Large Filing Separator Sheet

Case Number: 10-2865-EL-BGN

File Date: 3/10/11

Section: 7

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3.2.2 Species Composition
To reduce problems with misidentification, call files with at least five echolocation pulses were identified to one of three species groups (low-frequency, mid-frequency, or *Myotis* spp.) using a combination of call characteristics (minimum frequency and slope) calculated in Analook (Baerwald and Barclay 2009).

The low-frequency species group includes bat passes with minimum frequencies typically below 30 kilohertz (kHz) and could include hoary bats, big-brown bats, and silver-haired bats. The mid-frequency species includes bat passes with minimum frequencies between 30 and 45 kHz and minimum slope values <40 octaves per second. The mid-frequency group could possibly include evening bats, eastern red bats, and tri-colored bats. Bats in the *Myotis* genus typically produce echolocation calls with minimum frequencies 38 – 50 kHz, and have minimum slope values of >40 octaves per second. Bat passes identified to the *Myotis* species group could possibly include Indiana bats, little brown bats, and northern bats.

The number of identifiable bat passes (five or more echolocation pulses) was tabulated for each detector to document species group composition. Original detections and identified detections will be provided to the ODNR per the Protocol (ODNR 2009), following review of this report. Total bat activity and species composition findings were also compared to the Rodriguez (2009) study within the Project Area as well as other acoustical bat studies.

4 Results

4.1 Acoustic Monitoring

Bat acoustic monitoring was conducted over a total of 248 nights from March 15 to November 17 (at Towers 1, 2, and 3 during 2009, and a combination of 2009 and 2010 for Towers 4 and 5). All analyses concerning the detectors at Towers 4 and 5 include a combination of data collected from the 2009 and 2010 sampling seasons. Because a full season of monitoring was not completed at Tower 0 as a result of the pulley system failure, the data from this tower are not included in this report.

Various equipment problems (e.g. blown fuses, battery failure, microphone/cable failure, detector failure, operator error) resulted in some detector nights that were incomplete or not sampled. Based on a complete season of sampling (March 15 – November 15), there were a total of 248 possible detector nights for each detector or a total of 2,480 detector nights for all ten detectors combined. Detectors were functional for 1,960 detector nights or 79.0% of the possible detector nights. The percentage of successful detector nights per Anabat unit ranged from 94.0% (at both 2 LO and 5 HI) to 42.7% (at 3 LO). Appendix E, Table E-1 shows the installation dates and provides a summary of successful detector nights for all detectors. Appendix E, Table E-2 provides a summary of the total number of bat passes recorded as well as the total number of bat passes identified to each species group for each detector.

4.1.1 Total Bat Activity

Visual examination and filtering of files to eliminate extraneous noise (i.e. wind, insects, etc.) resulted in a total of 5,490 bat passes recorded from all detectors. During the 2009 survey, 5,324 bat passes were recorded and 166 bat passes were recorded during spring 2010. Graphs of nightly bat activity for the HI and LO detectors at each tower are presented in Figures 4-1 through 4-5. Nightly bat activity averaged for all detectors is presented in Figure 4-6. Monthly averages for each detector are presented in Table 4-1. The first bat pass of 2009 sampling season was recorded on March 24 (10 days after Anabat deployment), while the first of 2010 was recorded on March 20 (five days after Anabat employment). The last bat pass of the season was recorded two days before Anabat decommissioning, which was November 15, 2009 (Note: because detectors were only deployed in the spring of 2010, no fall 2010 "last bat pass" is reported). The greatest number of bat passes was recorded at detector 4 LO (1,326 bat passes), while the lowest number was recorded at 2 LO (38 bat passes).

Table 4-1 Monthly Averages for Total Bat Activity Represented as Mean Bat Passes per Detector Night.

	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI	4 LO	5 HI	5 LO	All HI	All LO
March	0.1	0.0	*	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0
April	0.8	1.4	1.0	0.8	1.0	1.7	3.0	2.7	0.2	1.1	0.8	1.5
May	2.7	1.5	2.8	0.2	1.8	4.5	2.0	4.2	1.2	4.3	2.1	2.6
June	2.9	0.6	4.5	0.1	2.3	5.8	2.4	7.1	1.7	6.6	2.8	3.7
July	4.6	0.4	5.8	0.1	5.1	3.3	4.5	9.7	5.0	4.5	5.0	3.5
August	19.6	1.4	13.6	0.1	9.8	0.7	8.4	22.4	9.4	7.7	12.2	9.5
September	6.3	1.0	4.5	0.0	1.9	3.5	3.5	3.3	2.8	8.9	3.8	3.3
October	1.2	0.1	0.8	0.0	1.2	0.2	1.4	1.4	0.8	1.6	1.1	0.7
November	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.9	0.0	0.0	0.1	0.2
All Months	3.5	0.7	3.8	0.2	2.2	2.2	3.2	6.8	2.2	4.0	3.0	2.6

*Indicates no data

The mean bat activity averaged across the entire survey period ranged from 0.2 to 6.8 bat passes per detector night (recorded at detectors 2 LO and 4 LO, respectively) (Table 4 - 1). Mean bat activity averaged across all detectors was 2.8 bat passes per detector night. Bat activity was highly variable from night to night (Figures 4-1 to 4-5) and ranged from 0 – 59 bat passes per detector night. The most active night for any one detector was August 9, 2009 at detector 1 HI (Figure 4-1).

Seasonal Differences in Total Bat Activity

While a few bat passes were recorded in late March and early April, the first notable increase in mean nightly bat activity occurred between mid-April and early May (Figure 4-6). The increase in bat activity during these spring months is possibly attributable to migrant bats or to the increased activity of resident bats; however, the distinction cannot be drawn from these data.

The most active period for bats was during August when mean bat activity for all HI detectors reached 12.2 bat passes per detector night (Table 4-1) and was preceded by a sharp increase in activity in late July (Figure 4-6). Mean activity diminished after the peak in mid-August, with another smaller peak in mid and late September (Figure 4-6). Low numbers of detections continued through October with a few detections into early November. On average, bat activity hovered at appromixately 1.0 bat pass per detector night for all HI and LO detectors during October and diminished to 0.1 and 0.2, respectively, during November (Table 4-1).

Altitudinal Differences in Bat Activity

During the complete survey period, the mean number of bat passes was 3.0 and 2.6 passes/detector night for all HI and LO Anabat units, respectively. From a seasonal perspective, more bat passes were recorded at the LO detectors early in the year, during the late April and early May rise in activity levels (Figure 4-6). From mid-July through mid-August, there was more activity recorded at the HI detectors, with an additional increase during late September, compared to the LO detectors.

4.1.2 Species Composition

A total of 3,402 bat passes were identified to low-frequency, mid-frequency, or *Myotis spp.* groups. Table E-2 in Appendix E shows the number of bat passes identified to each species group for each detector. Low-frequency bats were the most prevalent (2,370 bat passes) frequency group and composed 69.7% of the identifiable bat passes. *Myotis spp.* (699 bat passes, 20.5%) and mid-frequency (333 bat passes, 9.8%) were less common than the low-frequency bats.

Figures 4-7 through 4-9 show the mean number of bat passes recorded from all HI and LO detectors across the sampling season for each of the three species groups. Table 4-2 shows the monthly mean activity for low-frequency bats identified at each detector and Tables 4-3 and 4-4 show monthly means for mid-frequency bats and *Myotis spp.*, respectively.

Table 4-2 Monthly Averages for Low-Frequency Bat Activity, Represented as Mean Bat Passes per Detector Night.

	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI	4 LO	5 HI	5 LO	All HI	All LO
March	0.0	0.0	*	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
April	0.2	0.1	0.5	0.1	0.5	0.1	1.0	1.2	0.1	0.2	0.3	0.3
May	0.9	0.1	1.4	0.0	0.6	0.2	0.5	1.8	0.5	1.2	0.8	0.6
June	1.2	0.1	1.9	0.0	0.8	0.6	1.3	3.4	0.6	2.6	1.1	1.5
July	2.1	0.1	2.8	0.0	2.2	0.0	2.2	4.6	2.3	2.2	2.3	1.5
August	9.6	0.0	7.2	0.0	4.6	0.0	3.9	11.3	4.9	4.3	6.1	4.6
September	3.1	0.1	2.6	0.0	0.7	0.7	2.1	1.6	1.3	4.2	2.0	1.4
October	0.4	0.0	0.3	0.0	0.3	0.0	0.8	0.4	0.4	0.5	0.5	0.2
November	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.1
All Months	1.5	0.1	1.9	0.0	0.9	0.2	1.6	3.3	1.1	1.7	1.4	1.0

*Indicates no data

Table 4-3 Monthly Averages for Mid-Frequency Bat Activity, Represented as Mean Bat Passes per Detector Night.	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI	4 LO	5 HI	5 LO	All HI	All LO
March	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
April	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.1
May	0.3	0.5	0.0	0.0	0.0	0.3	0.1	0.6	0.1	1.3	0.1	0.4
June	0.1	0.1	0.1	0.0	0.0	0.3	0.0	0.6	0.0	0.8	0.0	0.4
July	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.2	0.5	0.1	0.2
August	0.4	0.1	0.4	0.0	0.0	0.0	0.2	1.1	0.7	1.3	0.4	0.5
September	0.2	0.2	0.2	0.0	0.1	0.1	0.1	0.0	0.3	0.9	0.2	0.3
October	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.1	0.5	0.1	0.1
November	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
All Months	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.5	0.1	0.6	0.1	0.2
*Indicates no data												

Table 4-4 Monthly Averages for *Myotis Spp.* Bat Activity, Represented as Mean Bat Passes per Detector Night.	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI	4 LO	5 HI	5 LO	All HI	All LO
March	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
April	0.0	0.8	0.1	0.5	0.1	1.0	0.0	0.7	0.0	0.4	0.0	0.7
May	0.1	0.3	0.1	0.1	0.3	2.6	0.0	0.3	0.1	0.8	0.1	0.7
June	0.0	0.3	0.0	0.0	0.1	3.8	0.1	0.9	0.1	1.1	0.1	0.8
July	0.1	0.2	0.0	0.0	0.4	2.3	0.1	1.6	0.1	0.9	0.1	0.7
August	0.1	0.6	0.3	0.0	0.4	0.3	0.1	4.9	0.1	1.0	0.2	2.1
September	0.6	0.5	0.3	0.0	0.2	1.5	0.4	0.7	0.1	2.1	0.3	0.9
October	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.3	0.0	0.2
November	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All Months	0.1	0.3	0.1	0.1	0.2	1.3	0.1	1.2	0.1	0.8	0.1	0.6
*Indicates no data												

Low-frequency bats were more prevalent at HI detectors than LO detectors, whereas the opposite was true for mid-frequency and *Myotis spp.* bats. The average number of low-frequency bat passes per detector night at all five HI detectors was 1.4 passes/detector night compared to 1.0 passes/detector night at LO detectors (Table 4-2). On average, mid-frequency bat activity was found to be twice as high at LO detectors compared to HI detectors (Table 4-3) and *Myotis* species were six times greater at LO detectors compared to HI detectors (Table 4-4).

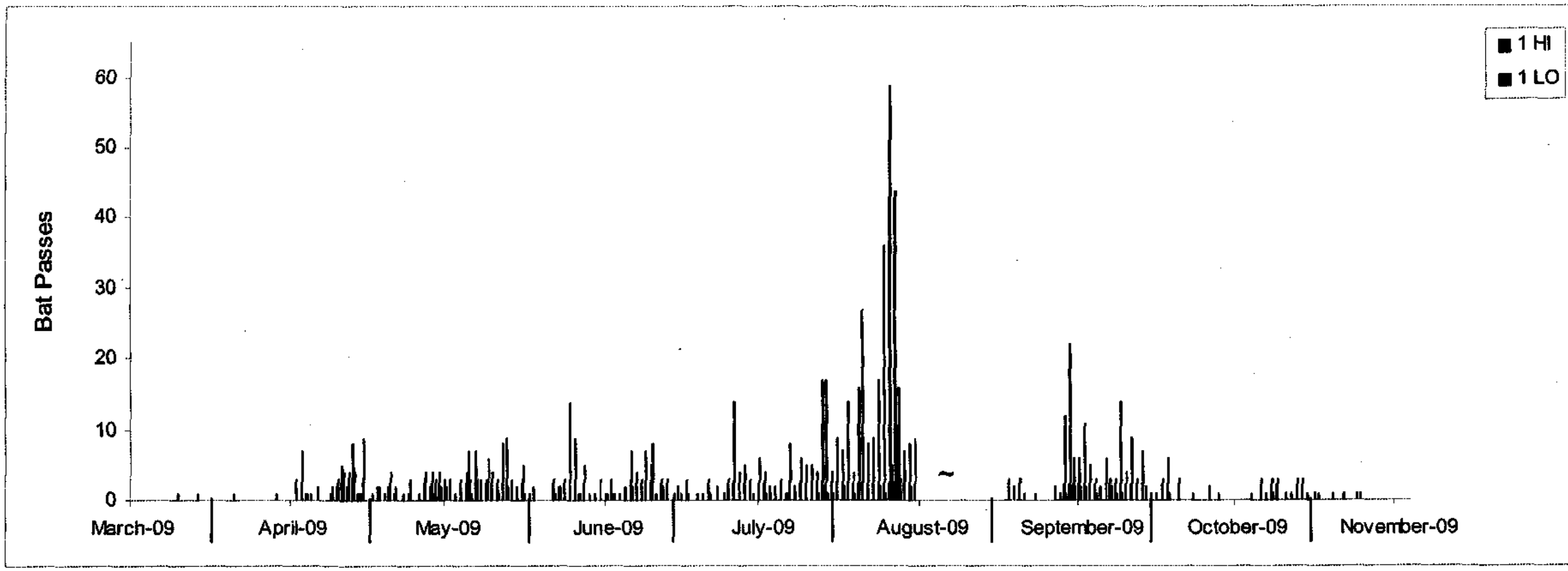

Figure 4-1 Seasonal Bat Activity for Tower 1 (2009 Data). Values are the total number of bat passes (2 or more echolocation calls) for all species. ~ signifies dates when both high and low detectors were not functioning for five days or more.

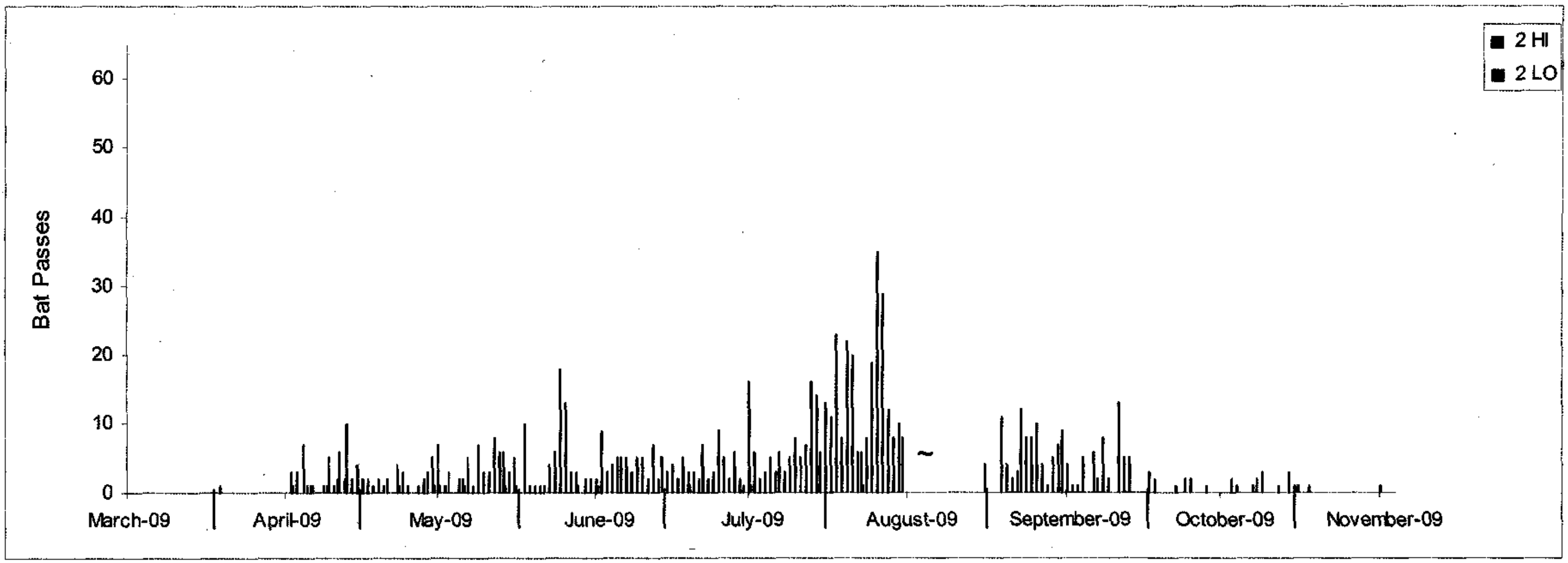

Figure 4-2 Seasonal Bat Activity for Tower 2 (2009 Data). Values are the total number of bat passes (2 or more echolocation calls) for all species. ~ signifies dates when both high and low detectors were not functioning for five days or more.

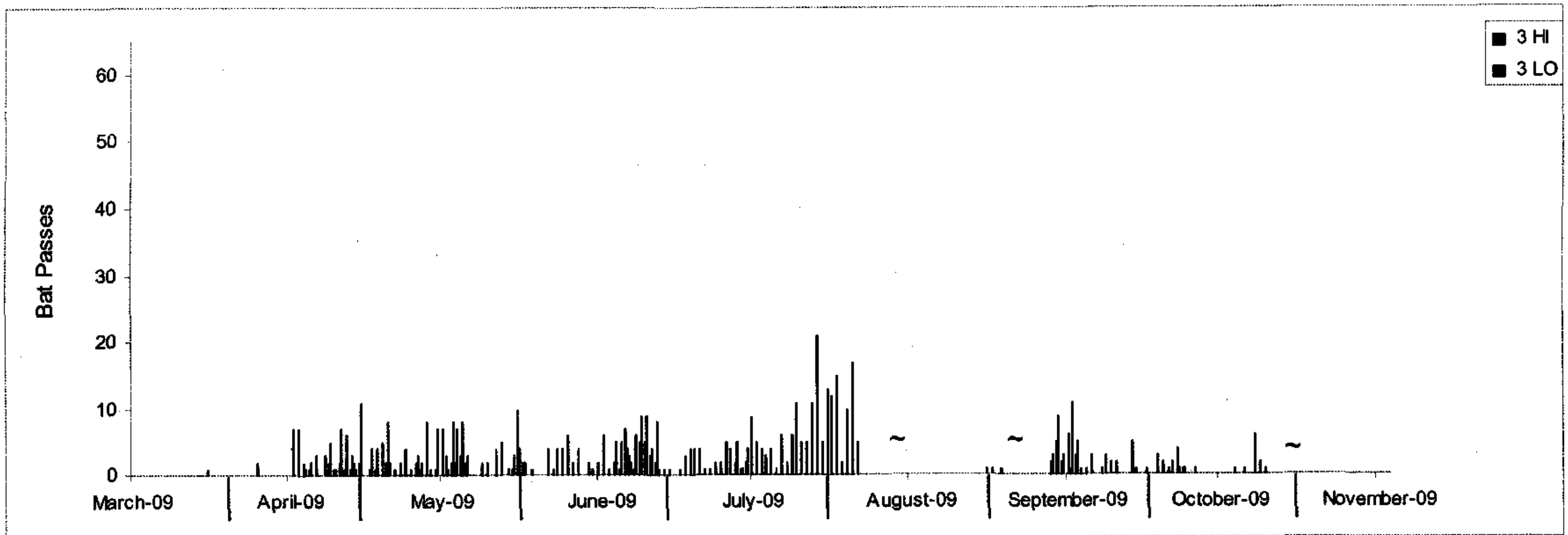

Figure 4-3 Seasonal Bat Activity for Tower 3 (2009 Data). Values are the total number of bat passes (2 or more echolocation calls) for all species. ~ signifies dates when both high and low detectors were not functioning for five days or more.

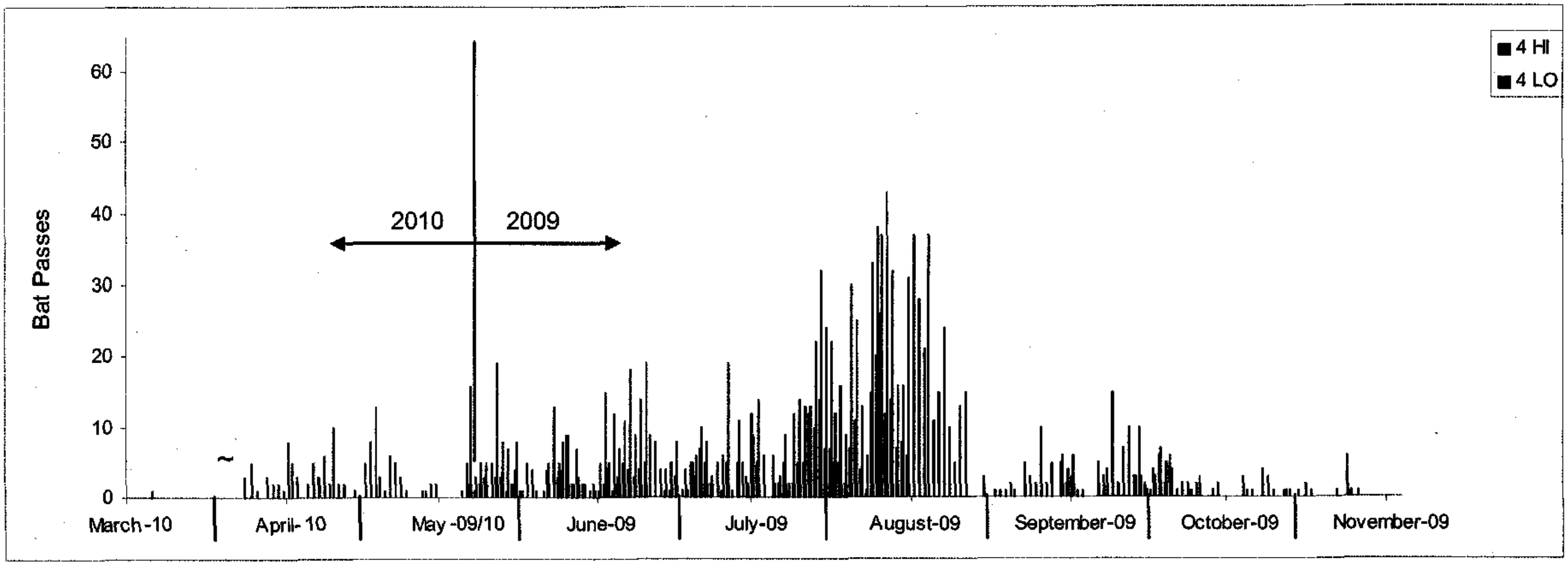

Figure 4-4 Seasonal Bat Activity for Tower 4 (2009/2010 Data). Values are the total number of bat passes (2 or more echolocation calls) for all species. ~ signifies dates when both high and low detectors were not functioning for five days or more.

