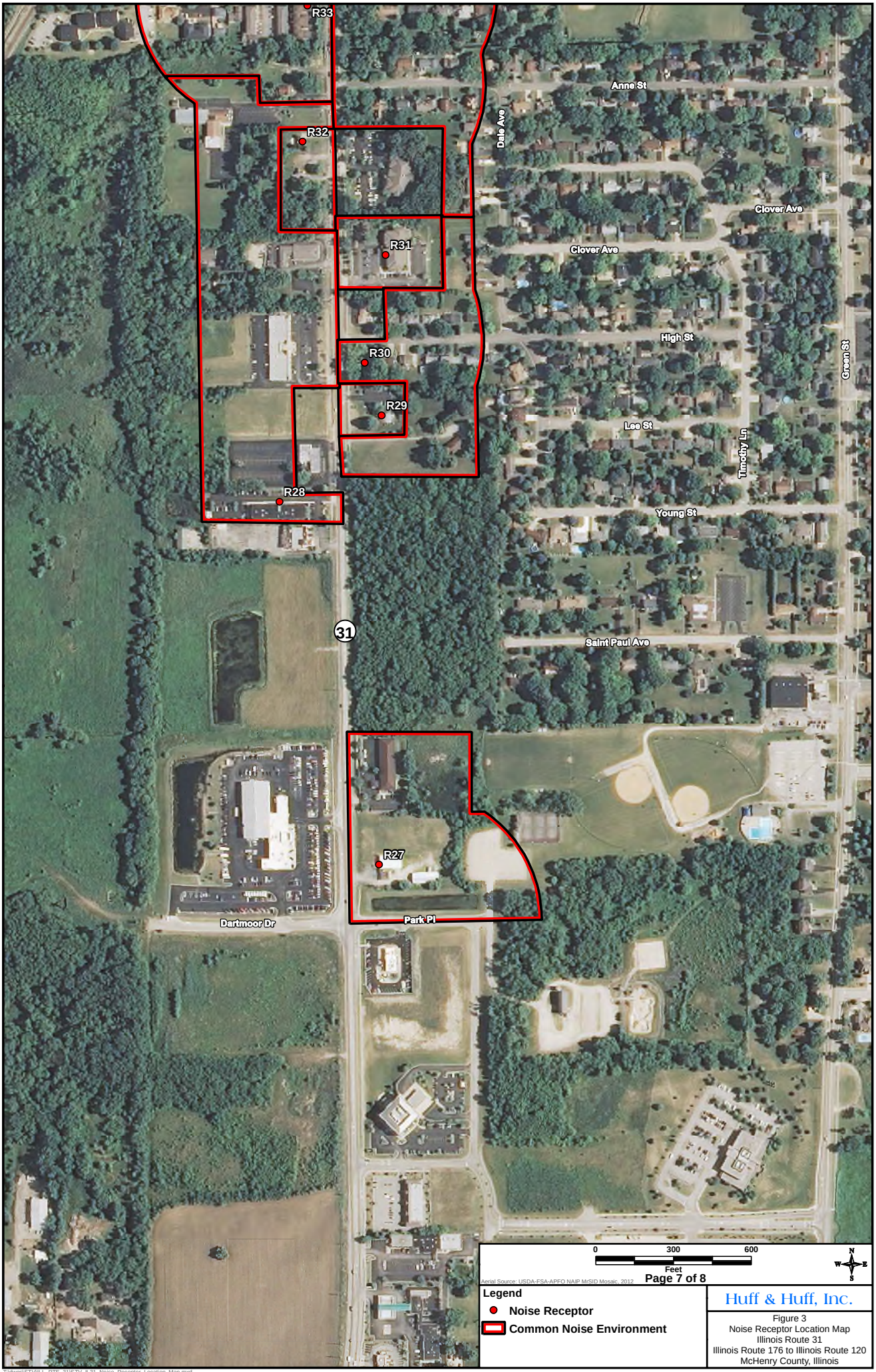

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- Noise Receptor
- Common Noise Environment

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Figure 3
Noise Receptor Location Map
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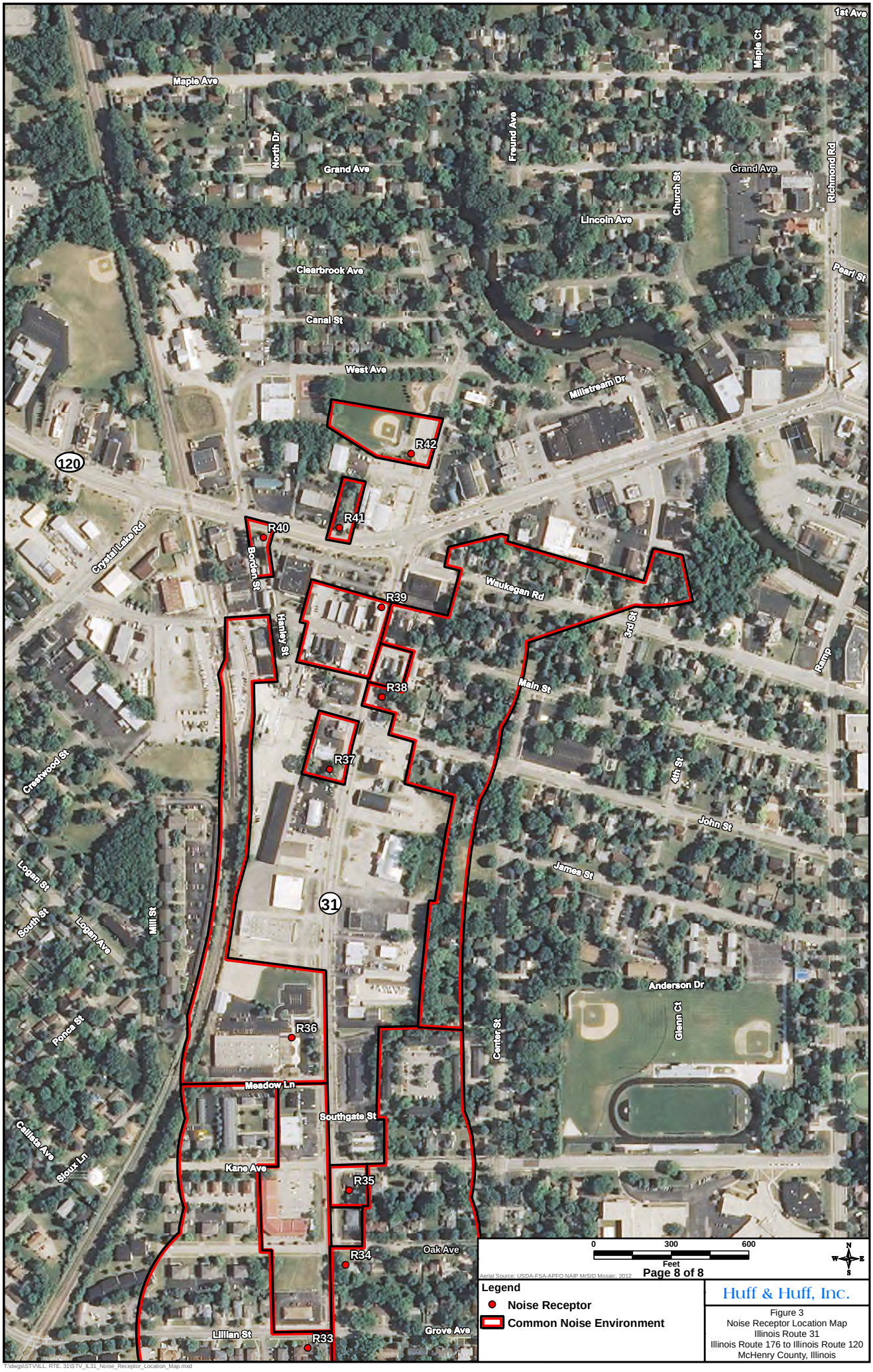

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4. FIELD NOISE MEASUREMENTS

Ambient noise level measurements show existing site conditions. The traffic volumes and conditions during the actual noise level measurements need to be considered when evaluating field measurements as typical for the area. The following methodology was used to collect noise level measurements.

Traffic noise levels measured during monitoring events are representative of the traffic characteristics (volume, speed and composition) for the period of time measured. This may or may not be the peak-hour noise condition at the location being measured. In addition, the noise levels are also influenced by other noise sources in the area other than the traffic noise and the characteristics of the location, such as shielding afforded by existing berms or structures. Consequently, comparison of the noise levels between locations needs to also consider the variations in site characteristics in addition to varying traffic conditions. Noise monitoring was conducted at receptors R9, R10, R18, R21, R22, R26, R28, R30, R33, R36, and R42. The IDOT Highway Traffic Noise Assessment Manual states that between 25 to 50 percent of receptors that are included in the noise analysis should be evaluated by noise monitoring. The eleven monitored sites are 26% of the total 42 receptors, which is within the range recommended by IDOT. These receptors were selected so that noise monitoring would occur throughout the project corridor, with the exception of the extreme south potion of the corridor; during monitoring, active road construction was occurring at the IL Route 176/IL Route 31 intersection, which did not represent typical ambient noise levels. The noise monitoring results are compared to noise modeling results for the existing conditions to validate the noise model. Traffic noise modeling is completed using the FHWA-approved Traffic Noise Model (TNM 2.5).