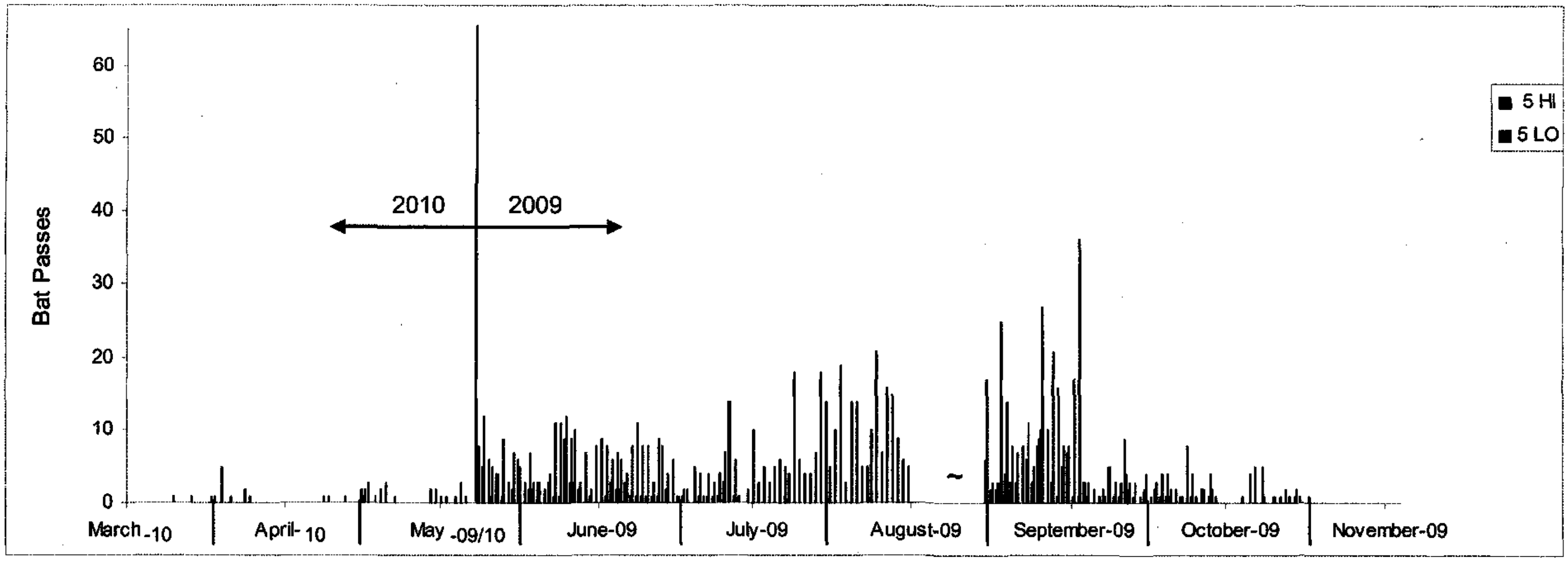

Figure 4-5 Seasonal Bat Activity for Tower 5 (2009/2010 Data). Values are the total number of bat passes (2 or more echolocation calls) for all species. ~ signifies dates when both high and low detectors were not functioning for five days or more.

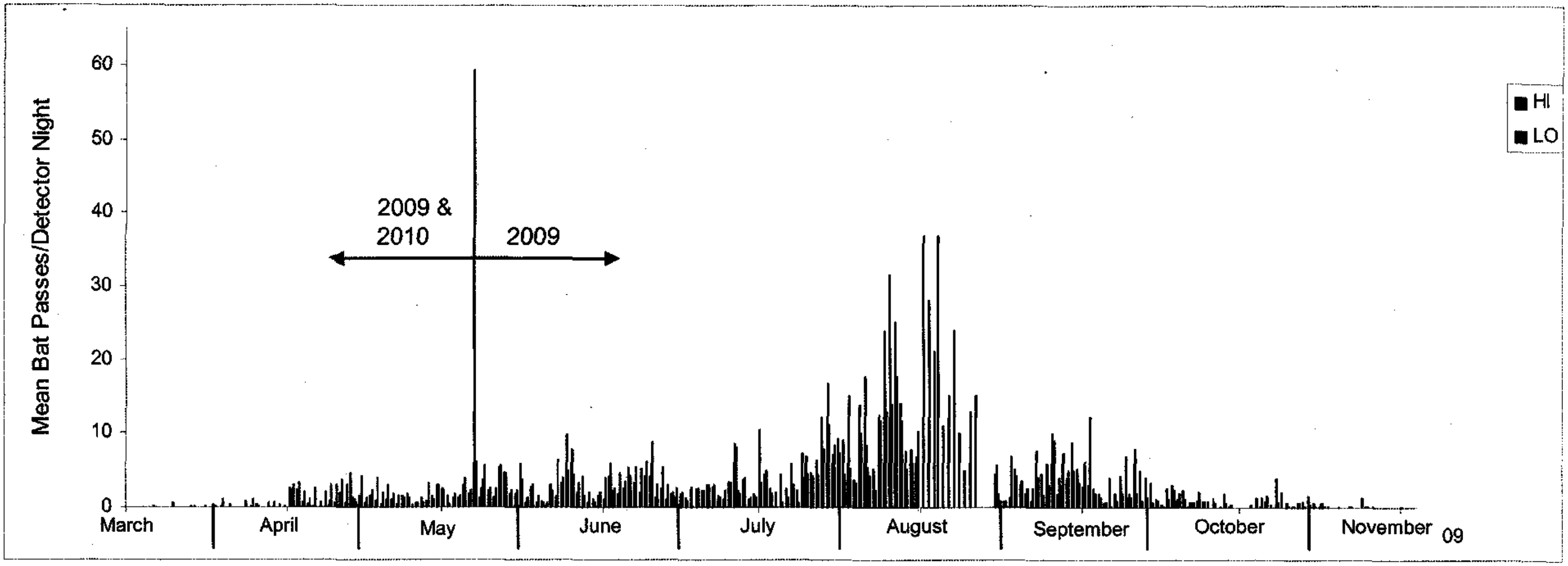

Figure 4-6 Seasonal Bat Activity for all meteorological towers across 2009 and 2010 sampling periods. Values are the mean number of bat passes (2 or more echolocation calls) for all species.

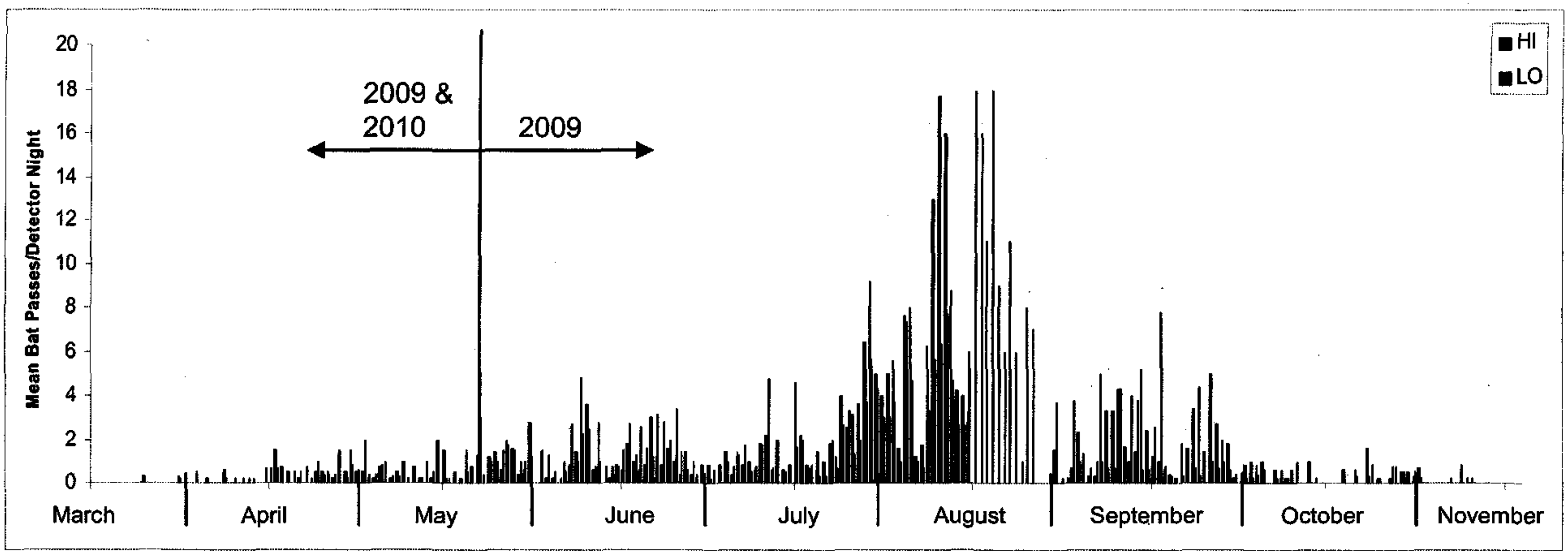

Figure 4-7 Seasonal Bat Activity for low-frequency bats across all meteorological towers across 2009 and 2010 sampling periods. Values are the mean number of bat passes identified as low-frequency bats (5 or more echolocation calls).

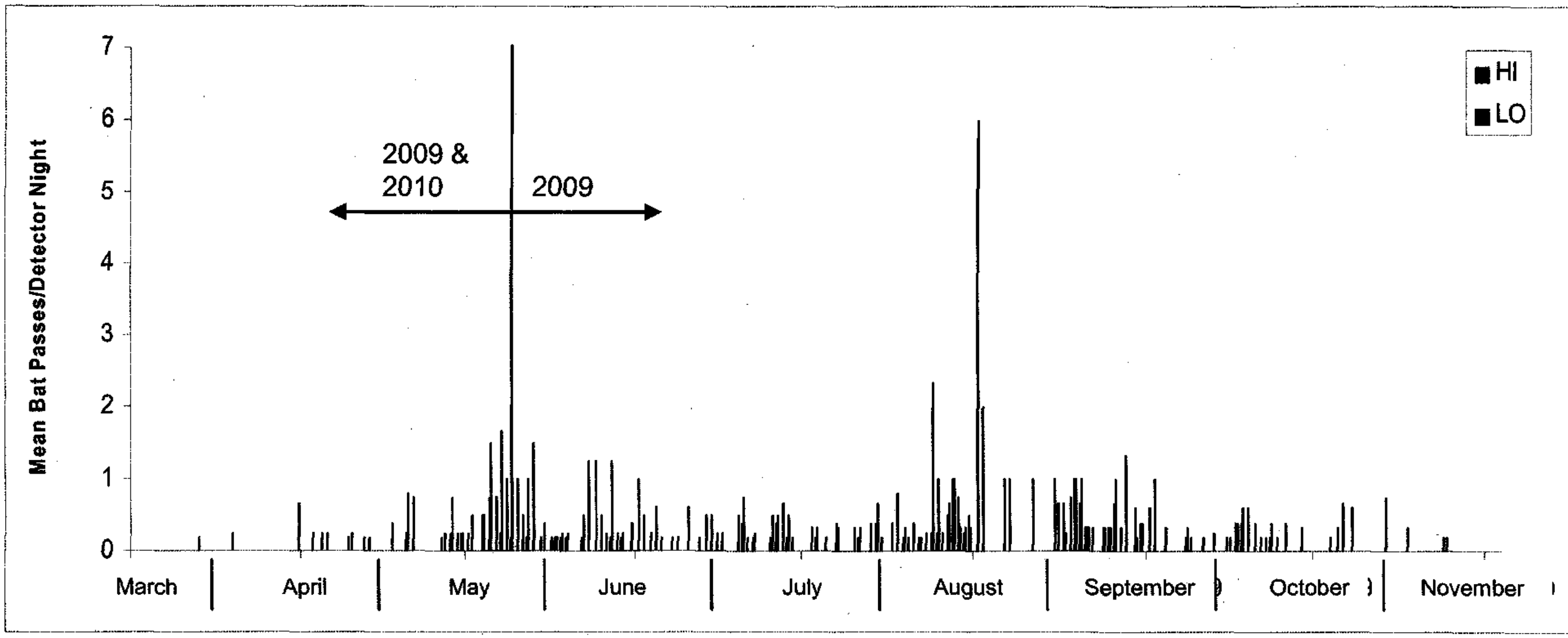

Figure 4-8 Seasonal Bat Activity for mid-frequency bats across all meteorological towers across 2009 and 2010 sampling periods. Values are the mean number of bat passes identified as mid-frequency bats (5 or more echolocation calls).

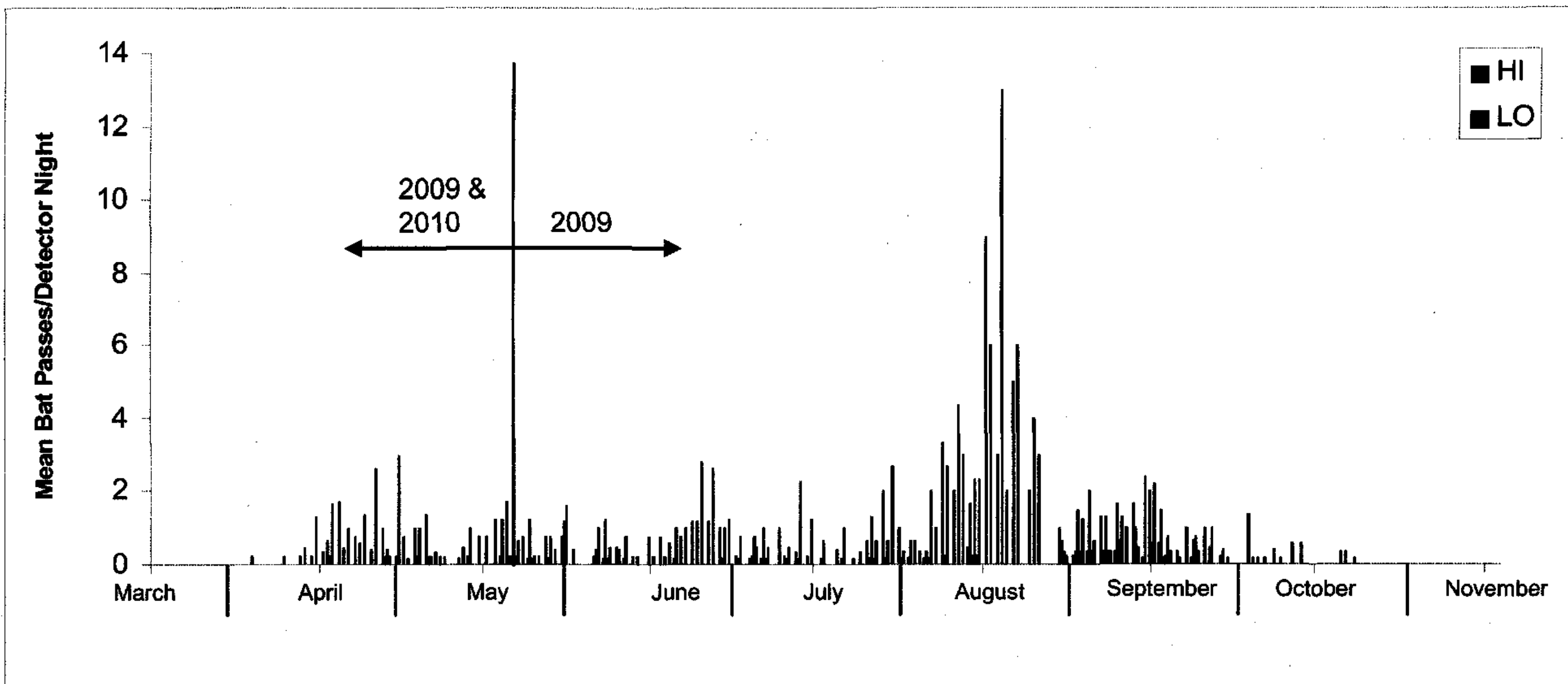

Figure 4-9 Seasonal Bat Activity for Myotis spp. across all meteorological towers across 2009 and 2010 sampling periods. Values are the mean number of bat passes identified as Myotis spp. (5 or more echolocation calls).

5 Discussion and Conclusions

This acoustic monitoring study focused on collecting baseline information regarding bat activity levels at the Black Fork wind farm in north-central Ohio. The state of Ohio currently has protocols regarding pre-construction bat surveys at inland wind farms (ODNR 2009). The Black Fork project complied with the ODNR-recommended moderate level surveys, which required both acoustic monitoring and mist net surveys. This report describes the acoustic monitoring results from the study conducted in 2009and 2010. The mist net survey results were previously submitted under separate cover (see Appendix B).

It is important to note that acoustic monitoring provides a general idea of bat activity; however the technology cannot discriminate distinct individuals or precisely determine species composition (ODNR 2009). As such, the numbers of bat passes recorded by a given detector are used to infer abundance; however these numbers do not necessarily represent the number of bats present, as a single bat could make several passes within a night.

As reported previously, the detectors were operational and properly recording bat activity during approximately 79% of the survey period. This percentage of successful detector nights is within the range reported for acoustic studies in Ohio and western New York (Stantec 2008a [67.5%], Good et al. 2008 [88.5%], Reynolds 2009 [84.9%]). It was assumed that if a detector was on during the nighttime sampling period, that night counted as a detector night. However, issues such as bad cable connections and microphone corrosion have the potential to render the detector incapable of recording bat activity even though the detector was running. The instances where data gaps occurred were the result of equipment failure and malfunctions as well as CF card exchange issues. Due to the location of the equipment and being subjected to the elements, it was not expected that all detectors would be operational throughout the entire survey period. There were periods of time when the detectors were not correctly reporting bat activity, thus it is possible that the results presented for mean bat activity at the Project actually could be underestimated. This is particularly true for the LO detector at Tower 2, which only recorded 38 bat passes.

The acoustic monitoring results from the Project indicate bat activity levels in the range of those observed at other proposed wind farm sites in Ohio, the northeast and Midwest where information is publically available (Arnett et al. 2007, Stantec

Good et al. 2008, Stantec 2008a, Stantec 2008b, Reynolds 2009). The mean activity level recorded for the Project (approximately 3.0 passes per detector night) is within the range reported for the Timber Road II site in Ohio (Good et al. 2008 [2.8 passes per night]) and less than half of what was reported during fall studies at the Buckeye Wind site (Stantec 2008a [6.73 pass per night]). Mean activity levels for the Project are also slightly lower than those reported for other studies in the northeast (Reynolds 2009 [6.5 passes per night], Arnett et al. 2007 [5.5 calls per night), and Stantec 2008b [3.5 passes per night]). Reynolds also reported a number of projects with slightly lower activity levels ranging from 2.0 to 2.9 bat passes per detector night from projects in Pennsylvania, New York, Virginia, and Minnesota.

The highest levels of total bat activity in the Project Area were recorded from mid-July through August. This finding was consistent with seasonal activity levels observed at other proposed wind farms in Ohio, the northeast and Midwest (Redell et al. 2006, Arnett et al. 2007, Good et al. 2008, Mabee and Schwab 2008, Reynolds 2009). All of these studies reported relatively similar peaks in bat activity levels and timing compared to the results of this study. Good et al. (2008) reported a peak in bat activity levels between late July and mid-August in western Ohio. Reynolds (2009) reported a peak in bat activity in late July into early August in western New York. Mabee and Schwab (2008) reported that peak bat activity for all species occurred during mid-July in north central New York. An acoustic study performed by Arnett et al. (2007) in Massachusetts found that bat activity peaked in late July to mid-August. Redell et al. (2006) reported that bat activity increased in August and peaked in late August at a site in south-central Wisconsin.

Additional data for the Black Fork Project is available in Rodriguez (2008), which describes acoustical bat studies that were performed at the Black Fork Project Area between October 1 and November 15, 2008 (see Appendix A for full report). While the Rodriguez report does not cover spring and summer activity periods, it does cover part of the 2008 fall season, which allows some comparisons to be made to the present study. Rodriguez (2008) reported that bat activity within the fall sampling period was relatively high in early October (with the highest concentrations at both high and low detectors occurring between October 5 and 10, 2008) and tapered off towards the middle of November. This pattern was similar to the results of this study (see Figure 4-6). Activity levels were slightly higher during the 2008 sampling period, possibly due to differences in weather or other influences on bat distribution or behavior between the two studies.

Across all sampling periods at the Project (2009-2010), low-frequency bats were the dominant species group recorded (69.7%) at both high and low detectors. This suggests that mid-frequency species (9.8%) and *Myotis* spp. (20.5%) are not as abundant within the Project Area. This trend coincides with the results of the mist net study where the big brown bat (low-frequency group), was the most common species captured (E & E 2009). The second most abundant species captured during the mist net surveys, Northern *Myotis* coincides with the second most common group (*Myotis spp.*) detected during the acoustic surveys. This trend was also found in the Project Area during the Rodriguez (2008) study.