4.1 Traffic Volumes

Traffic volumes along IL Route 31 were counted during field monitoring. The number of cars and trucks were recorded separately along with any other noise sources observed during monitoring. The traffic volumes were counted as a total during the 10-minute noise monitoring periods. The traffic volumes counted were extrapolated to hourly volumes. This procedure is accepted by the Federal Highway Administration as a representative noise monitoring method, detailed in IDOT's "Highway Noise Assessment Manual," Section 3.5.2.

4.2 Time and Day for Measurements

Noise monitoring is typically conducted during the period representing the worst hourly noise level. This may or may not be during the peak-hour traffic volumes, as traffic may be stop-and-go during this period or at a reduced travel speed. Traffic was moving steadily on adjacent roadways during the measurements. Noise monitoring was conducted at all sites on August 7, 2014 between the hours of 11 am to 4 pm.

4.3 Weather Conditions

Weather conditions have some effect on noise measurement readings. Noise measurements cannot be taken if wind speed exceeds 12 mph. A wind screen was used at all times during the monitoring to reduce wind noise. The conditions during the monitoring are summarized as follows:

WEATHER CONDITIONS DURING THE NOISE MONITORING

Condition	Required	Actual*
Pavement	Dry	Dry
Humidity	Less than 90%	65%
Temperature	14 to 112 degrees F	75 degrees F
Wind Speed	Less than 12 mph**	7 mph

* National Weather Service Data
** Miles per hour

The weather conditions during the noise monitoring were within the recommended ranges for all parameters listed.

4.4 Instrumentation

A Brüel & Kjaer Type 2250L sound level meter was used for monitoring the actual noise level. The L_{eq} was recorded for the "A" weighted scale. L_{eq} is the equivalent level of sound (in decibels or dB(A)) which represents the level of sound, held constant over a specified period of time. This reflects the same amount of energy as the actual fluctuating noise over that time period. The instrument was calibrated prior to use. The instrument was set up approximately five (5) feet from the ground and the measurement was conducted for 10 minutes. The noise meter was placed in an outdoor location where human activity typically occurs or in a location representative of that location.

4.5 Field Noise Monitoring Results

Table 3 compares the noise monitoring results for the eleven monitored locations to the TNM 2.5 modeled existing noise levels. Noise monitored levels ranged from 55 dB(A) to 74 dB(A). The difference between modeled and monitored noise levels provides an indication of the representativeness of the TNM 2.5 model. Section 5 describes the TNM 2.5 modeling methodology and results. Monitored noise levels are within 3 dB(A) of the modeled noise levels, which validates the TNM 2.5 model. The impact analysis and abatement evaluation will be conducted using the build traffic noise model results.

TABLE 3
NOISE MONITORING RESULTS, L_{eq}

Receptor	Noise Level Monitored, dB(A)	Modeled Existing Noise Level, dB(A)*	Difference Between Modeled and Monitored, dB(A)
R9	60	61	1
R10	59	59	0
R18	74	76	2
R21	68	65	-3
R22	56	58	2
R26	55	57	2
R28	55	55	0
R30	66	64	-2
R33	65	67	2
R36	61	58	-3
R42	56	59	3

*Modeling methodology and results are presented in Section 5 and Section 6, respectively.

5. NOISE ANALYSIS METHODOLOGY

Modeling of traffic noise levels at the receptors located within the project limits was conducted utilizing the FHWA-approved TNM 2.5. Traffic noise levels for the receptor sites were predicted using existing (2013) and future (2040) traffic volumes.

TNM 2.5 data inputs include traffic volume, traffic mix (cars, heavy trucks, and medium trucks), traffic controls, receptor distance, elevation, and average speeds during free flowing conditions. Information sources used in the analysis are briefly described in the following subsections.

5.1 Traffic Volumes

STV, Inc. provided average daily traffic (ADT) for the years 2013 and 2040 for IL Route 31 and the major crossroads within the project limits. The daily volumes were converted to peak hour volume using a K factor of 10 percent.

5.2 Traffic Composition

Three types of vehicles, including cars, medium trucks, and heavy trucks, are input into TNM 2.5. Truck composition for the roadways was determined based on the traffic counts provided. The percentage of automobiles for the existing condition on IL Route 31 is estimated to be between 91 percent and 100 percent with medium and heavy trucks combined accounting for between 0 percent and 9 percent. Truck traffic is assumed to be half medium trucks and half heavy trucks. The range in values is associated with the variation in traffic volumes that occur within the project limits.

5.3 Receptor Distance/Elevation

The selected representative receptors include residences, a library, a recreation area, a park, a school, medical facilities, offices, and a restaurant. The distance and elevation of each receptor directly affects the predicted traffic noise level. Receptor locations are between 10 feet and 430 feet from the existing IL Route 31 edge of pavement. The specific location of the receptor is based upon identifying the location where outdoor activity occurs.

5.4 Speed Conditions

The average free-flow speeds for the corridor (posted speed limits) were included as listed:

- IL Route 176 to Ray Street: 40 mph
- Ray Street to Drake Drive: 45 mph
- Drake Drive to 1,200 feet south of Veterans Parkway: 55 mph
- South of Veterans Parkway to High Point Road: 50 mph
- High Point Road to south of Dartmoor Drive/Park Place: 45 mph
- South of Dartmoor Drive/Park Place to south of Anne Street: 40 mph
- South of Anne Street to Meadow Lane: 35 mph
- Meadow Lane to IL Route 120: 30 mph
- IL Route 120: 30 mph

6. TNM 2.5 RESULTS

6.1 Existing, No-Build and Build Receptor Noise Evaluation

Existing (2013), No-Build (2040), and Build (2040) traffic noise levels were predicted for the forty-two receptor sites utilizing TNM 2.5. Table 4 presents the existing (2013) and projected (2040) noise levels for the analyzed receptor sites, as well as the anticipated difference in noise levels for these two time periods.

The existing 2013 modeled noise levels range from 56 dB(A) at R23 and R28 to 78 dB(A) at R18. The projected No-Build 2040 traffic noise levels range from 57 dB(A) at R5, R23, and R28 to 79 dB(A) at R18. Receptor noise levels were found to either remain the same or increase between one dB(A) and two dB(A) from the existing scenario to the 2040 No Build scenario. Any increase in traffic noise levels between the existing and 2040 No Build scenarios is due to increased traffic volumes for the 2040 No Build condition.

The projected Build 2040 traffic noise levels range from 59 dB(A) at R5, R23, and R28 to 74 dB(A) at R18. The projected Build 2040 noise levels change from -4 dB(A) and five dB(A) from the existing condition. One receptor, R18, showed a noise level decrease in the Build 2040 condition, due to IL Route 31 being moved approximately 12 feet west in this location, away from R18. The speed limit on IL Route 31 is also proposed to decrease to 45 mph near R18, from the existing 55 mph speed limit. Increases in noise levels between the existing and 2040 Build conditions are due to an increase in traffic volumes and the widening of IL Route 31, which moves traffic closer to some receptors.

Under the proposed 2040 Build scenario, 23 receptor locations approach, meet, or exceed the FHWA NAC in the Build condition, and therefore warrant a noise abatement analysis. None of the receptors are considered impacted due to a substantial increase (greater than 14 dB(A) increase) in traffic noise levels.

TABLE 4
NOISE IMPACT SUMMARY – TNM 2.5 MODELING RESULTS

Receptor Number	Activity Category/ NAC (dB(A))	Distance to Existing Edge of IL Route 31 Pavement, ft.	Existing 2013 Noise Level, dB(A)	No-build 2040 Noise Level, dB(A)	Build 2040 Noise Level, dB(A)	Increase in Build Noise Levels over Existing Noise Levels, dB(A)
R1	C / 67	70	68	69	**69**	1
R2	E / 72	180	62	63	65	3
R3	B / 67	210	63	64	64	1
R4	C / 67	180	63	63	65	2
R5	B / 67	430	57	57	59	2
R6	B / 67	100	67	67	**68**	1
R7	C / 67	120	65	65	**67**	2
R8	C / 67	315	60	60	60	0
R9	E / 72	135	65	65	66	1
R10	C / 67	140	63	63	65	2
R11	B / 67	130	68	68	**69**	1
R12	B / 67	100	66	67	**69**	3
R13	B / 67	80	65	66	**68**	3
R14	B / 67	160	60	61	63	2
R15	B / 67	60	67	68	**68**	1
R16	B / 67	160	64	65	**67**	1
R17	B / 67	50	69	70	**70**	1
R18	C / 67	70	78	79	**74**	-4
R19	B / 67	90	63	63	65	2
R20	B / 67	130	64	65	**66**	2
R21	B / 67	90	67	68	**71**	4
R22	E / 72	185	60	61	63	3
R23	C / 67	360	56	57	59	3
R24	B / 67	150	60	61	64	4
R25	E / 72	105	64	65	68	4
R26	C / 67	185	58	59	60	2
R27	C / 67	105	60	61	65	5
R28	C / 67	240	56	57	59	3
R29	C / 67	125	58	59	61	3
R30	B / 67	90	66	67	**69**	3
R31	C / 67	150	58	59	61	3
R32	B / 67	100	62	62	**66**	4
R33	B / 67	60	67	68	**67**	0
R34	B / 67	40	68	68	**69**	1
R35	C / 67	50	67	67	**68**	1
R36	C / 67	105	61	61	**66**	5
R37	B / 67	45	64	65	**69**	5
R38	B / 67	20	66	67	**71**	5
R39	B / 67	30	73	74	**76**	3
R40	B / 67	35	69	71	**71**	2
R41	B / 67	10	72	74	**73**	1
R42	C / 67	85	59	61	62	3