The general pattern of seasonal bat activity within the Project Area appears to be consistent with spring and fall migration periods. In the spring, activity levels increased in mid-April with a noticeable peak until early May, and subsequent peaks into late May and early June. In the fall, activity levels declined through September following an August peak, with activity tapering to low levels through October and November.

The Black Fork Project Area contains adequate habitat for a variety of bat species including riparian woodlots and upland forested blocks amid an agriculturally dominated land use matrix. As discussed in Section 2, the majority of land cover within the Project Area is classified as agricultural fields and only a small percentage is classified as forested, the later of which could be considered high quality habitat. This habitat structure is characteristic of many areas in the Midwest and is reflected by the similar bat activity documented in the Project Area compared to sites in Ohio, nearby western New York, the northeast, and the Midwest. The predominance of low-frequency bat detections implies that individuals comprising these species (e.g. hoary bats and silver-haired bats), and not the mid-frequency or *Myotis* species groups (the later of which includes the federally endangered Indiana bat) are most likely to be impacted by the operation of the proposed wind farm.

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A Black Fork Bat Acoustic Monitoring Report - 2008

Bat Monitoring at the Proposed Black Fork Wind Farm in Crawford County, Ohio

DRAFT REPORT - Fall 2008

Prepared For:

Ecology and Environment, Inc
and
Samuel Gary Jr. & Associates

Performed By:

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EXECUTIVE SUMMARY

To document the baseline bat activity within the project area of the proposed Black Fork Wind Farm, acoustic monitoring was performed using six (6) Anabat ultrasonic detectors installed on three (3) separate meteorological towers within the project area. For each tower, one detector was installed at 5 meters while another detector was installed at 40 meters. A total of 290 bat passes were recorded during the period of early October 2008 to the middle of November 2008. Activity was equally composed of migratory (eastern red, silver-haired, and hoary bats) and non-migratory (big brown, pipistrelle, and myotis bats) species. Activity was highest at 5 meters in height which was marked by myotis, big brown, silver-haired, and red bats, while hoary bats were found more active at 40 meters in height.

Bat use during the 2008 fall migration period appears to be low for the project area. Bat activity as determined by this acoustic monitoring survey suggests that activity within this seasonal migration period is by migratory and non-migratory species when recording was performed at heights of both 5 and 40 meters, which illustrates the importance of monitoring at low and high heights. Activity appears to generally be high in early October and decrease towards the middle of November with some peak nights of activity. Post-construction monitoring should be performed to fully assess whether or not an impact on bats (especially sensitive species, i.e. Indiana bat) is present by the proposed wind farm.

INTRODUCTION

Recently, the impact of operating wind energy developments on bats has become a concern due to an unexpected high number of bat fatalities found at a number of these facilities (Arnett 2005; Kunz et al. 2007). These results have been produced mostly from post-construction mortality surveys performed at a number of wind farms in the eastern United States with comparable results from agricultural areas in southwestern Alberta, Canada (CWEA 2006; Kunz et al. 2007). Most of the fatalities from these studies comprised of migratory species and were found during the fall migratory period. Known species included in fatalities at wind projects are big brown bats (*Eptesicus fuscus*), little brown bats (*Myotis lucifugus*), northern long-eared bats (*Myotis septentrionalis*), eastern pipistrelle (*Pipistrellus subflavus*), Mexican free-tailed bats (*Tadarida brasiliensis*) and migratory tree-roosting bats such as; eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), and Seminole bat (*Lasiurus seminolus*) (Arnett et al. 2008; Kunz et al. 2007; Piorkowski 2006). In Ohio, there exists no known information on the impact to bats. The closest incidences have been reported more than 200 miles to the southeast in forested ridgetops of West Virginia and Pennsylvania. Mortality estimates during the late summer and early fall ranged from 1,364-1,980 bats for the 44 turbine facility in West Virginia and 400-660 bats for the facility in Pennsylvania (Arnett 2005). Questions remain as to how bats are being killed by wind turbines and to what degree bat populations are being affected.

Due to these findings, pre-construction monitoring is essential in understanding the current levels of bat activity as well as in projecting potential levels of bat mortality once pre-construction monitoring has been compared to post-construction monitoring. The purpose of this study was to provide a pre-construction baseline survey of the bat activity during the fall 2008 migratory period at the proposed wind energy development location; Black Fork Wind Farm in Crawford County, Ohio. A total of 10 bat species potentially occur in Crawford County consisting of resident (non-migratory) and migratory species (Table 1).

Common Name	Species Name
Big Brown Bat	*Eptesicus fuscus*
Silver-haired Bat	*Lasionycteris noctivagans*
Eastern Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Eastern Small-footed Myotis	*Myotis leibii*
Little Brown Bat	*Myotis lucifugus*
Northern Long-eared Myotis	*Myotis septentrionalis*
Indiana Bat	*Myotis sodalis*
Evening Bat	*Nycticeius humeralis*
Eastern Pipistrelle	*Perimyotis subflavus*

Table 1. List of bat species possibly found in the project area.

METHODS

Passive Acoustical Monitoring

Passive acoustical monitoring was performed for approximately one and half months (early October to mid-November 2008) during the fall migratory period at three locations using Anabat Bat Detection Systems (Titley Electronics, Ltd) (Figure 1). Two Anabat detectors were placed on a single meteorological (met) tower at approximately 5 meters and 40 meters in height within the project area. These met towers were chosen due to their representative extent of the project area. A pulley system was installed onto the met tower at approximately 5 and 40 meters once the tower was lowered by the contracted tower crew. This pulley system was used to raise the Anabat microphones near these approximate heights. In all instances, the Anabat microphones were sheltered from weather and placed pointing downward towards a Lexan polycarbonate plate for reflection of sound. The plate was pointed approximately 45° in reference to the microphone to reflect sound coming generally above the microphone. This placement was used to assist in surveying a greater distance of airspace up towards the theoretical sweep zone. Due to logistics, all Anabat units were not installed on the same date but within subsequent days from the initial installation. Installation of units at the West Tower–Niese (units 1 and 2) and North Tower–Morrow (units 3 and 4) were installed by consultant. Installation of Anabat units at the South Tower–Sutter (units 5 and 6) was performed by Ecology and Environment, Inc personnel.

Choice of placing the ultrasonic detector at 40 meters on the met tower was made due to the ability to record bat echolocation calls at a level relatively near the potential turbine rotor sweep and to record the activity of potentially migrating bats, since mortalities of migratory species have been found to be highest at wind project sites (Kunz et al. 2007). In addition, migrating bats may fly up to heights of 100 meters and the number of bat fatalities has been shown to increase exponentially with turbine height (Barclay et al. 2007). Detectors were placed around 5 meters to possibly record the activity of different species which has been the case in past studies (Arnett et al. 2006; Arnett et al. 2007). This activity is most likely attributable to resident species and/or the foraging activity of bats.

Acoustic monitoring was performed with the Anabat Bat Detection System. The latest SD1 version was used to record sound files and extract frequency and time information of bat echolocation calls. The Anabat SD1 bat detector is a frequency-division detector which allows for the detection of a broad range of frequencies, therefore allowing for the recognition of a variety of bat species. Recorded sound files were stored onto a compact flash (CF) memory card within the SD1, which are used to facilitate the collection of bat calls during extended periods of recording. The compact flash card and SD1 were programmed to start recording an hour before sunset and to stop recording an hour after sunrise. Data was downloaded from the CF cards and uploaded to an ftp site. Collection of data and maintenance of equipment in the field was performed by Ecology and Environment, Inc.

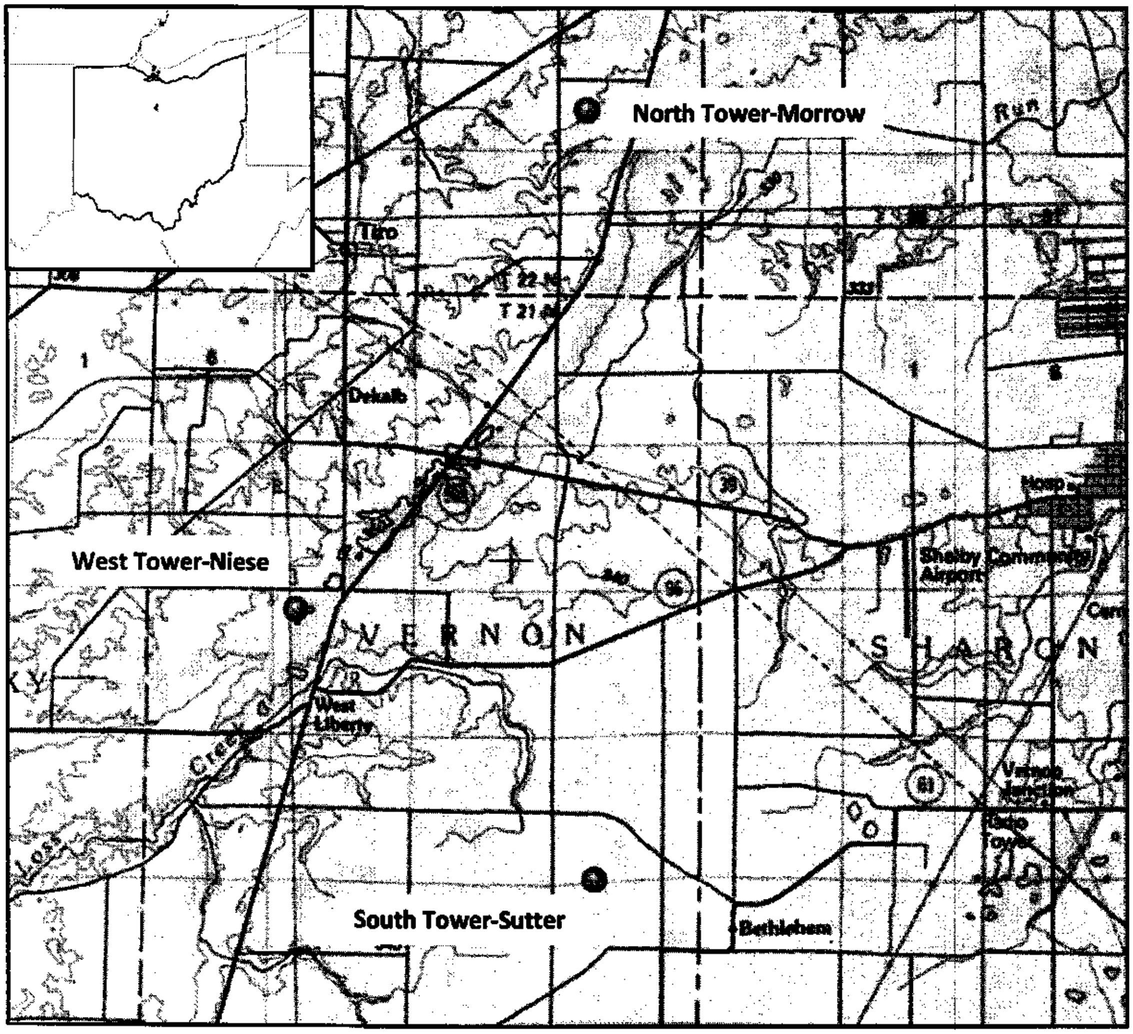

Figure 1. Map of Anabat Locations in the wind resource area. Units 1 and 2 were located at the West Tower, units 3 and 4 were located at the North Tower, and units 5 and 6 were located at the South Tower. Units 1, 3, and 5 were set at 5 meters while units 2, 4, and 6 were set at 40 meters.

Anabat Data Analysis

Analysis of recorded calls was performed to assess the species composition and relative activity of the bat fauna within the project area. Qualitative analysis of recorded echolocation calls was performed using AnalookW bat call analysis software, version 3.3m (Corben 2006). Sound files were visually screened to remove files of non-bat calls, so that only suitable bat calls remained. Call files were examined visually, compared to libraries of known bat reference calls, and assigned to species or when a single species could not be deciphered from the call these calls were assigned to species-group categories. This was possible only when clear calls were recorded and only with certain species. Fragmentary, unclear calls or calls that were assignable to more than 3 species were designated as "unknown."

Call rates by species, as well as total detections and trends in species' presence in the data were analyzed. To quantify rates and put call data in a comparable context to other studies, two indices were calculated; an index of average bat passes per night (ABN index) and an index of bat passes per hour (ABH index). Each index was calculated by using all nights in which monitoring occurred and for each individual system. When calculating for bat passes per hour, fifteen (15) hours were surveyed per night of data.

RESULTS

From all Anabat systems, a combined total of 20,351 sound files were recorded within a period from early October to mid November 2008. Visual examination and filtering of files to eliminate extraneous noise (i.e. wind, insects, etc.) resulted in 290 bat passes between all six units. Although numbers of bat passes recorded are used to infer abundance, these numbers do not necessarily constitute the number of bats present, that is, a single bat could possibly make several passes within a night.

Considering activity rates, the West Tower (n = 63) had fewer calls than the North Tower (n = 119) and South Tower (n = 108), yet the number of bat passes was not significantly different between all towers (ANOVA, $F = 1.78, p = 0.17$). When comparing the heights, there was a significant difference between 5 meters to 40 meters (Table 2). There was a significant difference in the number of bat passes recorded at 5 meters compared to 40 meters at both the North Tower and West Tower, yet a non-significant difference was found at the South Tower (Table 2). There was no significant difference among 5 meter (ANOVA, $F = 2.69, p = 0.07$) or among 40 meter heights (ANOVA, $F = 0.50, p = 0.60$) of all the towers. When considering bat activity rates, units 1 and 3 demonstrated the highest value which was followed by units 5, 2, and 6 (Table 3A and 3B). All units with the exception of 5 and 6 monitored for the same number of nights.

Height Comparison (5 m vs. 40 m)	t	p
All towers	2.06	< 0.05
North	3.84	< 0.001
West	2.30	< 0.05
South	1.63	0.11

Table 2. Paired t-tests comparing number of bat passes recorded at 5 meters to 40 meters.

A - Nightly	Anabat Unit	Met Tower	Height	Bat Passes	No. of Nights Recorded	ABN Index
	1	West	5 m	69	44	1.57
	2	West	40 m	39	44	0.89
	3	North	5 m	86	44	1.95
	4	North	40 m	33	44	0.75
	5	South	5 m	37	40	0.93
	6	South	40 m	26	39	0.67

B - Hourly	Anabat Unit	Met Tower	Height	Bat Passes	No. of Hours Recorded	ABH Index
	1	West	5 m	69	660	0.10
	2	West	40 m	39	660	0.06
	3	North	5 m	86	660	0.13
	4	North	40 m	33	660	0.05
	5	South	5 m	37	600	0.06
	6	South	40 m	26	585	0.04

Table 3. Overall bat activity indices. (A) Bat activity based upon number of bat passes and number of nights in which monitoring was performed. (B) Bat activity based upon number of bat passes and number of hours for nights with solely recorded data.

For consideration of species identity, bat passes were put into the most specific category when possible as sufficient data allowed. The following 9 designations were used to classify bat passes:

BISIHO – Big Brown, Silver-haired and Hoary bat group
BIBRSILV – Big Brown and Silver-haired bat group
BIBR – Big Brown bat

SILV – Silver-haired bat
HOAR – Hoary bat
RED – Eastern Red bat
PIPI – Eastern Pipistrelle bat
MYOTIS – Myotis bat group
UNKNOWN – un-assignable to species or species group

Percent species/species group composition from the combined data of the six Anabat units were as follows from highest to lowest; MYOTIS (n = 55), BIBRSILV (n = 52), RED (n = 38), BISIHO (n = 29), SILV (n = 24), HOAR (n = 11), BIBR (n = 4), and PIP (n = 3) (Figure 2). Unknown calls represented 26% (n = 74) of the total detections due to a large number of fragmentary calls. Although species composition among towers is similar, the species groupings with the most passes differed among towers (Figure 3). Bat passes recorded at the North Tower was made up mostly of BIBRSILV, MYOTIS, and RED and more passes were detected by BISIHO, BIBRSILV, BIBR, SILV, and RED at the North Tower compared to the other towers. Composition at the South Tower was mainly comprised of BIBRSILV, RED, and BISIHO. The majority of passes detected at the West Tower included calls detected by MYOTIS, BIBRSILV, and RED with more passes by MYOTIS and HOAR being recorded at the West Tower compared to the other towers. When comparing 5 versus 40 meter heights including all towers, more passes were recorded at 5 meters for all species groupings with the exception of HOAR which had more passes detected at 40 meters (Figure 4). Some consistency was found in most passes by species group when comparing 5 meter to 40 meter heights at each individual tower (Figure 5). The RED, HOAR, SILV, and MYOTIS group were consistently higher in the number of passes at 5 meters. The only exception to this result is that RED was equal in number at 5 and 40 meters of the South Tower.

Nightly activity appeared higher at the beginning of the monitoring period and lessened towards the termination of monitoring when considering the combined data from all met towers (Figure 6). Yet, this pattern also appeared episodic with some nights having peak activity; 5, 9, 15 October. This activity was attributed to a number of bat passes recorded at the North and West Towers (Figure 7) and at a height of 5 meters (Figure 8). Activity was characterized by RED and MYOTIS on 5 October 2008, and BIBRSILV and SILV on 9 and 15 October 2008.

Hourly activity resulted in general trend of high number of passes recorded during the hours of 7:00 pm and 8:00 pm with decrease until the hour of 7:00 am (Figure 9). This trend was consistent when comparing by tower or by height (data not shown).

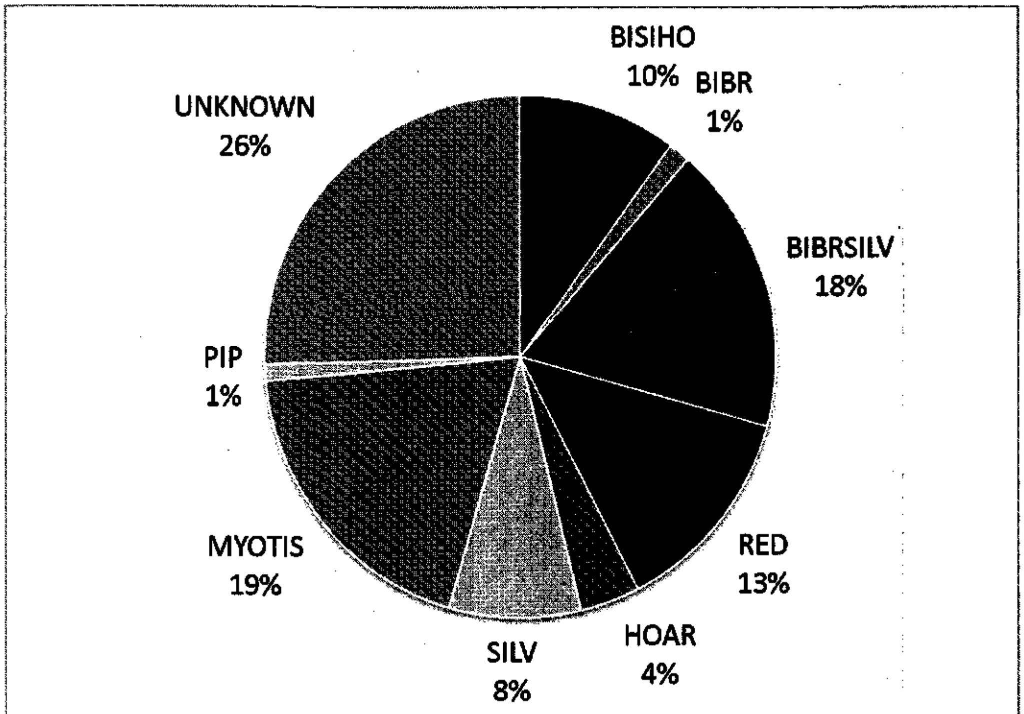

Figure 2. Percent composition of species and species groupings from overall bat passes.

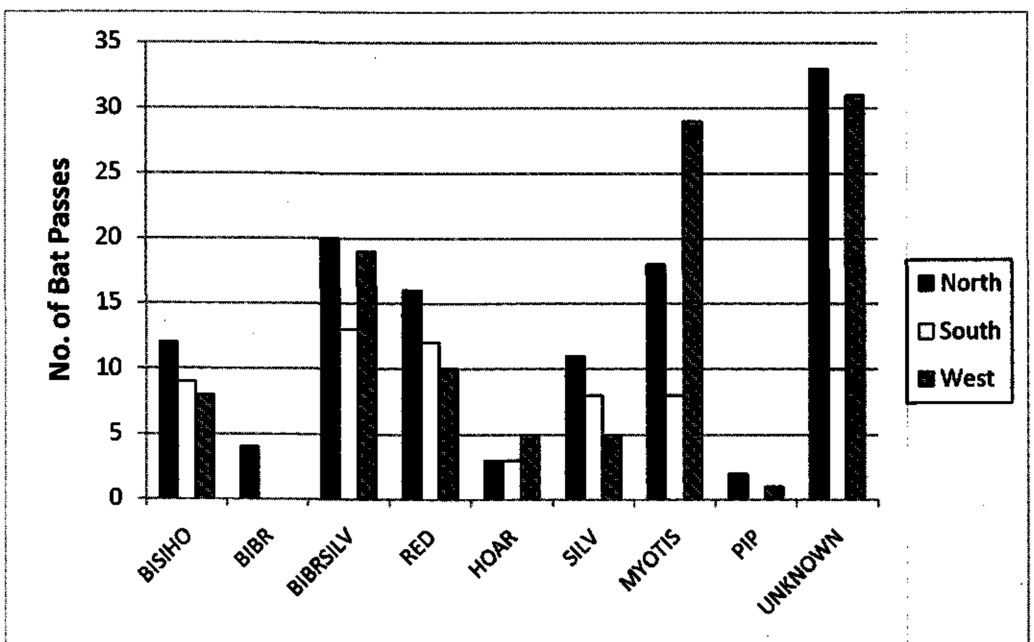

Figure 3. Comparison of species composition and activity among towers.

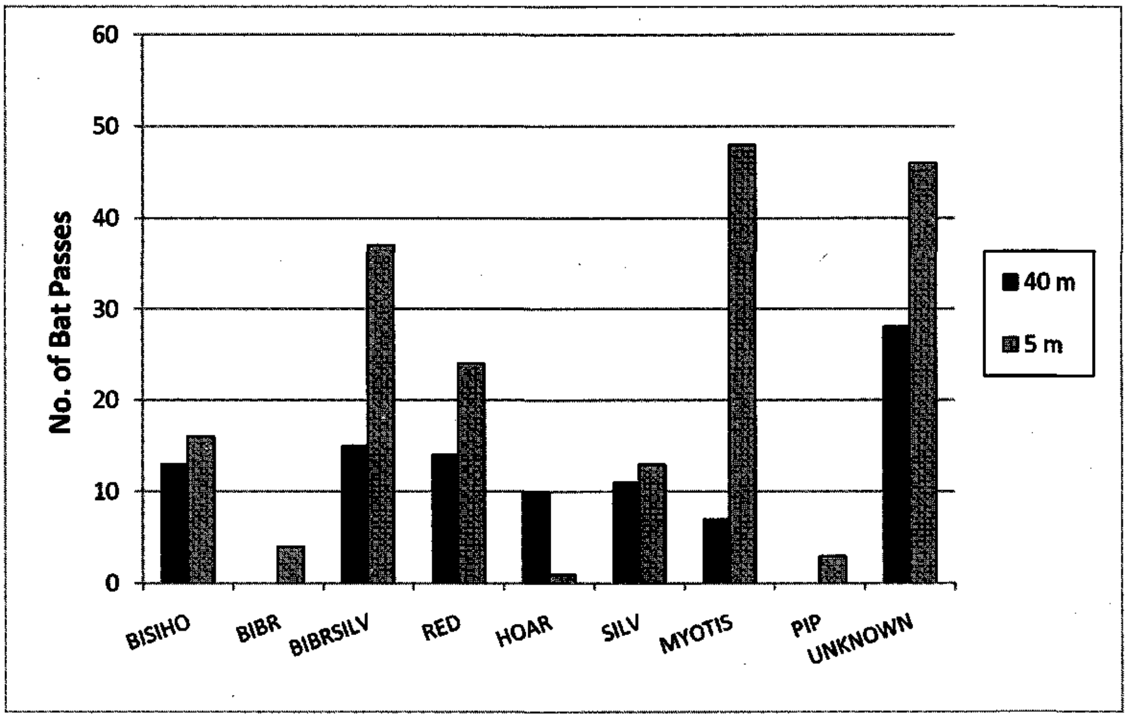

Figure 4. Comparison of species composition and activity between the 5 meter and 40 meter heights.

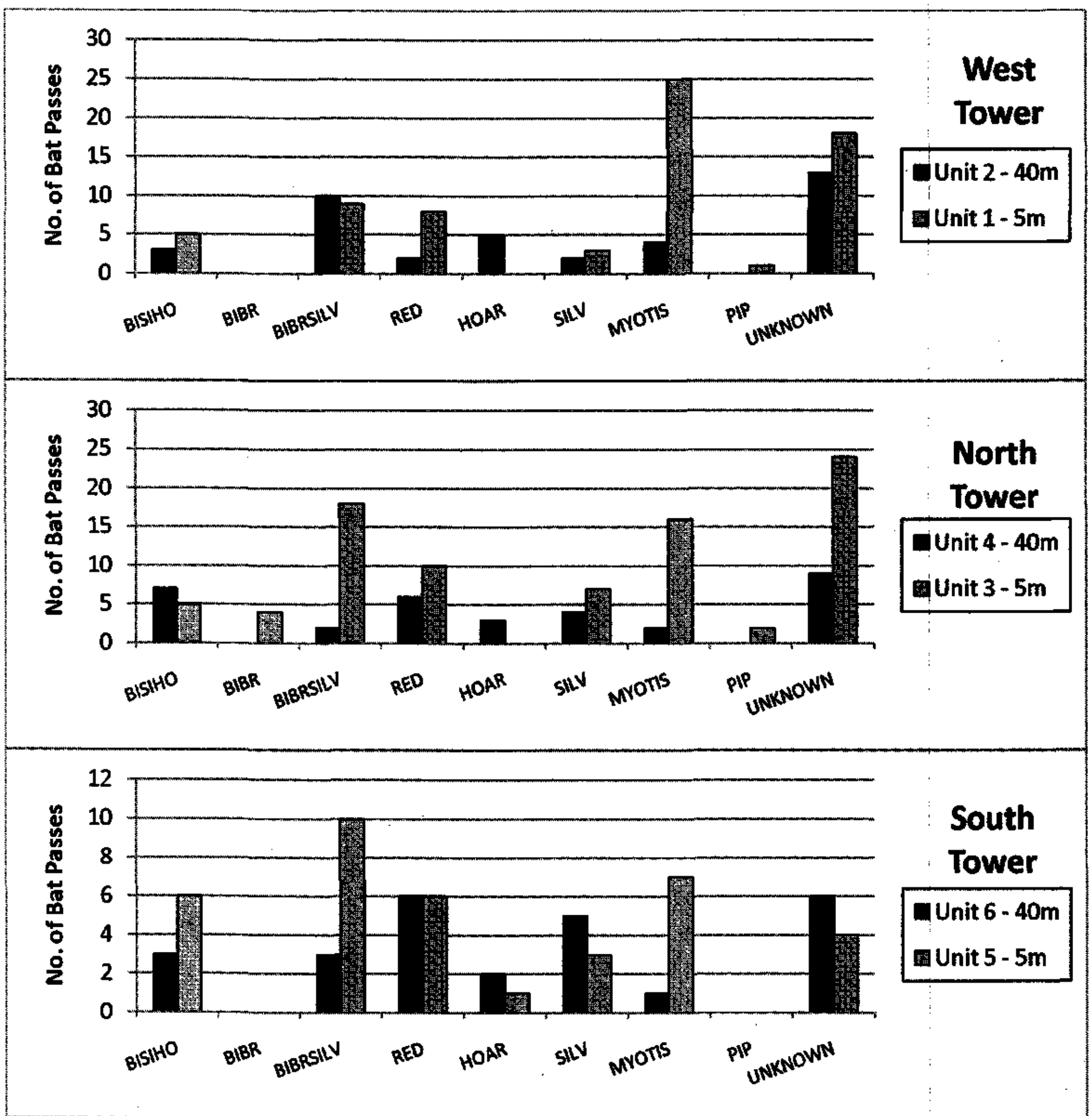

Figure 5. Comparison of species composition and activity between the 5 meter and 40 meter heights for each individual tower.

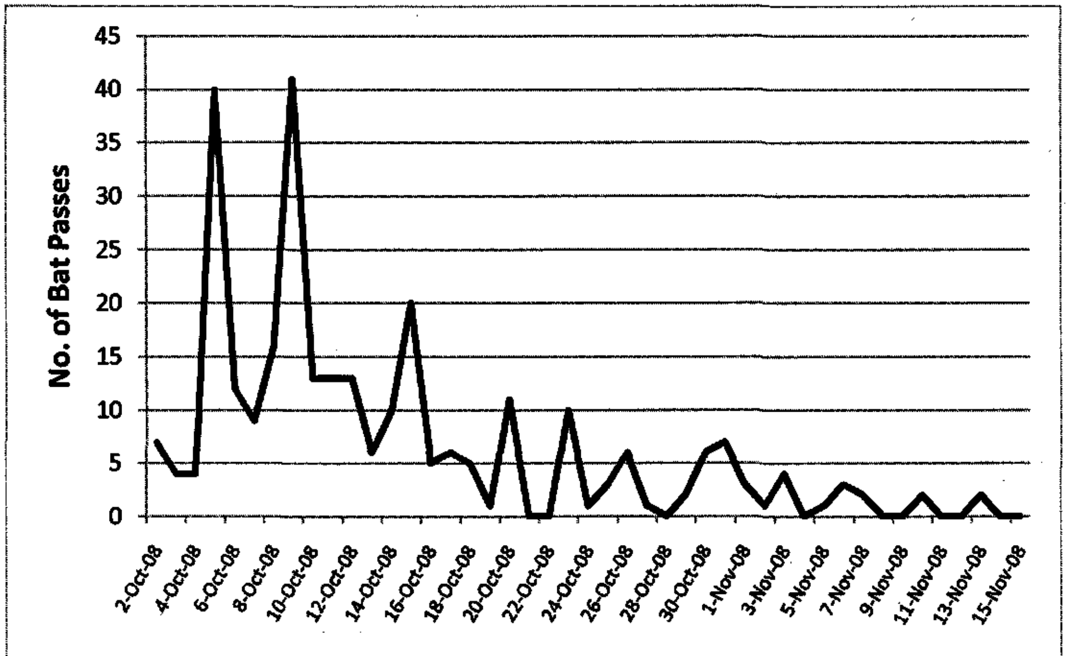

Figure 6. Combined nightly total of bat passes from the six Anabat units.

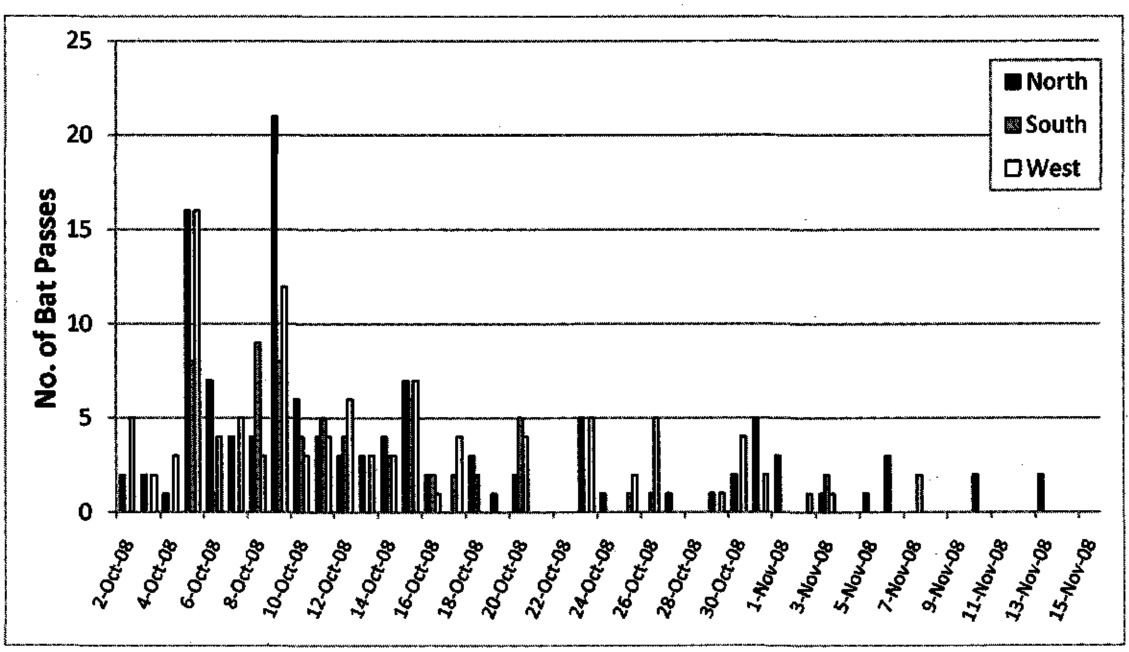

Figure 7. Comparison of nightly bat passes between 5 meter and 40 meter heights.

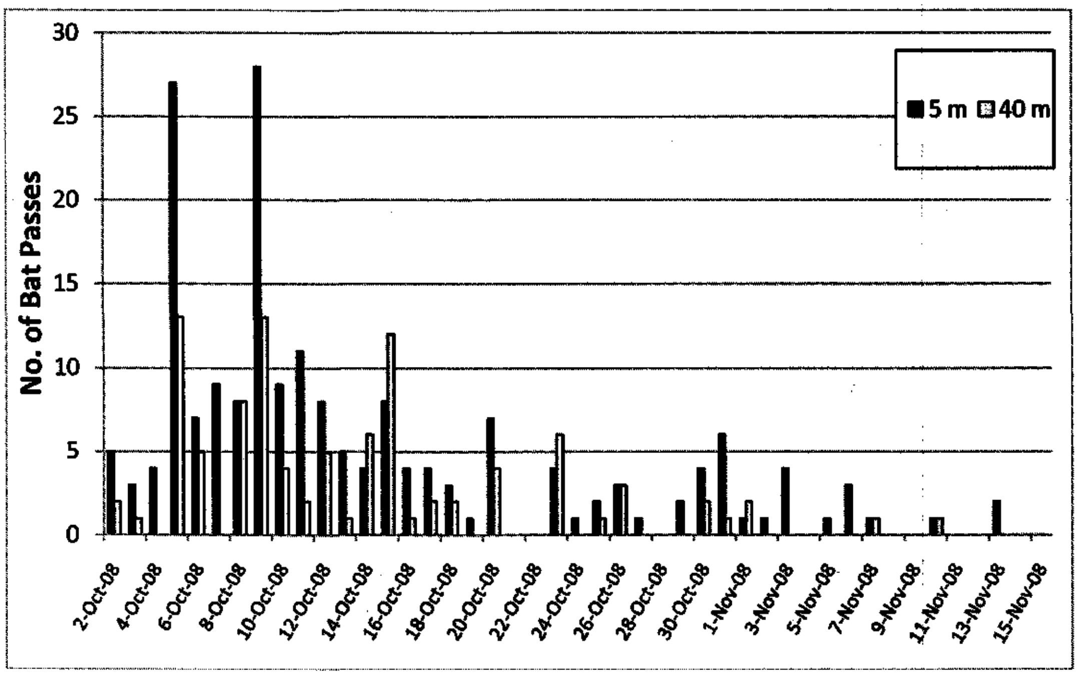

Figure 8. Comparison of nightly bat passes between 5 meter and 40 meter heights.

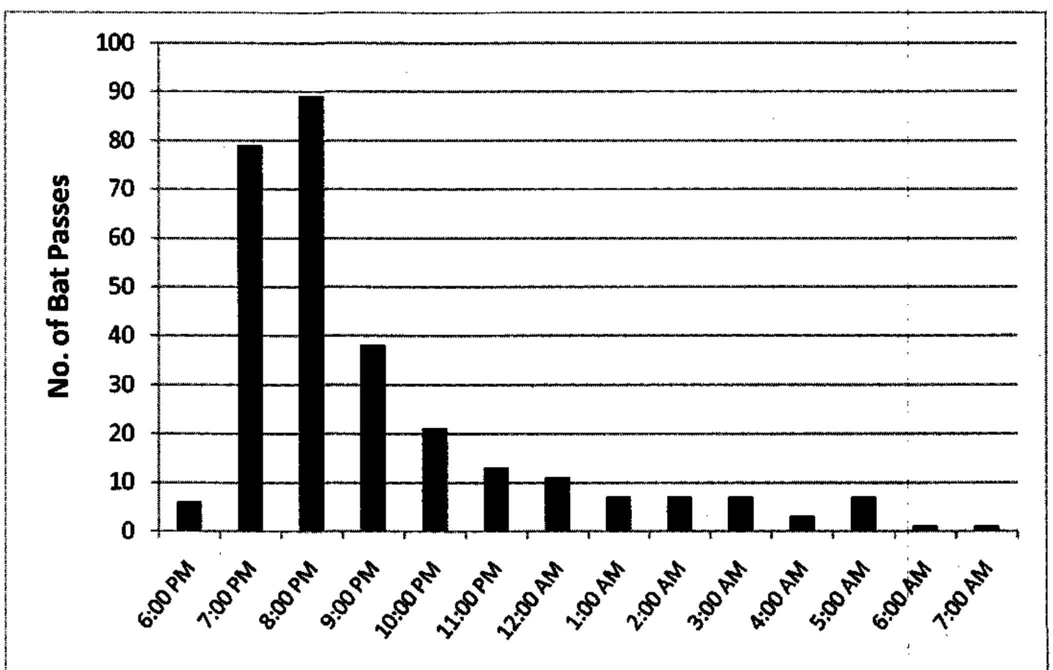

Figure 9. Combined hourly total of bat passes from the six Anabat units.

DISCUSSION

Anabat acoustical monitoring during the fall 2008 season was performed to document baseline bat activity in the project area of the proposed Black Fork Wind Farm in Crawford County, Ohio. Species (or described by species group) that were detected in this study consisted of species that potentially occur in the project area based on existing distributional records.

Bat activity did not appear to be distinct among the tower locations, yet the height at which passes were recorded did demonstrate a difference in the levels of activity. Activity appeared to be higher at 5 meters than 40 meters at least at two tower locations. Activity at 5 meters was distinguished by myotis, red, and big brown/silver-haired bats. Hoary bats demonstrated more activity at 40 meters compared to 5 meters. These results are somewhat congruent with previous studies demonstrating high frequency bats (myotis and red bats) having higher activity at decreased heights while low frequency bats (hoary and big brown bats) having higher activity at increased heights (Arnett et al. 2006; Arnett et al. 2007). The only exception found in the present study compared to previous studies is that the activity of big brown and silver-haired bats was found to be higher at decreased heights. Yet, the finding that hoary bat activity was higher at 40 meters corresponds to the suggestion that migratory bats tend to fly at increased heights due to increased mortalities with increasing turbine height (Barclay et al. 2007) and that the majority of fatality estimates consisted of migratory species especially hoary bats (Kunz et al. 2007). Thus, it is important to maintain a monitoring program at both low and high heights to adequately document bat activity in the area.

The primary species detected in this study (from most to least abundant) were myotis species, big brown bats (*Eptesicus fuscus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and eastern pipistrelles (*Perimyotis subflavus*). Based on distributional records, four species of myotis potentially occur in the project area; eastern small-footed myotis (*Myotis leibii*), little brown bat (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*), and Indiana bat (*Myotis sodalis*). All of these myotis species tend to prefer forests and at forest edge, but can be found foraging near water sources and occasionally open areas. The distribution of these species in the project area will depend on the distribution of forested areas as well as water sources. Of these species, little brown bats and northern long-eared myotis have been reported among fatality studies (Arnett et al. 2008).

Big brown bats have resulted in the least numbers among reported fatalities. Big brown bats are non-migratory and found in variety of habitats with known occurrences in many man-made structures. The distribution of big brown bats in the project area will depend on their nightly feeding and drinking activity near adjacent water sources. Silver-haired bats have been reported frequently among fatality incidences at wind farm locations. These migratory species generally inhabit forested areas but are known to forage in open meadows and along watercourses. Taking these habitat characteristics into account, roosting locations may not occur in the project area due to a lack of forested tracts but foraging sites may occur along riparian areas. Eastern red bats also prefer forested areas and water sources. They have been reported as the second most affected by wind turbines due to past fatality reports. Hoary bats are the species most reported in fatalities from wind energy facilities. Forested areas would be important habitat especially those found along riparian areas in the proximity of the project area. Only three passes were recorded for the eastern pipistrelle bat, yet this species can be more abundant in the project area where forests, forest edges, and water sources are located since they are most active in these areas. Eastern pipistrelles are the third most often reported among fatality reports.

The decreasing yet sporadic number of passes recorded during the monitoring period of early October to mid-November is indicative of migratory activity occurring across the project site. Yet, the overall rates of bat activity detected reveal relatively low activity. The monitoring results demonstrate that on average about 1 bat pass could be detected during the night (Table 3A) and less than 1 bat pass could be detected during an hour (Table 3B), yet hourly data could be misleading due to the number of hours later in the night in which bats become less active. Which is apparent based on the hourly activity of bats recorded from the present study that is generally consistent with other studies in which bats are more active at the beginning hours of the night (Arnett et al. 2006; Arnett et al. 2007; Fielder 2005). Nevertheless, information to make a projection of expected post-construction bat activity and/or mortality is lacking. To date, a thorough study has not been completed to demonstrate the correlative nature between pre-construction acoustic bat pass rates and post-construction mortality rates. Given these results, post-construction monitoring is necessary to ascertain whether or not the proposed wind farm will have an effect on bat species residing in and migrating through the project area especially considering the presence of the federally endangered Indiana bat.

CONCLUSION

Bat use during the 2008 fall migration period appears to be low for the project area. Bat activity as determined by this acoustic monitoring survey suggests that activity within this seasonal migration period is by migratory and non-migratory species when recording was performed at heights of both 5 and 40 meters. Activity appears to generally be high in early October and decrease towards the middle of November with some peak nights of activity. Post-construction monitoring should be performed to fully assess whether or not an impact on bats (especially sensitive species, i.e. Indiana bat) is present by the proposed wind farm.