Boldface indicates the noise levels approach, meet or exceed the NAC in future build condition

7. ABATEMENT ANALYSIS

7.1 Abatement Alternatives

Traffic noise abatement measures were considered for the 23 impacted receptors that approach, meet, or exceed the appropriate FHWA NAC. The most feasible approach to abating noise impacts in this area would be to construct a noise barrier. This may include a noise wall, an earth berm or a combination of both. Noise barriers placed adjacent to the roadway will attenuate traffic-related noise and are the most practical measure for this project. An effective noise barrier must be tall enough to break the line-of-sight between the receptor and source and typically extends beyond the last receptor four times the distance between the receptor and noise barrier. Noise barriers have a zone of effectiveness, or shadow zone, which is generally within 200 feet of the noise barrier; therefore, less noise reduction is achieved as the distance between the receptor and the noise barrier increases.

TNM 2.5 was used to perform the noise barrier feasibility and reasonability evaluation for the 23 impacted receptors. When determining if an abatement measure is feasible and reasonable, the noise reductions achieved, number of residences benefited, total cost, and total cost per residence benefited are considered.

7.2 Feasibility and Reasonability

An analysis of noise abatement measures (noise barriers) was conducted in conformance with FHWA requirements contained in Title 23 *Code of Federal Regulations* Part 772 for each of the impacted receptors. In order for a noise abatement measure to be constructed, it must meet both the feasibility and reasonability criteria, described below.

Feasibility

The feasibility evaluation is a combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure. The acoustical portion of the IDOT policy, as required by FHWA regulations, considers noise abatement to be feasible if it achieves at least a 5 dB(A) traffic noise reduction at an impacted receptor. Factors including but not limited to safety, barrier height, topography, drainage, utilities, maintenance, and access issues are also considered.

Reasonability

As per the FHWA regulations, a noise abatement measure is determined to be reasonable when all three of the following reasonableness evaluation factors are met:

- cost effectiveness of the highway traffic noise abatement measure;
- achievement of IDOT's noise reduction design goal; and,
- consideration of the viewpoints of the benefited receptors (property owners and residents) if all other criterion are achieved.

A noise abatement measure is considered cost-effective to construct if the noise wall construction cost per benefited receptor is less than the allowable cost per benefited receptor. A benefited receptor is any receptor that is afforded at least a 5 dB(A) traffic noise reduction from the proposed noise abatement measure. The FHWA regulations allow each State Highway Authority to establish cost criteria for determining cost effectiveness.

IDOT policy establishes the actual cost per benefited receptor shall be based on a noise wall cost of $25 per square foot, which includes engineering, materials, and construction. The base value allowable cost is $24,000 per benefited receptor, which can be increased based on three factors as summarized below:

- the absolute noise level of the benefited receptors in the design year build scenario before noise abatement;

- the incremental increase in noise level between the existing noise level at the benefited receptor and the predicted build noise level before noise abatement; and

- the date of development compared to the construction date of the highway. These factors are considered for all benefited receptors.

Absolute Noise Level Consideration

Predicted Build Noise Level Before Noise Abatement	Dollars Added to Base Value Cost per Benefited Receptor
Less than 70 dB(A)	$0
70 to 74 dB(A)	$1,000
75 to 79 dB(A)	$2,000
80 dB(A) or greater	$4,000

Source: IDOT Highway Traffic Noise Assessment Manual

Increase in Noise Level Consideration

Incremental Increase in Noise Level Between the Existing Noise Level and the Predicted Build Noise Level Before Noise Abatement	Dollars Added to Base Value Cost per Benefited Receptor
Less than 5 dB(A)	$0
5 to 9 dB(A)	$1,000
10 to 14 dB(A)	$2,000
15 dB(A) or greater	$4,000