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B Black Fork Mist-netting Survey Report - 2009

002741.BF08.06_CHI1308

Bat Mist-Netting Survey Report for Black Fork Wind, LLC Crawford and Richland Counties, Ohio

October 2009

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Table of Contents

List of Tables

Table **Page**

List of Figures

List of Abbreviations and Acronyms

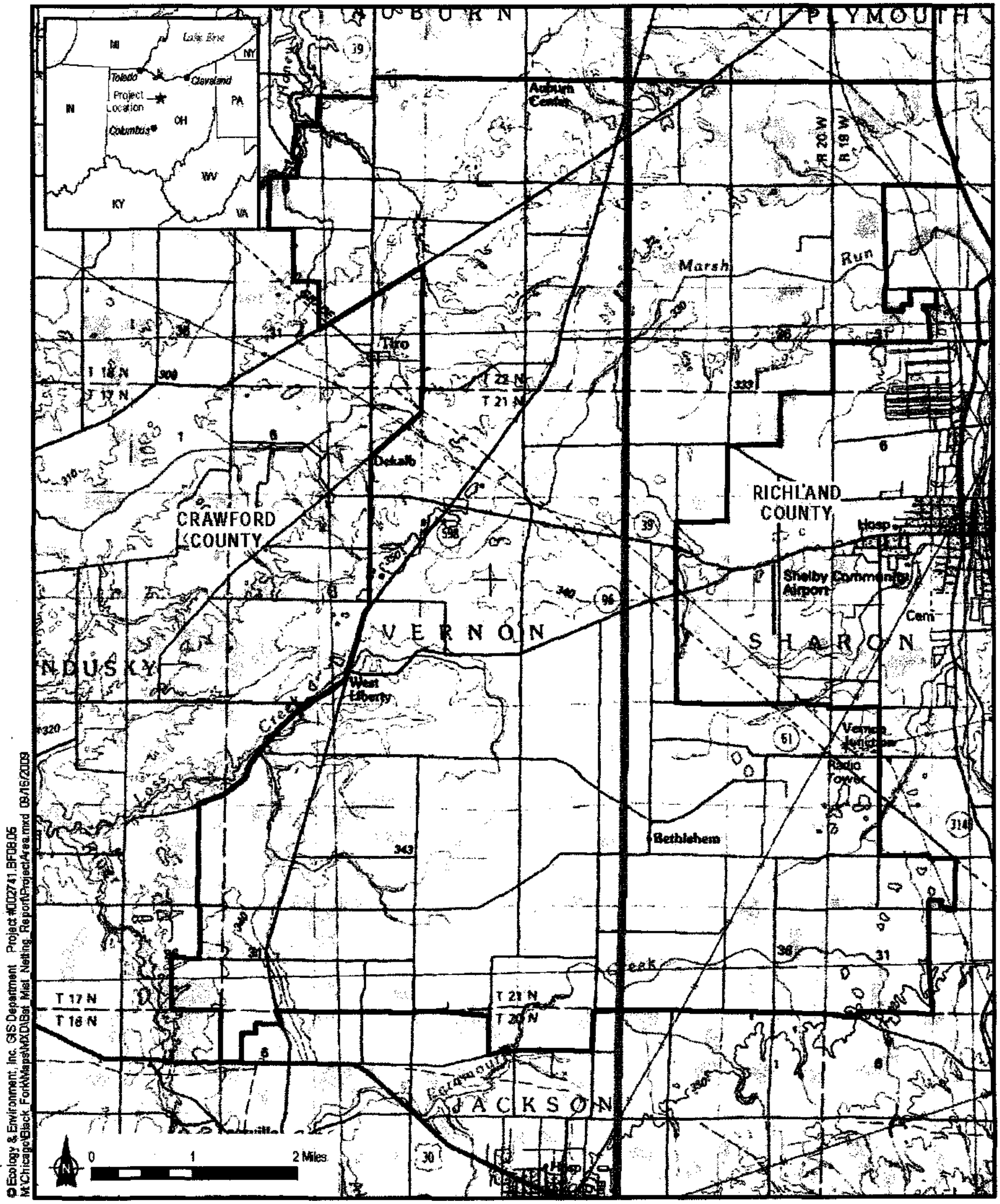
Black Fork	Black Fork Wind, LLC
E & E	Ecology and Environment, Inc.
GIS	Geographic Information System
ha	hectares
km	kilometers
m/s	meters per second
MCP	minimum convex polygon
MW	megawatt
ODNR	Ohio Department of Natural Resources
Project	Black Fork Wind Project
USFWS	U.S. Fish and Wildlife Service
WNS	White Nose Syndrome

1 Introduction

Ecology and Environment, Inc., (E & E) conducted bat mist-netting surveys in June and July 2009 for Black Fork Wind, LLC (Black Fork) at the Black Fork Wind Project (Project) in Crawford and Richland counties, Ohio (Figure 1-1). The Project involves the development of a 201.6-megawatt (MW) wind energy facility using 112, 1.8-MW Vestas V100 commercial wind turbines. While Black Fork anticipates utilizing Vestas V100 turbines, different turbines may be selected due to equipment availability. The Project area covers over 29,000 acres, with most of the land used for agriculture, mainly crop production.

Bat mortality at wind energy facilities is a potential issue that raises concern. Bat fatalities at wind facilities received little attention until 2003 when 1,400–4,000 bats were estimated to have been killed at the Mountaineer Wind Energy Center in West Virginia (Kerns and Kerlinger 2004). Documentation indicating bat fatalities at numerous other facilities is continuing to increase; however, at this time there has been no reported mortality of Indiana bats (*Myotis sodalis*) or any other endangered bat species (Kunz et al. 2007; Arnett et al. 2008). Limited post-construction monitoring has provided the scant information available on bat fatalities at wind farms. Pre-construction surveys at wind facilities have been routinely conducted and most commonly employ mist-nets and acoustic detectors to assess local bat species' presence and activity.

Due to concerns about the impact of wind energy development on birds and bats, the Ohio Department of Natural Resources (ODNR) coordinated with the U.S. Fish and Wildlife Service (USFWS) to develop pre-construction survey guidelines, which are outlined in the 2009 "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio." The scope and intensity for bat surveys is based upon a three-tiered approach for these studies, where ODNR may recommend minimum, moderate, or extensive studies based on variables such as location, habitat quality, and overlapping range of threatened/endangered species. The objective of the pre-construction survey is to document species' presence/absence, diversity, and relative abundance, which will be used to assess potential impacts of the proposed wind project on bats (ODNR 2009).



Proposed Project Area (08-14-09)

County Boundary

Figure 1-1
Project Area Location
Black Fork Wind Project
Crawford and Richland Counties, Ohio

Source: ESRI 2008; USGS 1981-83.

Based upon the May 20, 2009 consultation between E & E, Black Fork, ODNR, and the USFWS, it was recommended that Black Fork conduct a moderate-level survey that would include bat mist-netting. The moderate-level survey requirements were recommended based on the amount of contiguous forest in the Project area and Indiana bat records in Richland County. More specifically, this study was conducted to determine species composition and activity levels of bats in the Project area, and to determine the presence/absence of state threatened Rafinesque's big-eared bats (*Corynorhinus rafinesquii*), eastern small-footed Myotis (*Myotis leibii*), and the federally endangered Indiana bat (*Myotis sodalis*). Rafinesque's big-eared bat and the eastern small-footed Myotis have each only been recorded once within the state of Ohio (ODNR 2009), but the Indiana bat has been documented in 21 counties including Richland County, and there are known winter hibernacula in Preble and Hocking counties (USFWS 2007).

Indiana bats typically spend the summer along streams and rivers, raising their young under the peeling bark of trees in maternity colonies of 50 to 100 individuals. During the winter, they hibernate in caves and abandoned mines until spring when they return to their summer roosting locations. In the summer they forage for insects in the treetops along riparian forests and floodplains, as well as in upland forests and low open areas. The bats return year after year to their roosting and hibernating sites, and normally do not utilize houses or other man-made structures. In Ohio, only two caves are listed as winter hibernacula for Indiana bat populations and both are in the southern part of the state. A Priority 2 cave (>1,000 and <10,000 bats) is located in Preble County and a Priority 4 cave (<50 bats) is listed in Hocking County.

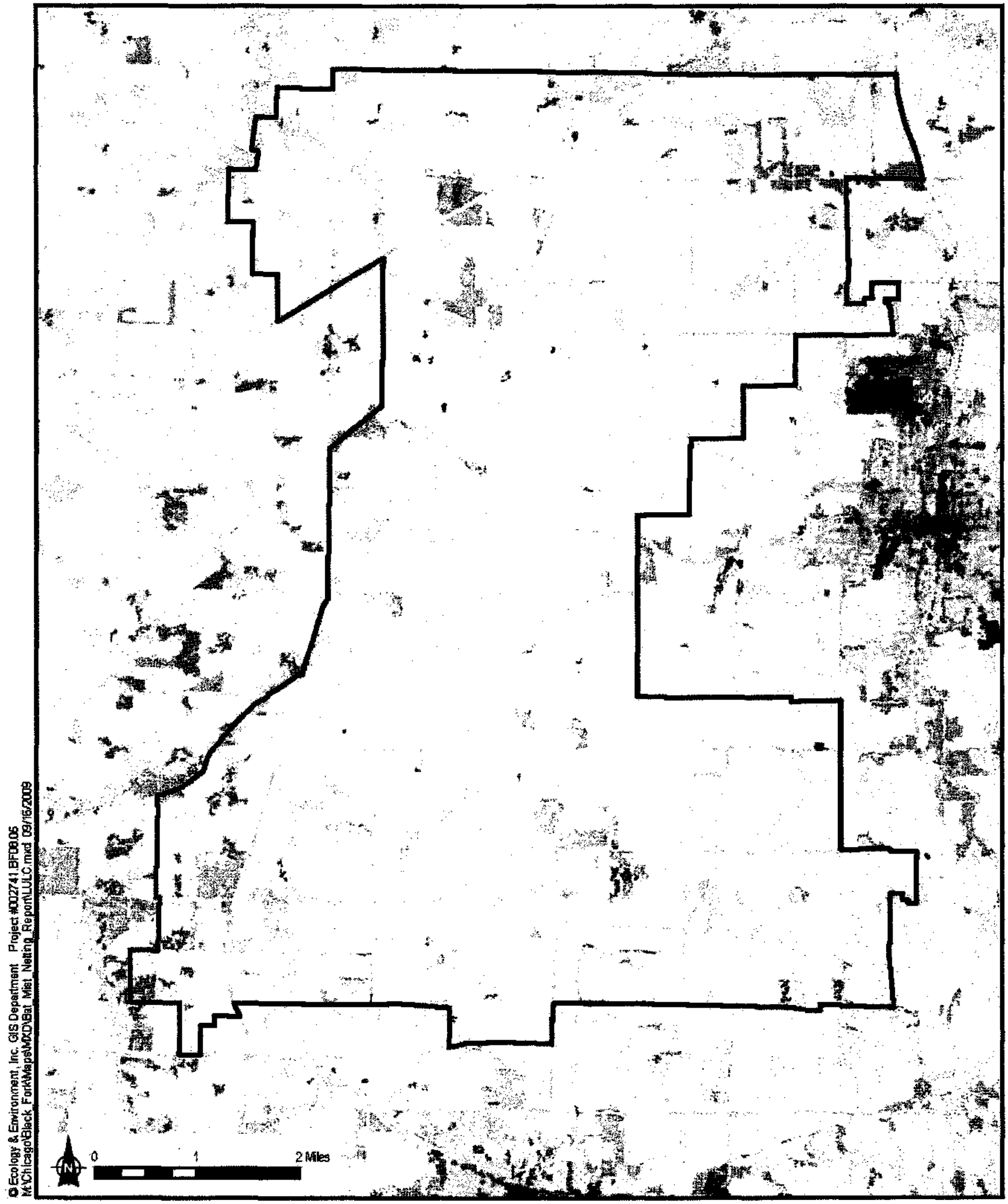
The current threats to Indiana bats in winter are disturbances during hibernation and cave degradation, and threats during the summer months include habitat modification in riparian and upland forests, loss of suitable roosting trees, pesticides, and pollution.

2 Project Habitat

The Project area is located on private land and consists of agricultural fields, pasturelands, forest blocks, and riparian corridors (Figure 2-1). Approximately 7% of the land use is rural residential/developed. The primary land cover within the Project area is agricultural fields (82%) used for grain cultivation (e.g., corn, soybeans, and wheat). There are also small amounts (3%) of the Project area allocated to cattle grazing and idle farm lands or "old fields." Plants, excluding cultivated species, observed in the agricultural fields include common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), creeping thyme (*Thymus serpyllum*), common burdock (*Arctium minus*), shepherd's-purse (*Capsella bursa-pastoris*), dandelion (*Taraxacum officinale*), lambsquarters (*Chenopodium album*), and common cocklebur (*Xanthium strumarium*).

Forested habitat represents 8% of the Project area and is composed mainly of deciduous upland forest blocks and forested riparian areas. The dominant tree species are American beech (*Fagus grandifolia*), American basswood (*Tilia americana*), sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), and white oak (*Quercus alba*). The presence of Ohio buckeye (*Aesculus glabra*) and basswood is considered an indicator of the mixed mesophytic forest type (Bailey 1995). More specifically, the forested plant communities within the Project area are defined as American Beech-Sugar Maple Glaciated Midwest Forest, and Bulrush- and Maple-Ash-Elm Swamp Forest (Faber-Langendoen 2001).

Water resources within the Project area consist of perennial and intermittent streams, drainage ditches, and small ponds. Several tributaries to the Sandusky River are within the Project boundary and include the headwaters of the Sandusky River, Loss Creek, and Paramour Creek in the south and Broken Sword Creek and Honey Creek in the north. An unnamed tributary to Marsh Run flows northeast from the central portion of the Project area as part of the Huron River Watershed. The forested riparian areas associated with these streams could potentially provide summer habitat for Indiana bats.



Proposed Project Area (08-14-09)

Land Use and Classifications

- Barren Land (Rock/Sand/Clay)
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grassland/Herbaceous
- Mixed Forest
- Open Water
- Pasture/Hay
- Shrub/Scrub
- Woody Wetlands

Source: ESRI 2009, USGS NCLD 2001.

Figure 2-1
Land Use/Land Cover
Black Fork Wind Project
Crawford and Richland Counties, Ohio

3 Survey Methods

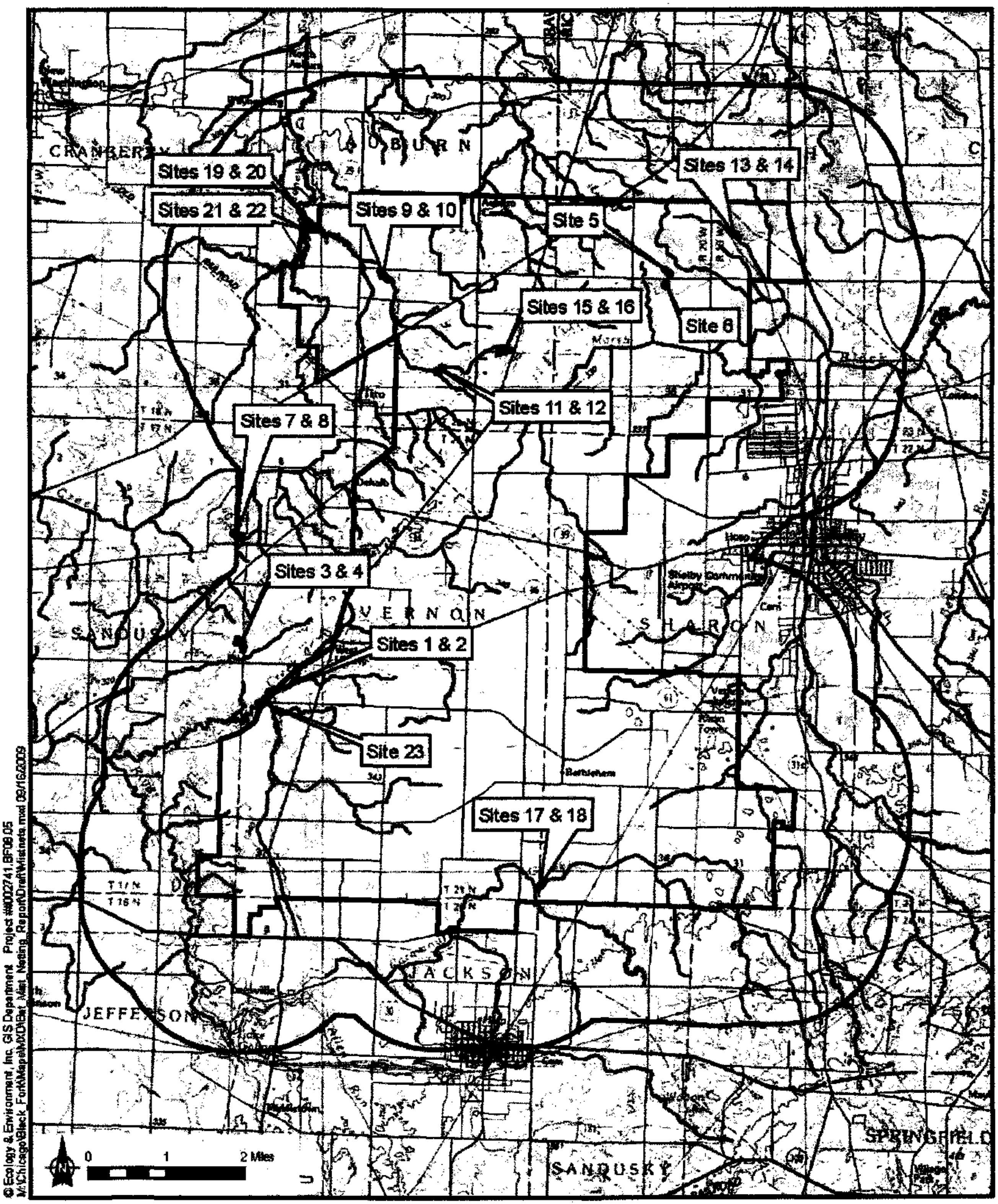
The bat survey protocol and survey locations were developed through consultation with USFWS and ODNR. E & E biologists utilized mist-nets and acoustic monitoring to document species' presence/absence and to characterize diversity and relative bat abundance within the Bat Survey Area. The Bat Survey Area is defined as the Project area plus a 1.5-mile buffer around the perimeter of the Project. Extending our survey efforts beyond the project boundary allowed us to sample areas with a high potential for bat habitat including the riparian areas to the west of the project boundary (see Figure 3-1).

Prior to mist-netting activities, ODNR and USFWS staff reviewed the potential bat habitat within the Project area. Mist-netting locations were selected based on the size and abundance of forested habitat fragments. Forest blocks larger than 50 acres in size were targeted. USFWS and ODNR recommended that 23 netting sites be sampled. The netting sites that were selected were representative of the available bat habitat in the Project area. The locations of the mist-netting sites are presented in Figure 3-1.

3.1 Mist-Netting

Mist-net surveys were conducted in accordance with ODNR (2009) and USFWS (2007) guidelines. Details of the sampling protocol are outlined below.

- The surveys were conducted between June 15 and July 20. Per ODNR and USFWS protocols, surveys should be conducted between June 15 and July 31.
- For forest blocks greater than 100 acres, a minimum of two net sites were required. For forested areas between 50 and 100 acres in size, a minimum of one net site was required. Based on the size and distribution of forested blocks within the Project area, 23 net sites were required.
- Each net site consisted of four nets with at least one "high" net (approximately 7.5 meters tall). At least two nets at each site were spaced a minimum of 30 meters apart. Each net site was sampled for two non-consecutive nights.



- Mist-Net Survey Locations
- Streams
- 1.5 Mile Buffer
- Proposed Project Area (08-14-09)

Figure 3-1
Bat Survey Area and Mist-Netting Locations
Black Fork Wind Project
Crawford and Richland Counties, Ohio

Source: ESRI 2008, USGS 1981-83.

- Nets were placed in potential flight corridors (e.g., streams, road cuts, forested areas), perpendicular to the corridor, covering as much of the corridor as possible.
- The surveys began at sunset (approximately 9:00 pm) and lasted for at least 5 hours.
- Surveys were conducted in weather conditions that satisfied the recommended USFWS guidelines and were characterized by air temperatures above 10° C, little to no precipitation, and low wind conditions (< 2 meters per second [m/s] at the net site).
- The number of bats captured and associated individual data (species, measurements, etc.) was recorded (see below).

E & E bat biologists, approved and permitted by USFWS (Permit #TE212427-0) and ODNR (Permit #10-201), conducted the mist-netting surveys.

Survey effort for bat mist-netting was recorded as the number of net nights. A net night is defined as one net location surveyed for one night (sunset to 5 hours after sunset). Nets were checked at least once every 10 minutes. Captured bats were identified to species. Sex, age (Anthony 1988), and reproductive status (Racey 1988) were noted. Measurements including mass, forearm length, ear length, and tragus length were also recorded. Photos were taken of at least one individual from each species captured at each site. Due to the similarity in physical appearance between little brown bats (*Myotis lucifugus*) and Indiana bats (*Myotis sodalis*), all individuals identified as those species were photographed, focusing on key characteristics including the head, tragus, calcar, and feet. To identify recaptures during the sampling night, a small black mark was applied to the forearm of each bat with a marker.

USFWS recommends in the Indiana bat (*Myotis sodalis*) Draft Recovery Plan: First Revision (2007) that genetic testing, through the collection of fecal (or guano) samples, be performed for suspected Indiana bats. Because of the similarity in physical features between the Indiana bat and little brown bats, a sampling plan was devised to collect guano samples from captured bats from both species. As a result, guano samples were collected from five bats that were initially suspected to be Indiana bats, and also from four bats identified as little brown bats. This sampling methodology provided control for the field observations. The samples were placed in glass vials and sent to the genetics laboratory of Dr. Jan Zinck (The Conservation Genetics Laboratory, Department of Biology, Portland State University, Portland, OR) for confirmation of species identification (USFWS 2007). To reduce bias, the samples were sent blind, i.e., there was no indication of our preliminary identification sent with the samples.

Due to concerns over White Nose Syndrome (WNS), equipment such as bags that held bats, nets, and all surfaces (measuring equipment, gloves, etc.) that came in contact with a bat were decontaminated following USFWS protocols (USFWS 2009).

3.2 Radio Telemetry

Radio telemetry was recommended to calculate home range, define site use, and identify maternity colonies of target bat species (ODNR 2009). When target species were captured, a 0.3-gram radio transmitter (Advanced Telemetry Systems, Model A2414) was attached between the bat's shoulder blades using surgical glue (Torbot bonding cement) after trimming a small patch of fur to expose the skin. Attempts were made to triangulate locations during the active period of the life of the transmitter. Yagi three-element directional antennas attached to radio receivers (Communication Specialist, Model R-2000) were used to detect and record the bearing of the strongest signal using a magnetic compass. Coordinates of the observer's location and bearing (compass degrees) were recorded simultaneously by two bat biologists every five minutes. These data were entered into an Excel spreadsheet and imported into telemetry analysis software (LOAS, Ecological Software Solutions LLC).

Bearings were corrected for true north (7° W) and bearing intersections were calculated using the best biangulation method in the program LOAS (Ecological Software Solutions LLC). The estimated locations from all nights were combined into a single-point layer and imported into a geographic information system (GIS). The fixed kernel density estimator in Hawth's GIS Analysis Tools extension (Beyer 2004) was used to estimate home range. Parameters were set as follows: scaling factor = 1,000,000, smoothing factor (h) = 500, and cell size = 10 meters (m). These parameters were used to produce 95%, 75%, and 50% volume contours. In addition, a 100% minimum convex polygon (MCP) was calculated.

3.3 Acoustic Monitoring

Anabat SD1 detectors were used in conjunction with the net surveys and placed in forest interior flyways and edges adjacent to mist-net sites to provide additional information on bat activity near the survey sites. Acoustic monitoring provides a general idea of bat activity, but the technology cannot discriminate distinct individuals or precisely determine species composition (ODNR 2009). Anabat detectors recorded activity from sunset until netting activities ceased (5 hours later). The detectors recorded the time and frequency of bat echolocation calls in proximity to the detectors. The calls were recorded onto a data card and then analyzed using computer software.

Analook DOS version 4.9j was used to view, sort, and filter bat call data. Call files that were fragmented or of poor quality were filtered out using filter parameters adapted from Britzke and Murray (2000). Call files that contained at least five pulses were identified as bat passes and classified into species groups based on frequency and slope characteristics calculated in Analook. Although sometimes it is possible to distinguish species from characters in the calls, factors such as intraspecific variation and variation within a call sequence make reliable identification difficult (Murray et al. 2001). To minimize problems with misidentification, calls were sorted into three groups: low-frequency bats, mid-frequency bats, and *Myotis* species.

Low-frequency bats include big brown bats (*Eptesicus fuscus*), hoary bats (*Lasiurus cinereus*), and silver-haired bats (*Lasionycteris noctivagans*). Mid-frequency bats could possibly include eastern red bats (*Lasiurus borealis*), evening bats (*Nycticeius humeralis*), and tri-colored bats (*Perimyotis subflavus*). The *Myotis* species group may include Indiana bats (*Myotis sodalis*), little brown bats (*Myotis lucifugus*), northern Myotis (*Myotis septentrionalis*), and eastern small-footed Myotis (*Myotis leibii*).

The number of detector nights was recorded as a measurement of survey effort. A detector night is defined as one detector set to record for one night (sunset to 5 hours after sunset). An attempt was made to survey each site with at least one detector night. When additional detectors were available, they were set up at biased locations to obtain additional call data. Based on instrument availability, some sites were sampled with as many as three detector nights.

4 Results and Discussion

4.1 Mist-Netting

Twenty-three mist-netting sites were sampled from June 15 through 18, June 23 through 30, and July 7 through 19, 2009. The survey effort and a list of dates on which each site was surveyed are presented in Table 4-1. Representative habitat photos of the sites are presented in Appendix A.

Five species of bats were captured over the survey period with a total of 293 individual bats caught during the 184-net night effort. The five species captured include the big brown bat, eastern red bat, hoary bat, northern Myotis, and little brown bat. Species capture data for each site is presented in Table 4-2 and the associated sex, age, and measurement information for each individual bat captured is presented in Appendix B. All representative bat photos were copied to a CD available at the end of this report.

Table 4-1 2009 Presence / Absence Study: Survey Effort by Site at the Black Fork Wind Project

Site ID	Date(s) Surveyed	No. Net Nights	No. Detector Nights
1	June 15, 28	8	1
2	June 28, July 16	8	3
3	June 16, 23	8	2
4	June 16, 23	8	1
5	June 17, July 11	8	2
6	June 17, July 11	8	1
7	June 18, 27	8	2
8	June 18, 27	8	1
9	June 24, 30	8	1
10	June 24, 30	8	1
11	June 26, July 7	8	1
12	June 26, July 7	8	1
13	June 29, July 10	8	2
14	June 29, July 10	8	1
15	July 8, 14	8	2
16	July 8, 14	8	1
17	July 9, 12	8	2
18	July 9, 12	8	1

Table 4-1 2009 Presence / Absence Study: Survey Effort by Site at the Black Fork Wind Project

Site ID	Date(s) Surveyed	No. Net Nights	No. Detector Nights
19	July 13, 17	8	2
20	July 13, 17	8	2
21	July 15, 18	8	2
22	July 15, 18	8	2
23	July 16, 19	8	3
Total		**184**	**37**

Table 4-2 Bat Capture Summary at the Black Fork Wind Project

Site	Big Brown Bat	Eastern Red Bat	Hoary Bat	Little Brown Bat	Northern Myotis	Total Captured
1	2	-	-	1	6	**9**
2	3	-	-	4	5	**12**
3	6	-	-	3	7	**16**
4	-	-	-	1	5	**6**
5	11	-	-	2	10	**23**
6	17	-	-	4	3	**24**
7	-	-	-	-	8	**8**
8	-	-	-	1	4	**5**
9	-	1	-	-	4	**5**
10	17	1	-	-	4	**22**
11	22	4	-	2	4	**32**
12	11	2	-	-	1	**14**
13	7	2	-	-	3	**12**
14	2	-	-	1	1	**4**
15	13	2	-	1	10	**26**
16	1	-	-	-	8	**9**
17	6	-	-	1	2	**9**
18	4	3	-	1	-	**8**
19	5	1	-	-	5	**11**
20	3	3	-	3	6	**15**
21	2	4	-	1	2	**9**
22	1	-	2	1	3	**7**
23	1	-	-	4	2	**7**
Total	**134**	**23**	**2**	**31**	**103**	**293**

Note: These numbers do not include recaptures.

Big brown bats and northern Myotis were the most commonly captured bats and represent 81% of the total number of bats captured during the survey. Northern Myotis were captured at 22 of the 23 mist-net sites (96%), and big brown bats were captured at 19 sites (83%). Little brown bats were captured at 16 (70%) sites and eastern red bats were captured at 10 (43%) sites. Only two hoary bats were captured and both were male juveniles caught in the same net at approximately the same time (within 11 minutes of each other).

Site 11 had the most captures with 32 individuals. A large percentage of these captures (15 individuals, 47%) were lactating female big brown bats. The considerable number of lactating females captured at this location suggests that there may be a maternity colony of big brown bats within or in proximity to this site.

Five male bats belonging to the *Myotis* genus were captured and initially suspected to be Indiana bats based on external morphological characteristics including the presence of a keel on the calcar, fur attributes, and a lack of dense, long toe hairs extending past the claws. However, DNA test results from the guano samples for these five bats identified them as little brown bats (see Appendix C). To provide additional quality control for the guano analysis, four samples were collected from captured bats identified as little brown bats. The DNA test results confirmed the identification of these bats as little brown bats.

Juvenile bats were not captured until July 11, and were then captured every night through the end of the survey. Juveniles were captured from all species encountered during the survey, with the exception of eastern red bat. Although no juvenile eastern red bats were captured, adult females that were captured during the survey were lactating. These findings suggest that there are breeding populations of big brown bats, little brown bats, northern Myotis, hoary bats, and eastern red bats within the Bat Survey Area.

Adult sex ratios were male-dominated for the eastern red bat and little brown bats, but were female-dominated for big brown bats and northern Myotis (Table 4-3). The sex ratio for little brown bats is roughly 7:1 male-dominated, which may suggest the presence of little brown bat bachelor colonies in the area.

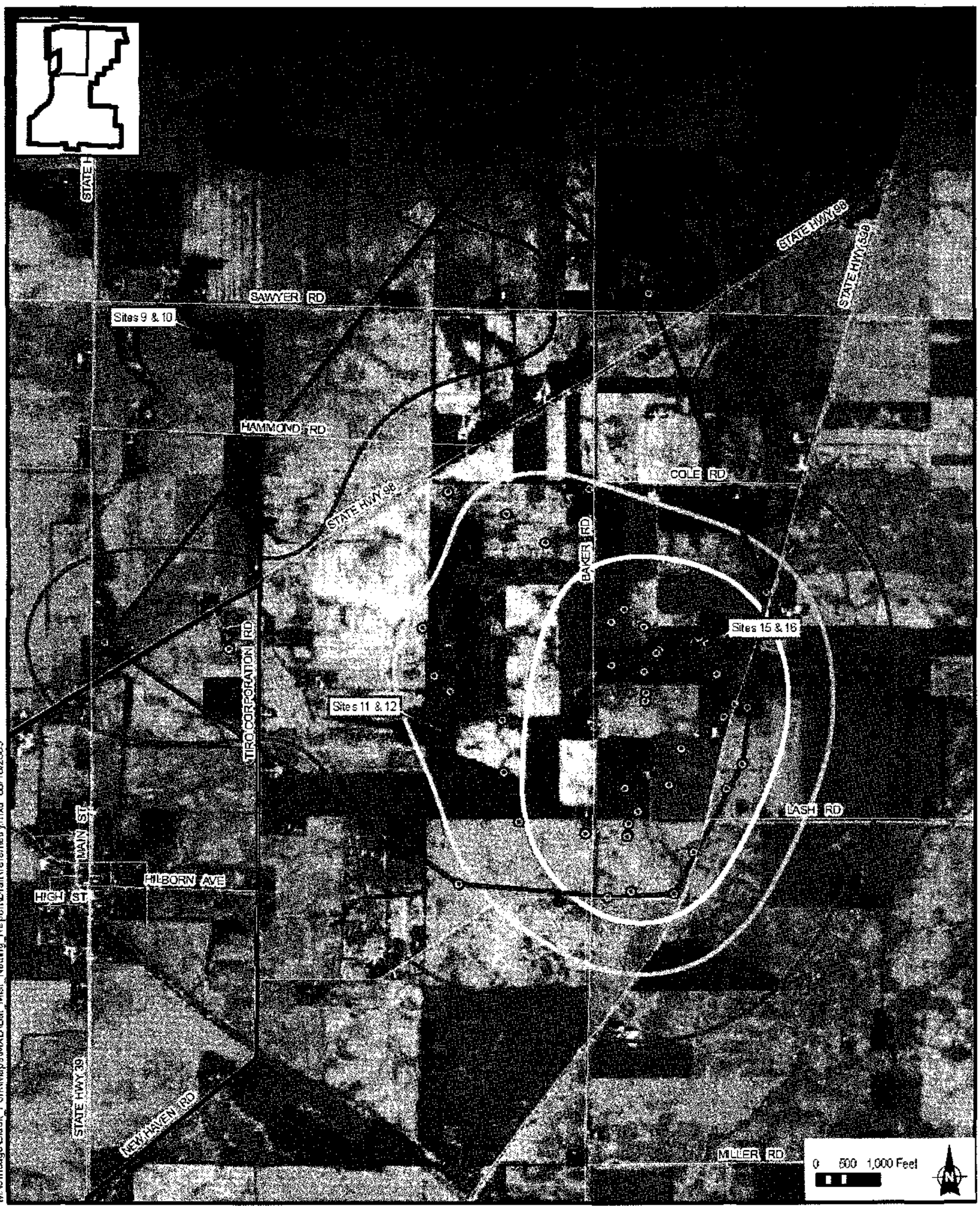
Table 4-3 Sex and Age Summary for Bats Captured at Black Fork Wind Project

Species	Adult		Juvenile	
	Female	Male	Female	Male
Hoary bat	-	-	-	2
Eastern red bat	6	17	-	-
Big brown bat *	64	55	7	7
Little brown bat	3	22	4	2
Northern Myotis	68	20	8	7
Total	**141**	**114**	**19**	**18**

*Sex and age data were not collected for one of the captured big brown bats.

4.2 Radio Telemetry

An adult male little brown bat that was preliminarily identified as an Indiana bat was radio-tagged and tracked for three nights during its nightly foraging activities. The three nights of telemetry data resulted in 47 estimated locations (Figure 4-1). The farthest estimated location was 3.5 kilometers (km) north of the machine shed where the bat was presumed to roost during the day. The area of the MCP was 685.7 hectares (ha) with an E/W dimension of approximately 3.1 km and an N/S dimension of approximately 3.5 km. The 95%, 75%, and 50% volume contours had areas of 957.3 ha, 392.8 ha, and 178.7 ha, respectively. While the 95% vol-



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Capture Location
Roost Location
Telemetry Locations
Mist-Net Survey Locations
Minimum Convex Polygon
Project Area

Kernel Home Ranges
50%
75%
95%

Figure 4-1
Capture, Roost, and Telemetry Locations for a Radio-tagged Little Brown Bat Captured in the Survey Area
Black Fork Wind Project
Crawford and Richland Counties, Ohio
Source: ESRI 2008, E & E 2009

ume contour gives a good approximation of all areas visited by the bat during the tracking period, the 75% and 50% contours are more indicative of core use areas.

Figure 4-1 shows the two large forest blocks this little brown bat was using extensively. These blocks include the forested area in which it was captured (Site 11) and the forested area at which it was observed roosting on the morning of July 11, 2009 (Sites 15 and 16). The nightly activity of this bat is summarized below.

On the night of July 8, 2009, the bat was observed roosting in a machine shed west of a barn at the junction of New Haven Road and Baker Road. At 9:35 pm, the bat left its roost, foraged around the barn for several minutes, and remained active until July 9, 2009, 12:35 am, at which time it roosted in the machine shed for the remainder of the night.

On July 9, 2009 the bat was observed roosting in the machine shed and emerged at 9:35 pm to forage. Telemetry data suggest the bat was primarily using locations on and around the forested areas of Sites 11 and 12. After midnight, the bat had moved to the forested area of Sites 15 and 16 with multiple locations observed in the field south of Sites 15 and 16 (Figure 4-1). On the morning of July 10, 2009 at 1:45 am, the bat roosted in the machine shed.

On July 10, 2009 at 9:35 pm, the bat emerged from the machine shed and foraged until July 11, 12:55 am when it likely roosted in the forest block of survey Sites 15 and 16 south of Cole Road, between Baker Road and State Route 598. The presumed roost location was on property adjacent to the Project, in a mature forest stand with many shagbark hickories (*Carya ovata*). At 3:45 am on July 11, the bat was still roosting in the same spot. The transmitter signal was variable in pulse duration, pitch, and signal strength, indicating transmitter failure, and no further locations were estimated.

4.3 Acoustic Monitoring

At Sites 1 through 23, a total of 2,359 bat passes were recorded from 37 detector sampling nights (mean = 63.7 bat passes/detector night). Survey effort for each site is indicated in Table 4-1. There were a total of 1,298 bat passes from the low-frequency group, 182 bat passes from the mid-frequency group, and 879 bat passes from the *Myotis* species group. A summary of the acoustic data is presented in Table 4-4. All acoustic data are provided on a CD that is included at the end of this report.

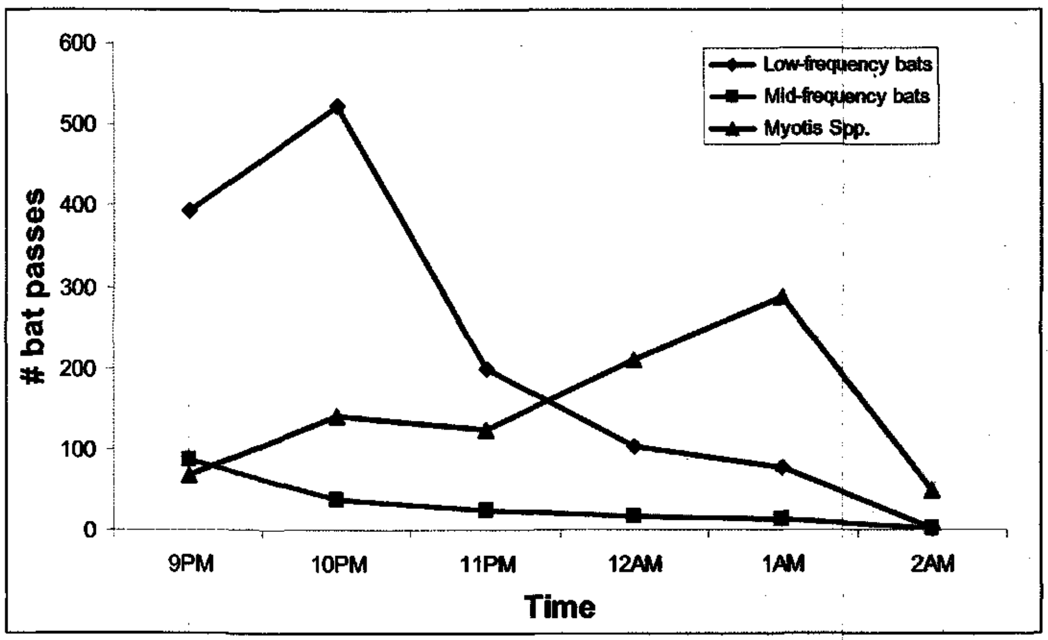
Table 4-4 Summary of Bat Passes Recorded with Anabat Detectors Near Netting Sites at the Black Fork Wind Project

Site	Low-Frequency	Mid-Frequency	*Myotis* Species	Total
1	-	-	6	**6**
2	14	-	30	**44**
3	76	-	74	**150**
4	6	-	3	**9**
5	283	15	27	**325**

Table 4-4 Summary of Bat Passes Recorded with Anabat Detectors Near Netting Sites at the Black Fork Wind Project

Site	Low-Frequency	Mid-Frequency	*Myotis* Species	Total
6	7	-	3	**10**
7	25	21	8	**54**
8	50	37	167	**254**
9	1	1	2	**4**
10	1	-	-	**1**
11	15	4	7	**26**
12	49	5	69	**123**
13	313	7	202	**522**
14	-	-	10	**10**
15	41	13	19	**73**
16	185	31	12	**228**
17	62	6	9	**77**
18	26	2	6	**34**
19	45	24	14	**83**
20	16	7	29	**52**
21	62	5	30	**97**
22	6	3	35	**44**
23	15	1	117	**133**
Total	**1,298**	**182**	**879**	**2,359**

Figure 4-2 shows the hourly breakdown for the total number of bat passes by species group. Most of the low-frequency bat passes were recorded between 9:00 pm and 11:00 pm, whereas activity for *Myotis* species bats did not peak until after midnight. Mid-frequency bats were not as prevalent as the other groups, and activity levels generally decreased within an hour after sunset.



Note: These data reflect combined bat passes from all sites.

Figure 4-2 Hourly Summary of Bat Passes Near Netting Sites at the Black Fork Wind Project

5 Conclusions

Twenty-three sites were surveyed for bat species' presence/absence using mist-netting at the Black Fork Wind Project in Crawford and Richland counties, Ohio. Surveys were conducted between June 15 and July 20, 2009 in representative forest habitats throughout the Project area. Survey sites were selected by E & E bat biologists based on the recommendations of the USFWS and ODNR during site visits. All survey protocols followed USFWS and ODNR guidance.

A total of 293 bats were captured and identified to species. Five species were represented including big brown bats, eastern red bats, hoary bats, northern Myotis, and little brown bats. Big brown bats and northern Myotis were the most commonly captured species, totaling 134 and 103 individuals, respectively. DNA analysis of guano samples was used to confirm the species identification for nine bats captured during the mist-netting survey. All nine of these samples were identified as little brown bats. No federally endangered or state listed bats were captured during this survey.

Anabat SD1 detectors were used during the mist-netting survey to provide supplemental information regarding bat activity in the Project area. Bat call sequences were identified to species group (low-frequency, mid-frequency, and Myotis) as suggested by ODNR. A total of 2,359 bat passes were recorded. Bat activity averaged 63.7 bat passes per detector night. Low-frequency and mid-frequency bat activity was highest during the 2 hours after sunset, whereas *Myotis* species activity did not peak until after midnight.

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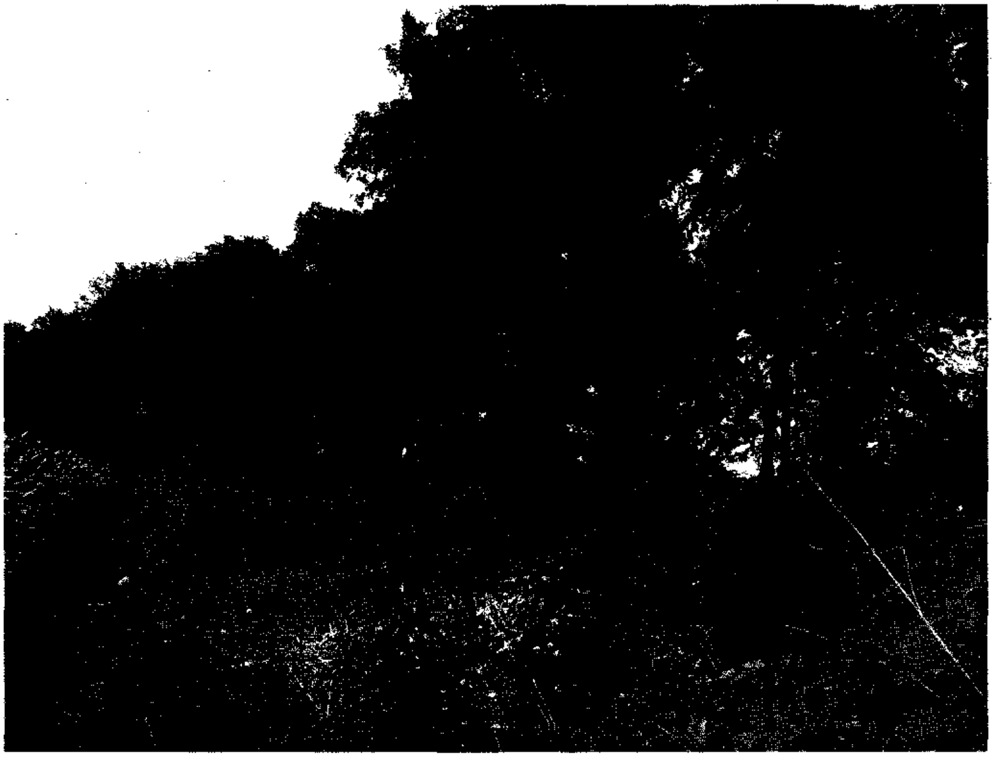
A Sampling Area Habitat Photos

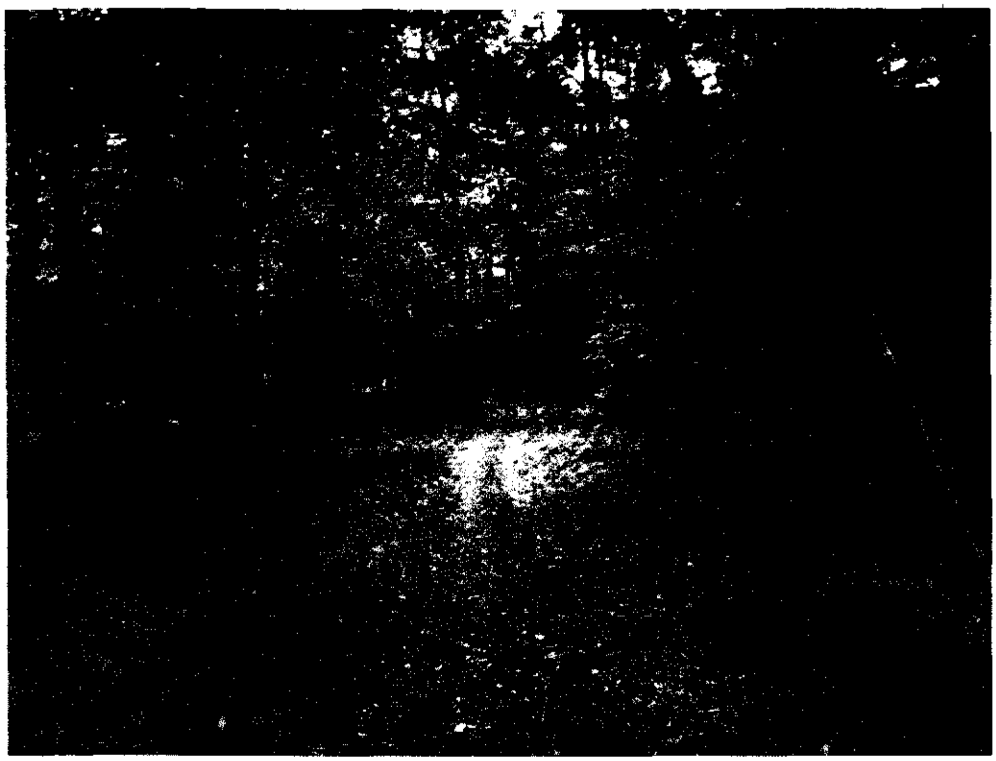
Habitat Photo 1: Typical perennial stream in a forested area. Photo was taken from Site 19 looking northeast.