Source: IDOT Highway Traffic Noise Assessment Manual

New Alignment / Construction Date Consideration

Project is on new alignment OR the receptor existed prior to the original construction of the highway	Dollars Added to Base Value Cost per Benefited Receptor
No for both	$0
Yes for either	$5,000

Note: No single optional reasonableness factor shall be used to determine that a noise abatement measure is unreasonable.
Source: IDOT Highway Traffic Noise Assessment Manual

The IDOT noise reduction design goal is to achieve an 8 dB(A) traffic noise reduction at a minimum of one benefited receptor. If a noise abatement measure is feasible, achieves the cost-effective criterion, and achieves the IDOT noise reduction design goal, then the viewpoints of benefited receptors are solicited on the construction of the noise wall.

7.3 Noise Wall Analysis

TNM 2.5 was used to perform the noise wall feasibility and reasonability check for the 23 impacted receptors. When determining if an abatement measure is feasible and reasonable, the noise reductions achieved, number of residences benefited, total cost, and total cost per residence benefited are considered.

Noise barriers were found to be not constructible at R34, R35, R37, R38, R39, R40, and R41, due to existing building setbacks. Because noise barriers at these receptors are not constructible, they are not considered to be feasible, and no further noise abatement analysis occurred at these receptors.

Fourteen noise walls were evaluated for the remaining 16 impacted receptors, all of which are in locations where noise barriers could feasibly be constructed (this includes a shared barrier at R32, R33, and R36). All noise walls were modeled along the proposed right-of-way. The barriers studied (denoted with a "B" prefix) included the following:

- B1: Barrier for R1
- B2: Barrier for R6
- B3: Barrier for R7
- B4: Barrier for R11
- B5: Barrier for R12
- B6: Barrier for R13
- B7: Barrier for R15
- B8: Barrier for R17
- B9: Barrier for R18
- B10: Barrier for R20
- B11: Barrier for R21
- B12: Barrier for R30

- B13: Barrier for R32, R33, and R36
- B14: Barrier for R16 (including R14)

Six of the analyzed noise walls did not achieve the feasibility criterion of a 5 dB(A) reduction at an impacted receptor (B1, B2, B3, B6, B10, and B11). Five of the analyzed noise walls are considered feasible, as they are constructible and achieve the feasibility criterion of a 5 dB(A) reduction at an impacted receptor; however, these barriers did not achieve the Noise Reduction Design Goal of an 8 dB(A) reduction at a benefited receptor (B7, B8, B9, B12, and B13). Three of the fourteen noise barriers would be considered acoustically reasonable (B4, B5, and B14) as well as feasible, as they achieve the IDOT noise reduction design goal of at least an 8 dB(A) traffic noise reduction at one or more benefited receptor locations, in addition to the 5 dB(A) reduction at an impacted receptor. The barriers that do not meet the Noise Reduction Design Goal in Table 5 would not do so because of gaps in the barrier to maintain driveways and crossroads in that area.

The three noise barriers that were feasible and met the noise reduction design goal (B4, B5, B14) were evaluated for cost-effectiveness. Table 5 summarizes the results of the adjusted allowable cost per benefited receptor determination. Table 6 summarizes the results of the noise abatement evaluation.

TABLE 5
ADJUSTED ALLOWABLE COST PER BENEFITED RECEPTOR SUMMARY

Barrier / CNE	Benefited Receptors	Adjustment Factor	Adjusted Allowable Cost per Benefited Receptors
B4 / R11	7	$0 - $1,000	$24,143
B5 / R12	1	$0 - $1,000	$24,000
B14 / R16	17	$0 - $1,000	$24,353

Note: No values are provided in the table where a noise wall does not meet noise reduction design goal/noise reduction criterion

TABLE 6
NOISE WALL COST REASONABLENESS EVALUATION

Barrier / CNE	Benefited Receptors	Length, ft.	Height, ft.	Total Noise Wall Cost[1]	Actual Cost per Benefited Receptor	Adjusted Allowable Cost per Benefited Receptor
B4 / R11	7	13,130	18	$5,908,500	$844,071	$24,143
B5 / R12	1	835	16	$334,000	$334,000	$24,000
B14 / R16	17	2,414	14	$844.900	$49,700	$24,353

[1] Based on the IDOT policy value of $25 per square foot

The three barriers found to be feasible and acoustically reasonable (B4, B5, B14) were both found not to be cost effective, as the cost to build the noise barrier exceeded the allowable cost to construct the barrier, based on IDOT allowable costs per benefitted receptor. Barrier B4 had a total barrier cost of $5,908,500 ($844,071 per benefitted receptor), and the allowable total barrier cost was $169,000 ($24,143 per benefitted receptor). Barrier B5 had a total barrier cost of $334,000

($334,000 for the one benefitted receptor), and the allowable total barrier cost was $24,000 ($24,000 for the one benefitted receptor). Barrier B14 had a total barrier cost of $844,900 ($49,700 per benefitted receptor), and the total allowable barrier cost of $414,00 ($24,353 per benefitted receptor).