Habitat Photo 2: Typical seasonal stream in a forested area. Photo taken from Site 11 looking east towards capture location of the radio-tagged little brown bat.



Habitat Photo 3: Typical narrow forested riparian corridor between crops. Photo was taken from Site 18 looking east.

Habitat Photo 4: Typical mixed stand forest with open understory. Photo was taken from Site 12 looking southwest.



Habitat Photo 5: Typical mixed stand forest with heavy understory growth. Photo was taken from Site 16 looking east.

Habitat Photo 6: Typical wetland in a forested area. Photo was taken looking east from Site 3.

B Capture Data for Each Site

Bat capture data for the Black Fork Wind Project. Sex: **(F)** Female; **(M)** Male. Age: **(A)** Adult; **(J)** Juvenile. Repro: **(L)** Lactating; **(NR)** Not reproductive; **(P)** Pregnant; **(PL)** Post-Lactating; **(S)** Scrotal. Mass was measured in grams. All length measurements were recorded in millimeters.

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
6/15/2009	1	*Myotis septentrionalis*	Northern Myotis	F	A	P	6.5	36	8.5	15.5
6/15/2009	1	*Myotis septentrionalis*	Northern Myotis	F	A	P	10	37	8	17
6/15/2009	1	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	35.5	6.5	14
6/15/2009	1	*Myotis septentrionalis*	Northern Myotis	F	A	P	6	36	6.5	14
6/15/2009	1	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.75	45.8	4.5	11
6/15/2009	1	*Myotis lucifugus*	Little brown bat	M	A	NR	7	38.5	3.5	10
6/16/2009	3	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5.5	34	6	14.5
6/16/2009	3	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	37	6.4	14
6/16/2009	3	*Myotis septentrionalis*	Northern Myotis	F	A	P	7.5	37	6	12.5
6/16/2009	3	*Eptesicus fuscus*	Big brown bat	M	A	NR	24	47	6	13
6/16/2009	3	*Myotis lucifugus*	Little brown bat	M	A	NR	8	39	5	11
6/16/2009	3	*Eptesicus fuscus*	Big brown bat	F	A	L	24	45	4	15.5
6/16/2009	3	*Eptesicus fuscus*	Big brown bat	M	A	NR	21	46	4	13.5
6/16/2009	3	*Eptesicus fuscus*	Big brown bat	M	A	NR	18.5	46	5	14.5
6/16/2009	4	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5	34	7	12.5
6/16/2009	4	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	34	5.5	12.5
6/17/2009	5	*Eptesicus fuscus*	Big brown bat	F	A	L	15.5	46	5.6	13
6/17/2009	5	*Eptesicus fuscus*	Big brown bat	M	A	NR	15.5	45	6.5	12
6/17/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	P	8	34	6	12.8
6/17/2009	5	*Eptesicus fuscus*	Big brown bat	F	A	L	22	46.3	4.7	14.9
6/17/2009	5	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	47	5.3	10.9
6/17/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	L	17.5	48	4	11.5
6/17/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	24	45	4.5	11
6/17/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	15.5	45.5	5	14
6/17/2009	6	*Myotis septentrionalis*	Northern Myotis	M	A	P	11.5	33	6.5	14
6/17/2009	6	*Myotis lucifugus*	Little brown bat	M	A	NR	9	38	5	11
6/17/2009	6	*Myotis septentrionalis*	Northern Myotis	F	A	P	8	37	8	16
6/17/2009	6	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	37	4.5	13

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
6/17/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	44	5	13
6/18/2009	7	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5.5	34.2	5.5	11.2
6/18/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	34	7	12
6/18/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	P	10	36.5	7	15
6/18/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	36	7.5	16.5
6/18/2009	8	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	32.6	6	12.8
6/18/2009	8	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	36	6	13
6/18/2009	8	*Myotis septentrionalis*	Northern Myotis	F	A	P	9	35.5	6	14
6/18/2009	8	*Myotis lucifugus*	Little brown bat	M	A	NR	7	35	4	11
6/23/2009	3	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	49.5	4.6	11.8
6/23/2009	3	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.75	36.3	5.9	14.3
6/23/2009	3	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	37.4	7.3	15.5
6/23/2009	3	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	36	5.9	12.5
6/23/2009	3	*Eptesicus fuscus*	Big brown bat	F	A	L	19.5	46	6.1	10.5
6/23/2009	3	*Myotis septentrionalis*	Northern Myotis	M	A	NR	8	36.5	6.5	14.5
6/23/2009	3	*Myotis lucifugus*	Little brown bat	F	A	L	7.5	35	6	11
6/23/2009	3	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	38	6	11
6/23/2009	4	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	36	5.1	13
6/23/2009	4	*Myotis septentrionalis*	Northern Myotis	M	A	NR	7.5	34.5	4.5	13.5
6/23/2009	4	*Myotis lucifugus*	Little brown bat	M	A	NR	7	37	5	11.5
6/23/2009	4	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	36	7	11
6/24/2009	9	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	36	7	14
6/24/2009	9	*Myotis septentrionalis*	Northern Myotis	F	A	L	8.5	38	8	15
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	17	47.3	5	13.5
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	47.3	6.5	13.9
6/24/2009	10	*Lasiurus borealis*	Eastern red bat	M	A	NR	12.5	39	2.5	9
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	45.5	5	13
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	46	4.5	14
6/24/2009	10	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	36	8	12
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	22	46.5	5	13.5
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	22.5	47	5	12
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	20.2	46	6.5	15

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	20.5	46	5	13
6/24/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	21.5	47.5	6	13
6/24/2009	10	*Eptesicus fuscus*	Big brown bat		A					
6/24/2009	10	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	36	8	13
6/24/2009	10	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6.5	38	5	9
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	15	47	4.8	12.8
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	17.5	47	6.4	13
6/26/2009	11	*Lasiurus borealis*	Eastern red bat	F	A	L	11.25	41.5	4.2	8
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	45.5	5.5	14
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	16.5	48.5	6	13
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	49	6	14.5
6/26/2009	11	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	33.5	7	15.5
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	16	47	7	15
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	19.5	44.8	5.4	12.4
6/26/2009	11	*Lasiurus borealis*	Eastern red bat	F	A	L	12	37.5	5	9.5
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	19.5	47	5.5	10
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	42.5	5.5	14.5
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	16.5	43.5	5.2	11.6
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	17.5	46	7.5	14.5
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	17.5	44.5	7	14
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	19	48.5	5	10.5
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	22	47	6	13
6/26/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	20	45	4.5	13
6/26/2009	11	*Myotis septentrionalis*	Northern Myotis	F	A	NR	7	38	8	14.6
6/26/2009	11	*Myotis lucifugus*	Little brown bat	M	A	NR	7	35	4	9.5
6/26/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	15	46	7.2	12.8
6/26/2009	12	*Eptesicus fuscus*	Big brown bat	M	A	NR	15.5	47	5.1	11.1
6/26/2009	12	*Eptesicus fuscus*	Big brown bat	M	A	NR	17.5	47	5.8	14
6/26/2009	12	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	45	6	14
6/26/2009	12	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35	7	14
6/27/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.75	36.6	7.2	18.2
6/27/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	34.5	6	12.5

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
6/27/2009	7	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6.75	36.5	5	14.2
6/27/2009	7	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	37.3	5.8	13
6/27/2009	8	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	35.5	8.5	14
6/28/2009	1	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	46	5	
6/28/2009	1	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	37	8	
6/28/2009	1	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35	5.5	
6/28/2009	2	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	35	7.5	13
6/28/2009	2	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	36.5	5	11
6/29/2009	13	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6.5	34	5	13.5
6/29/2009	13	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	32	6.5	14.5
6/29/2009	13	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	45.5	6.5	14
6/29/2009	13	*Lasiurus borealis*	Eastern red bat	M	A	NR	10.5	38.5	4.5	9
6/29/2009	13	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	50	5.2	12.5
6/29/2009	13	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	45.5	5	12.5
6/29/2009	13	*Lasiurus borealis*	Eastern red bat	M	A	NR	11	41	3.3	9
6/29/2009	14	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	36	6.5	13
6/29/2009	14	*Eptesicus fuscus*	Big brown bat	F	A	L	20	48	7.5	14.5
6/30/2009	9	*Lasiurus borealis*	Eastern red bat	F	A	L	12	39.5	4	9
6/30/2009	9	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35	6.5	13
6/30/2009	9	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	37.5	8.5	14
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	21.5	48	4	14
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	21.5	50	6	14.5
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	20.5	46.5	5	14
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	21	48	5.5	12.5
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L				
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	F	A	L	20.5	47	8	13
6/30/2009	10	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	49	6.5	14
6/30/2009	10	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35.5	6.5	14.5
7/7/2009	11	*Lasiurus borealis*	Eastern red bat	M	A	NR	13.5	37.5	4	8
7/7/2009	11	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	35.5	8.5	13.5
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	48	7	12
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	17	43.5	5	14

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	17	46.5	5.5	14
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	15.5	45.5	5	13
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	F	A	L	17.5	48.5	5	13.5
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	48.5	5.5	15
7/7/2009	11	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	47.5	5.5	12.5
7/7/2009	11	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	39	6	13
7/7/2009	11	*Myotis septentrionalis*	Northern Myotis	F	A	NR	6.5	37	7	14
7/7/2009	11	*Lasiurus borealis*	Eastern red bat	M	A	NR	12.5	42	4.5	8
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	16	44.5	5.5	13.5
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	18	47	6.5	13
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	M	A	NR	15	47.5	6.5	13.5
7/7/2009	12	*Lasiurus borealis*	Eastern red bat	M	A	NR	13.5	38.5	4.5	8.5
7/7/2009	12	*Lasiurus borealis*	Eastern red bat	M	A	NR	12	40	3	7
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	M	A	NR	15	44.5	4.5	12.5
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	19	44.5	6	15
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	18	47	7	15
7/7/2009	12	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	46	5.5	13.5
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	16	46.5	7	13
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	M	A	NR	14	46	5	13
7/8/2009	15	*Lasiurus borealis*	Eastern red bat	F	A	L	12	43	4	10
7/8/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A	L	6	36	7	14.5
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	M	A	NR	15	43.5	6	12
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	18	46	5.5	14
7/8/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	35	7.5	14.5
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	19	45	6	13.5
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	48.5	6	13
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	M	A	NR				
7/8/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	19	48.5	6.5	15
7/8/2009	15	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	33.5	6.5	13
7/8/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	35	6	15
7/8/2009	15	*Myotis lucifugus*	Little brown bat	M	A	NR	8	38.5	5	12.5
7/8/2009	15	*Lasiurus borealis*	Eastern red bat	M	A	NR	10	40.5	4	9

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/8/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A		9	38	5.5	14
7/8/2009	16	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	35	8.5	15
7/8/2009	16	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	35	7.5	16
7/8/2009	16	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5	35	6	13
7/8/2009	16	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	37	6	15
7/8/2009	16	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35	6.5	14
7/9/2009	17	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	46	5	12
7/9/2009	17	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	45.5	5	14
7/9/2009	17	*Myotis septentrionalis*	Northern Myotis	F	A		6	34	9	15
7/9/2009	17	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	35.5	8	14.5
7/9/2009	17	*Myotis lucifugus*	Little brown bat	M	A	NR	8	37	5	12
7/9/2009	18	*Eptesicus fuscus*	Big brown bat	F	A	PL	19	49	5	13
7/9/2009	18	*Lasiurus borealis*	Eastern red bat	M	A	NR	12	48	4	10
7/10/2009	13	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	43.5	5	10.5
7/10/2009	13	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5.5	35.5	6.5	14
7/10/2009	13	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	46.5	6.5	14
7/10/2009	13	*Eptesicus fuscus*	Big brown bat	F	A		19	44.5	5	11
7/10/2009	13	*Eptesicus fuscus*	Big brown bat	F	A	L	18.5	45	5.5	13.5
7/10/2009	14	*Eptesicus fuscus*	Big brown bat	F	A	L	16.5	48.5	5.5	13
7/10/2009	14	*Myotis lucifugus*	Little brown bat	M	A	NR	7	38	6	10
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	36	7.5	15
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	38	7	13.5
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	J	NR	6	36	8	14.5
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	M	J	NR	5.5	36	6.5	13
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	PL	6.5	34	8	15
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	M	A	NR	17.5	43	6	13
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	M	A	NR	18.5	45	6	15
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	45	5.5	14
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	F	A	L	19.5	46.5	5.5	13
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	M	J	NR	13.5	46	5	13.5
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	F	A	L	17	47	7	14
7/11/2009	5	*Myotis lucifugus*	Little brown bat	F	J	NR	7	36	4	14

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	M	J	NR	4.5	34.5	7.5	13.5
7/11/2009	5	*Eptesicus fuscus*	Big brown bat	M	J	NR	15	49	5.5	13.5
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	37.5	6.5	14
7/11/2009	5	*Myotis lucifugus*	Little brown bat	M	J	NR	7	37	5.5	12.5
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	J	NR	5.5	36.5	6.5	15.5
7/11/2009	5	*Myotis septentrionalis*	Northern Myotis	F	A	L	5.5	36.5	6	15.5
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	45	5	12.5
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	15.5	45	7	11
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	PL	18	46	8.5	14
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A		17	43.5	6	13.5
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	45.5	6	12
7/11/2009	6	*Myotis septentrionalis*	Northern Myotis	F	A	PL	8	37	6.5	13.5
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	L	21	50	4	12
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	L	23	44.5	5	11
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	L	15	46	3	13
7/11/2009	6	*Myotis lucifugus*	Little brown bat	F	J	NR	7.5	36.5	4	11
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	J	NR	14	48	7	14
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	J	NR	16	47	4	13.5
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	47.5	5	13
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	L	19	45.5	4	13
7/11/2009	6	*Eptesicus fuscus*	Big brown bat	F	A	PL	16	46.5	6	12
7/11/2009	6	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	39	4	9
7/12/2009	17	*Eptesicus fuscus*	Big brown bat	M	A	NR	20	48	6	11
7/12/2009	17	*Eptesicus fuscus*	Big brown bat	F	J	NR	13	46	6	13
7/12/2009	17	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	45	3	14
7/12/2009	17	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	46	4	10
7/12/2009	18	*Lasiurus borealis*	Eastern red bat	F	A	L	12	42.5	3.5	9
7/12/2009	18	*Eptesicus fuscus*	Big brown bat	F	J	NR	11.5	44	5.5	13.5
7/12/2009	18	*Eptesicus fuscus*	Big brown bat	M	A	S	16	45	5	12.5
7/12/2009	18	*Eptesicus fuscus*	Big brown bat	M	J	NR	11	43.5	6.5	14.5
7/12/2009	18	*Lasiurus borealis*	Eastern red bat	M	A	NR	11	36.5	4	8
7/12/2009	18	*Myotis lucifugus*	Little brown bat	M	A	NR	7.5	38	4.5	11.5

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/13/2009	19	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	3.5	6.5	14
7/13/2009	19	*Eptesicus fuscus*	Big brown bat	F	A	L	7.5	46	5.5	13.5
7/13/2009	19	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	45	6	12
7/13/2009	19	*Eptesicus fuscus*	Big brown bat	M	J	NR	12.5	46	5	13
7/13/2009	19	*Lasiurus borealis*	Eastern red bat	M	A	NR	11	41.5	4	10
7/13/2009	20	*Myotis lucifugus*	Little brown bat	M	A	NR	7	37	5	11.5
7/13/2009	20	*Myotis lucifugus*	Little brown bat	M	A	NR	7	35	5	12
7/13/2009	19	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	36	7	14
7/13/2009	19	*Myotis septentrionalis*	Northern Myotis	M	A	NR	5	36	7	14
7/13/2009	19	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	35.5	6	13
7/13/2009	20	*Myotis septentrionalis*	Northern Myotis	F	A	L	6	37	7	15.5
7/13/2009	20	*Lasiurus borealis*	Eastern red bat	M	A	NR	11	38.5	3.5	8.5
7/13/2009	20	*Eptesicus fuscus*	Big brown bat	M	A	NR	18	50	5	13.5
7/13/2009	20	*Lasiurus borealis*	Eastern red bat	M	A	NR	11.5	42	3.5	9
7/14/2009	15	*Myotis septentrionalis*	Northern Myotis	M	J	NR	6	35	5.5	13
7/14/2009	15	*Eptesicus fuscus*	Big brown bat	F	A	L	16.5	46	7	11.5
7/14/2009	15	*Eptesicus fuscus*	Big brown bat	F	J	NR	13.5	45	6	16
7/14/2009	15	*Eptesicus fuscus*	Big brown bat	M	J	NR	14	47	4.5	13.5
7/14/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	37	7	15.5
7/14/2009	15	*Eptesicus fuscus*	Big brown bat	M	J	NR	14	48.5	5	14.5
7/14/2009	15	*Myotis septentrionalis*	Northern Myotis	F	J	NR	6	35	7.5	13.5
7/14/2009	15	*Eptesicus fuscus*	Big brown bat	M	A	NR	16	46	3.5	13.5
7/14/2009	15	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6.5	35	5.5	12
7/14/2009	15	*Myotis septentrionalis*	Northern Myotis	F	A	L	9	37	7	16
7/14/2009	16	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	37.5	5.5	10.5
7/14/2009	16	*Eptesicus fuscus*	Big brown bat	M	A	NR	14	46.5	5.5	15
7/14/2009	16	*Myotis septentrionalis*	Northern Myotis	F	A	L	8	36.5	8	13.5
7/14/2009	16	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	36.5	8	15
7/15/2009	21	*Lasiurus borealis*	Eastern red bat	M	A	NR	13	42	3.5	8.5
7/15/2009	21	*Eptesicus fuscus*	Big brown bat	M	A	NR	17.5	46.5	5	11
7/15/2009	21	*Eptesicus fuscus*	Big brown bat	F	A	L	23	38.5	4.5	14.5
7/15/2009	21	*Lasiurus borealis*	Eastern red bat	M	A	NR	7.5	39	3	6

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/15/2009	21	*Myotis lucifugus*	Little brown bat	M	J	NR	7	35	6	11
7/15/2009	22	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	37	6.5	13
7/15/2009	22	*Eptesicus fuscus*	Big brown bat	F	A	L	20	48.5	6	12.5
7/15/2009	22	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	35	8	15.5
7/15/2009	22	*Myotis lucifugus*	Little brown bat	M	A	NR	8	37.5	5	11
7/16/2009	2	*Myotis septentrionalis*	Northern Myotis	M	J	NR	5.5	35	6.5	12
7/16/2009	2	*Myotis septentrionalis*	Northern Myotis	F	J	NR	5	33.5	6.5	11.5
7/16/2009	2	*Eptesicus fuscus*	Big brown bat	F	J	NR	15	48	4.5	11.5
7/16/2009	2	*Myotis septentrionalis*	Northern Myotis	M	J	NR	5.5	33	8	13.5
7/16/2009	2	*Myotis lucifugus*	Little brown bat	F	J	NR	7	47	5.5	11.5
7/16/2009	2	*Myotis septentrionalis*	Northern Myotis	M	J	NR	5	33	7	14.5
7/16/2009	2	*Eptesicus fuscus*	Big brown bat	M	A	NR	16.5	44	6	13
7/16/2009	2	*Eptesicus fuscus*	Big brown bat	F	J	NR	16	48	5.5	14
7/16/2009	2	*Myotis lucifugus*	Little brown bat	F	A	PL	8.5	37.5	5.5	12.5
7/16/2009	2	*Myotis lucifugus*	Little brown bat	F	J	NR	7	38	3	9.5
7/16/2009	23	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	37.5	7	11.5
7/16/2009	23	*Myotis septentrionalis*	Northern Myotis	F	J	NR	6.5	37	7.5	16
7/16/2009	23	*Myotis lucifugus*	Little brown bat	F	A	L	9	37	3.5	12.5
7/16/2009	23	*Myotis lucifugus*	Little brown bat	M	A	NR	6.5	37	6.5	14
7/16/2009	23	*Myotis lucifugus*	Little brown bat	M	A	NR	8	36.5	4.5	12
7/17/2009	19	*Eptesicus fuscus*	Big brown bat	F	A	L	18	47	4.5	14
7/17/2009	19	*Eptesicus fuscus*	Big brown bat	M	A	NR	13.5	45.5	4.5	12
7/17/2009	19	*Myotis septentrionalis*	Northern Myotis	F	J	NR	4.5	34	7	14.5
7/17/2009	20	*Myotis septentrionalis*	Northern Myotis	F	A	L	7.5	36	7.5	15
7/17/2009	20	*Eptesicus fuscus*	Big brown bat	M	A	NR	17	46.5	7	16
7/17/2009	20	*Eptesicus fuscus*	Big brown bat	F	A	L	17.5	45.5	4.5	15
7/17/2009	20	*Myotis lucifugus*	Little brown bat	M	A	NR	9	38	5.5	10.5
7/17/2009	20	*Myotis septentrionalis*	Northern Myotis	F	A	L	5.5	37	5	13.5
7/17/2009	20	*Myotis septentrionalis*	Northern Myotis	M	J	NR	5.5	37	5	13.5
7/17/2009	20	*Lasiurus borealis*	Eastern red bat	M	A	NR	10	39	3	8.5
7/17/2009	20	*Myotis septentrionalis*	Northern Myotis	F	J	NR	6	36	7.5	14.5
7/17/2009	20	*Myotis septentrionalis*	Northern Myotis	F	A	L	6.5	38	5	14

Appendix B: Bat Capture Data

Date	Site	Species	Common Name	Sex	Age	Repro	Mass	Arm	Tragus	Ear
7/18/2009	21	*Lasiurus borealis*	Eastern red bat	M	A	NR	10	37	3.5	7
7/18/2009	21	*Myotis septentrionalis*	Northern Myotis	M	A	NR	6	37	5.5	12.5
7/18/2009	21	*Myotis septentrionalis*	Northern Myotis	F	J	NR	6.5	35	6	13
7/18/2009	21	*Lasiurus borealis*	Eastern red bat	F	A	L	11.5	35	6	13
7/18/2009	22	*Lasiurus cinereus*	Hoary bat	M	J	NR	17.5	54	5	11
7/18/2009	22	*Myotis septentrionalis*	Northern Myotis	F	A	L	7	37	7	13
7/18/2009	22	*Lasiurus cinereus*	Hoary bat	M	J	NR	20	56	5	16
7/19/2009	23	*Eptesicus fuscus*	Big brown bat	M	J	NR	13.5	46	5	12
7/19/2009	23	*Myotis lucifugus*	Little brown bat	M	A	NR	6	37.5	6	12

C DNA Test Results

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Genetic species identification was completed for nine guano samples as outlined in Zinck et al., 2004. All nine DNA samples were sequenced with Mysp 1/2 and resulting sequences were compared to my database as well as sequences on Genbank. All sequences matched known (vouchered) *Myotis lucifugus* DNA sequences. As a point of reference, the DNA sequence for this same fragment in *Myotis sodalis* has approximately 12% sequence difference from *Myotis lucifugus* samples, leaving no room for confusion. Please feel free to contact me with any further questions.