Based on the evaluation, there are no noise walls that would be considered both feasible and reasonable; therefore, highway traffic noise abatement measures are not likely to be implemented for the IL Route 31 project, based on preliminary design.

8. COORDINATION WITH LOCAL OFFICIALS FOR UNDEVELOPED LANDS

Figure 2 depicts the land use within the project limits. Several undeveloped parcels of land exist along the corridor. For planning purposes, the Year 2040 Build scenario was analyzed to predict traffic noise levels on the undeveloped areas. The 66 dB(A) and 71 dB(A) noise contours in the undeveloped areas between Oak Crest and Thunderbird Lane are located approximately 150 feet and 50 feet, respectively, from the edge of pavement of the nearest planned traffic lane. The 66 dB(A) and 71 dB(A) noise contours in the undeveloped areas between Bank Drive and High Street are located approximately 75 feet and 30 feet, respectively, from the edge of pavement of the nearest planned traffic lane. Appendix A includes information that was sent to the local officials having jurisdiction over the undeveloped lands, and includes an exhibit depicting the approximate distances where the NAC is approached.

9. CONSTRUCTION NOISE

Trucks and machinery used for construction produce noise which may affect some land uses and activities during the construction period. Residents along the alignment will at some time experience perceptible construction noise from implementation of the project. To minimize or eliminate the effect of construction noise on these receptors, mitigation measures have been incorporated into the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction as Article 107.35.

10. CONCLUSION

Improvements to Illinois Route 31 in McHenry County, Illinois, are being proposed by the Illinois Department of Transportation. A noise analysis was performed for forty-two noise sensitive receptors within the project limits, including residences, a library, a recreation area, a park, a school, medical facilities, offices, and a restaurant.

Existing 2013 modeled noise levels range from 56 dB(A) to 78 dB(A). The projected No-Build 2040 traffic noise levels range from 57 dB(A) to 79 dB(A). The projected Build 2040 traffic noise levels range from 59 dB(A) to 74 dB(A). Under the proposed 2040 Build scenario, 23 receptor locations approach or exceed the FHWA NAC in the Build condition, and therefore warrant a noise abatement analysis.

Noise barriers were found to be not constructible at R34, R35, R37, R38, R39, R40, and R41, due to the minimal available right-of-way for barrier construction, and existing building setbacks. Fourteen noise walls were evaluated for the remaining 16 impacted receptors, all of which are in locations where noise barriers could feasibly be constructed. This includes shared barriers at select locations due to their close proximity. Eleven of the studied barriers would not provide adequate noise reductions to be considered feasible or reasonable. The three remaining noise walls that would provide adequate noise reductions were determined to not be economically reasonable, as the actual cost per benefitted receptor would exceed the allowable barrier cost per benefitted receptor as specified in the IDOT noise policy. For this reason, noise abatement measures are not proposed for the IL Route 31 project.

Appendix A

Huff & Huff, incorporated
environmental engineers and consultants

915 Harger Road, Suite 330
Oak Brook, IL 60523
Phone (630) 684-9100
Fax (630) 684-9120
Website: http://huffnhuff.com

CONVERSATION RECORD

Date: December 12, 2014

To: Scott Czaplicki, Illinois Department of Transportation District 1
John Clark and Sanjay Joshi, STV Incorporated

From: Jamie Bents, Huff & Huff, a subsidiary of GZA GeoEnvironmental, Inc.

Subject: Undeveloped Lands Coordination with Local Agencies
Traffic Noise Analysis
IL Route 31 Improvement Project
McHenry County, IL

The IL Route 31 noise contour mapping for undeveloped lands was discussed with representatives from the City of Prairie Grove (Jeannine Smith, Village Administrator), City of Crystal Lake (Elizabeth Maxwell, Planner), and the City of McHenry (Jon Schmitt, Director of Public Works) during the November 201, 2014 Community Advisory Group (CAG) meeting for the IL Route 31 project.

As a follow-up to these conversations, Illinois DOT will send (via e-mail) representatives of the City of Prairie Grove, the City of Crystal Lake, the City of McHenry, and McHenry County a copy of the noise contour map and a fact sheet summarizing how local officials can use the undeveloped lands analysis during site plan reviews for future land use development.

IL 31
IL 176 to IL 120
McHenry County

Traffic Noise Considerations - Undeveloped Lands

December 2014

As part of the preliminary engineering and environmental study (Phase I) for this proposed project, projected future traffic noise levels were evaluated for lands (either currently under your jurisdiction or land that may come under your jurisdiction) near the proposed roadway improvement. For your information, this study area includes undeveloped or agriculture land that is zoned for uses other than agriculture, or land that is planned for future development in a comprehensive land use plan. For developed lands, a traffic noise study has been completed for this project and will be included in the Combined Design Report which will be presented at the public hearing and transmitted to you upon completion of the Phase I study.

Attached for your information is an exhibit showing the predicted design year (2040) build traffic noise levels for these undeveloped lands identified along the project corridor. We hope this information will be useful to you in planning and permitting future development in your area. Although noise abatement is not warranted, we recommend that you carefully consider the future predicted noise levels to avoid potential issues of public concern over incompatible noise levels.

To help with your future planning and discernment regarding permitting decisions, we encourage you to obtain the Federal Highway Administration (FHWA) publication titled *Entering the Quiet Zone: Noise Compatible Land Use Planning* from their website at http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/quitezon.pdf.

For additional information regarding traffic noise, regulations and policy, noise analyses or noise abatement, visit the Department's website at http://www.idot.illinois.gov/transportation-system/environment/index under the Community tab.

The draft version of the Traffic Noise Technical Report is available on the project website at http://www.ilroute31.com/projectdocuments.html.

If you have any questions or concerns, please contact:

Illinois Department of Transportation
Bureau of Programming
201 W. Center Court
Schaumburg, IL 60196-1096
Attention: Scott Czaplicki, Project Manager
(847) 705-4107
scott.czaplicki@illinois.gov

Copies to: City of Crystal Lake, Village of Prairie Grove, City of McHenry, Nunda Township, McHenry County

TABLE 1
NOISE ABATEMENT CRITERIA - HOURLY WEIGHTED SOUND LEVEL

Activity Category[1]	$L_{eq}(h)$	Evaluation Location	Activity Description
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 nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/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.

Old Westbury Rd
Glenbrook Rd
Providence Ln
Crystal Lake
31
Kelly Ln
Ray St
Area Not Expected to Have Future Noise Levels at 66 or 71 dBA
Prairie Grove
Reiland Dr
Amway Dr
Rita Ave
176
Terra Cotta Ave
Mistwood Ln
Savannah Ln
Silk Oak Ln

Huff & Huff, Inc.

Legend

Primary Land Use Activity Category

B
F
C
G
E

Secondary Land Use Activity Category

E
F

Municipality

71 dBA

66 dBA

N
W
E
S

0 300 600

Feet

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Undeveloped Lands Analysis
Illinois Route 31
Illinois Route 176 to Illinois Route 120
McHenry County, Illinois

T:\dwgs\STV\ILL. RTE. 31\STV_IL31_Noise_Contour_Map.mxd

50' West of
Proposed Edge of Pavement

150' West of
Proposed Edge of Pavement

50' East of
Proposed Edge of Pavement

150' East of
Proposed Edge of Pavement

Prairie Grove

Half Mile Trail

31

Brighton Ln

Crystal Lake

Oak Crest Rd

Ripon Rd

Shady Oaks Ln

Stanf

Huff & Huff, Inc.

Legend

Primary Land Use Activity Category

B
F
C
G
E

Secondary Land Use Activity Category

E
F

Municipality

71 dBA

66 dBA

N
W E
S

0 300 600

Feet

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Undeveloped Lands Analysis
Illinois Route 31
Illinois Route 176 to Illinois Route 120
McHenry County, Illinois
Page 2 of 3

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Anne St
Dale Ave
Clover Ave
Clover Ave
High St
Lee St
Timothy Ln
Young St
Saint Paul Ave
31
McHenry
50' West of
Proposed Edge of Pavement
150' West of
Proposed Edge of Pavement
50' East of
Proposed Edge of Pavement
150' East of
Proposed Edge of Pavement

Huff & Huff, Inc.

Legend
Primary Land Use Activity Category
B
C
E
F
G
Secondary Land Use Activity Category
E
F
Municipality
71 dBA
66 dBA

N
W
E
S
0
300
600
Feet

Aerial Source: USDA-FSA-APFO NAIP MrSID Mosaic, 2012

Undeveloped Lands Analysis
Illinois Route 31
Illinois Route 176 to Illinois Route 120
McHenry County, Illinois

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