Sincerely,

Jan Zinck

Zinck, J M, D A Duffield, P C Ormsbee, 2004. Primers for identification and polymorphism assessment of Vespertilionid bats in the Pacific Northwest. Molecular Ecology Notes (2004) 4, 239–242

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Sincerely,

Jan Zinck

Zinck, J M, D A Duffield, P C Ormsbee, 2004. Primers for identification and polymorphism assessment of Vespertilionid bats in the Pacific Northwest. Molecular Ecology Notes (2004) 4, 239–242

C Site Photographs

Photo C-1: Low microphone example

Photo C-2: High microphone example (uninstalled)

D Anabat Filter Parameters

Appendix D Analook 4.9j Filter Parameters Altered From Default Settings[1]

Parameter	Value	Definition	Filters out:
Smooth	15.0	Sets the maximum distance between two successive points for them to be considered part of the same echolocation pulse.	Echoes, extraneous noise, poor quality pulses
Bodyover	80	Removes echolocation pulse if the number of data points in the body (narrow band component) is less than the set value.	Fragmentary pulses, approach phase pulses, and feeding buzzes
MinDur	1.0	Removes pulses that have a shorter duration than the set value.	Foraging calls (buzzes) and some fragmentary pulses
MinFMin	12.0	Removes pulses with a lower minimum frequency than the set value.	Extraneous noise
MinNCalls[2]	2.0	Removes files that have fewer pulses (N) than the set value.	Fragmentary and poor quality pulses

[1] Adapted from Britzke and Murray 2000.
[2] Parameter value is changed to 5.0 to sort out call files with a minimum of 5 pulses.

E Anabat Detector Results Tables

Table E-1 Summary of 2009-2010 Survey Effort at the Black Fork Wind Energy, LLC project, Crawford and Richland Counties, Ohio

	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI*	4 LO*	5 HI*	5 LO*	Total
Employment Date	3/15/09	3/15/09	4/2/09	3/15/09	3/15/09	3/15/09	5/21/09 & 3/15/10	5/21/09 & 3/15/10	5/21/09 & 3/15/10	5/21/09 & 3/15/10	-
Decommission Date	11/17/09	11/17/09	11/17/09	11/17/09	11/17/09	11/17/09	11/17/09 & 5/20/10	11/17/09 & 5/20/10	11/17/09 & 5/20/10	11/17/09 & 5/20/10	-
Successful Detector Nights											
March	17	17	0	17	17	17	8	16	17	17	**143**
April	30	30	29	30	30	26	1	25	30	11	**242**
May	31	31	31	31	31	19	11	31	30	16	**262**
June	30	30	30	30	30	9	30	30	30	30	**279**
July	31	31	31	31	31	3	31	30	31	11	**261**
August	14	17	16	16	5	3	17	25	17	3	**133**
September	19	28	30	30	17	11	30	7	30	30	**232**
October	31	31	31	31	21	13	27	23	31	31	**270**
November	17	17	17	17	11	5	11	9	17	17	**138**
TOTAL	**220**	**232**	**215**	**233**	**193**	**106**	**166**	**196**	**233**	**166**	**1960**
Percent of Successful Detector Nights (of 248 potential nights)	**88.7%**	**93.5%**	**86.7%**	**94.0%**	**77.8%**	**42.7%**	**66.9%**	**79.0%**	**94.0%**	**66.9%**	**79.0%**

* 2010 sampling period included between March 15 and May 19

Table E-2 Summary of 2009-2010 Bat Passes Recorded and Identified to Species Groups at the Black Fork Wind Energy, LLC project in Crawford and Richland Counties, Ohio

	1 HI	1 LO	2 HI	2 LO	3 HI	3 LO	4 HI	4 LO	5 HI	5 LO	Total
Total bat activity											
Bat Passes Recorded	772	173	814	38	423	233	524	1326	517	670	5,490
Species Groups											
Bat passes identified to low-frequency bats	340	14	403	2	169	19	264	637	245	277	2,370
Bat passes identified to mid-frequency bats	32	23	19	0	6	12	23	90	34	94	333
Bat passes identified to Myotis spp.	18	75	23	16	31	136	16	238	12	134	699
Bat passes identified to species group	390	112	445	18	206	167	303	965	291	505	3,402

N Transportation Study

January 2011

Transportation Study

Black Fork Wind Farm
Crawford and Richland County, Ohio

Prepared for.
Black Fork Wind Energy, LLC
400 Preston Ave, Suite 200
Charlottesville, VA 22901

Submitted by:
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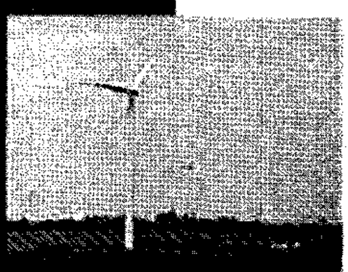
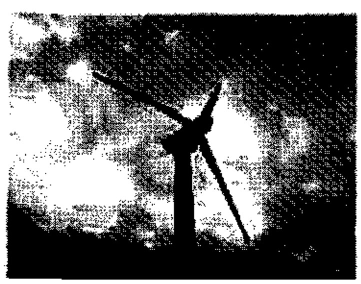
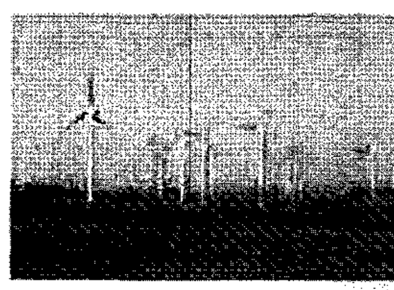

KEM
K.E. McCartney & Associates, Inc.

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TRANSPORTATION STUDY
BLACK FORK WIND PROJECT

TABLE OF CONTENTS

TRANSPORTATION STUDY
BLACK FORK WIND PROJECT

INTRODUCTION

The Black Fork Wind Project is located in Crawford and Richland Counties, Ohio, north of Crestline and west of Shelby. The project includes construction of approximately 91 wind turbines encompassing a 50 square mile area as shown in Figure-1. The construction effort will require the movement of a large number of oversized loads transported over the public roadway system. This report presents the results of a comprehensive inventory of the public roadway system within the project boundaries. The purpose of the report was to identify existing features which would restrict movements of the oversized vehicles and to identify potential impacts to the roadways as a result of the anticipated movements. The maintenance of the public roadway system is subject to the jurisdiction of the Ohio Department of Transportation (state routes), the Crawford and Richland County Engineer (county roads) and the local township trustees (township roads). The movement of oversized vehicles on this roadway system must be approved by the respective jurisdictional authority.

The report was prepared based upon our understanding of the proposed activities and from information provided by Black Fork Wind Energy, LLC regarding transport vehicle weights and configurations. The findings are considered preliminary and can be used as guidelines for further planning for construction of the wind farm. Additional design information may be required prior to the beginning the construction phase of this project.

SCOPE OF SERVICES

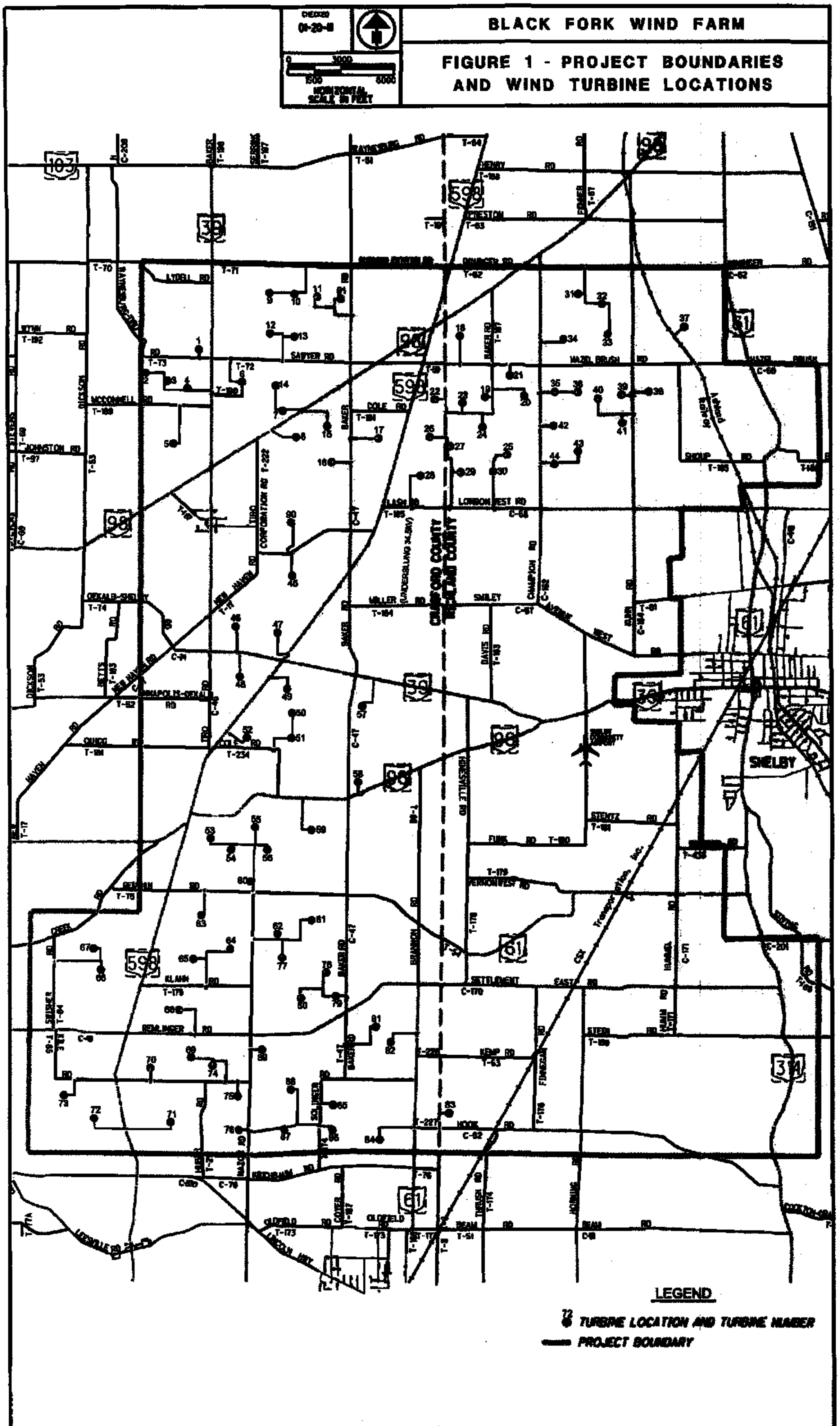
Following is a summary of the items reviewed on the roadway network for construction access to the project:

1. Review roadways for existing geometric conditions which would restrict movement of oversized loads.
2. Review location of existing utilities (aerial and underground) for potential restrictions of oversized loads.
3. Preliminary review of existing stream crossing structures and culverts for potential restrictions of oversized loads. A detailed load rating analysis of the structures was not performed.
4. Preliminary review of existing pavement conditions/buildup. A detailed pavement analysis was not performed.
5. Address concerns/issues regarding roadway infrastructure raised by Crawford and Richland County Engineer's office.
6. Prepare mapping and report with preliminary recommendations for construction access to the project.

The road requirements for wind turbine generator, tower and crane equipment are detailed as part of the "General Requirements, Project Site Infrastructure Layout and Public Roads", provided by Black Fork Wind Energy, LLC and included as Exhibit "A" in this report.

BLACK FORK WIND FARM

FIGURE 1 - PROJECT BOUNDARIES AND WIND TURBINE LOCATIONS



Following is the discussion, analysis and recommendations for each item reviewed:

ROADWAY INVENTORY

1. Existing Geometric Conditions

The entire roadway network within the project boundaries was reviewed for geometric conditions which would restrict movement of oversized loads. Following are geometric condition requirements primarily for turning movements, roadway profile and roadway alignment:

Turning Movements (general requirements)

- Minimum inside radius of 148 ft.
- Minimum roadway width of 23 ft.
- Clear area of additional 49 ft. inside of roadway radius for overhang

The minimum inside radius of 148 ft. was not met on any of the intersecting roads within the project boundaries. The majority of existing intersection radii ranged from 20 to 30 ft. Improvements will be required at any intersection where the routing requires turning movements for the transport vehicles. In addition, Figure 4 identifies utility pole and miscellaneous conflicts at intersections which may restrict transport movement. Improvements needed to meet the minimum radius will include areas outside of the existing roadway right of way. In these instances, work agreements or temporary easements may be required from individual property owners to complete this work.

Roadway Profile

- Maximum allowable gradient of 5%
- Minimum vertical radius of 1640 ft.

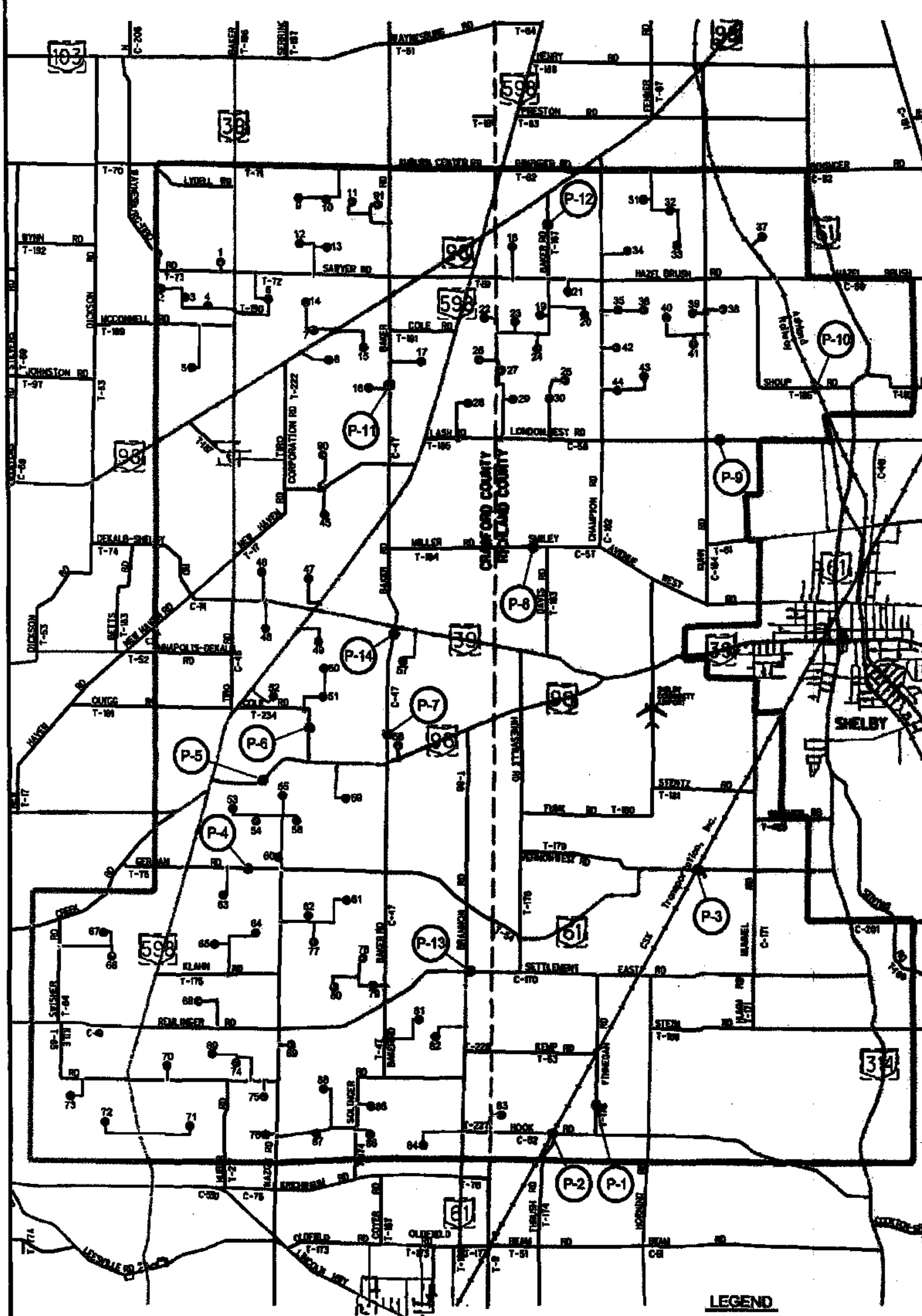
The roadway network within the project boundaries was reviewed for roadway profile. The maximum allowable gradient of 5% was not exceeded on any roadway. The roadway profiles were also reviewed for compliance with the requirement of a minimum vertical radius of 1640 feet. Fourteen locations were identified where the roadway profile did not meet minimum requirements. The locations are shown in Figure 2 – Profile Deficiencies. These locations are isolated areas and can be improved to meet minimum requirements by additional resurfacing on each side of the crest to provide a smooth transition for the transport vehicles. Three locations are railroad crossings, which can be improved to meet requirements by extending the approaches to avoid conflict with the rails. Each location will require a detailed design to ensure the minimum profile requirement is met. After determination of the routing, some of these locations may not be a factor and will not require improvements.

BLACK FORK WIND FARM

FIGURE 2
PROFILE DEFICIENCIES

CHECKED 01-20-11

HORIZONTAL SCALE IN FEET: 0, 1500, 3000, 6000



LEGEND

72 TURBINE LOCATION AND TURBINE NUMBER

• ACCESS POINT

● PROFILE DEFICIENCIES

(P-4) PROFILE DEFICIENCIES NUMBER

CM-151\Exhibit 2-Profile Deficiencies.dgn Sheet 01/21/2011

Roadway Alignment

- Curve of less than 20°

  The entire roadway network within the project boundaries was reviewed for compliance with alignment requirements for transport vehicles. Eight locations were identified where the roadway alignment does not meet minimum requirements for transport vehicles. These locations are shown in Figure 3– Curve Deficiencies. Improvements required range from minor widening to significant widening. After determination of the routing some of these locations may not be a factor and will not require improvements.

2. Existing Utilities

The entire roadway network within the project boundaries were reviewed for potential conflicts with transport vehicles. Utility poles with aerial facilities are located essentially on all of the roadways. The pole lines are located within the roadway right of way and are outside of the 24 foot clear width requirement. However, there are many locations where poles or telephone pedestals encroach on the required 148 foot pavement radius for turning movements at intersections. These locations are identified in Figure 4. Upon determination of routing for the transport vehicles, each location should be reviewed with the utility owner to determine feasibility of mitigation.

Aerial facilities cross the roadway in numerous locations. There is a combination of service lines and distribution lines for the telephone and electric. The "General Requirements" for the project indicate a 20 foot minimum vertical clearance. Many of the service lines to residences do not meet the clearance requirements. Upon determination of routing for the transport vehicles, each location should be reviewed with the utility owner to determine if temporary raising of the line is feasible.

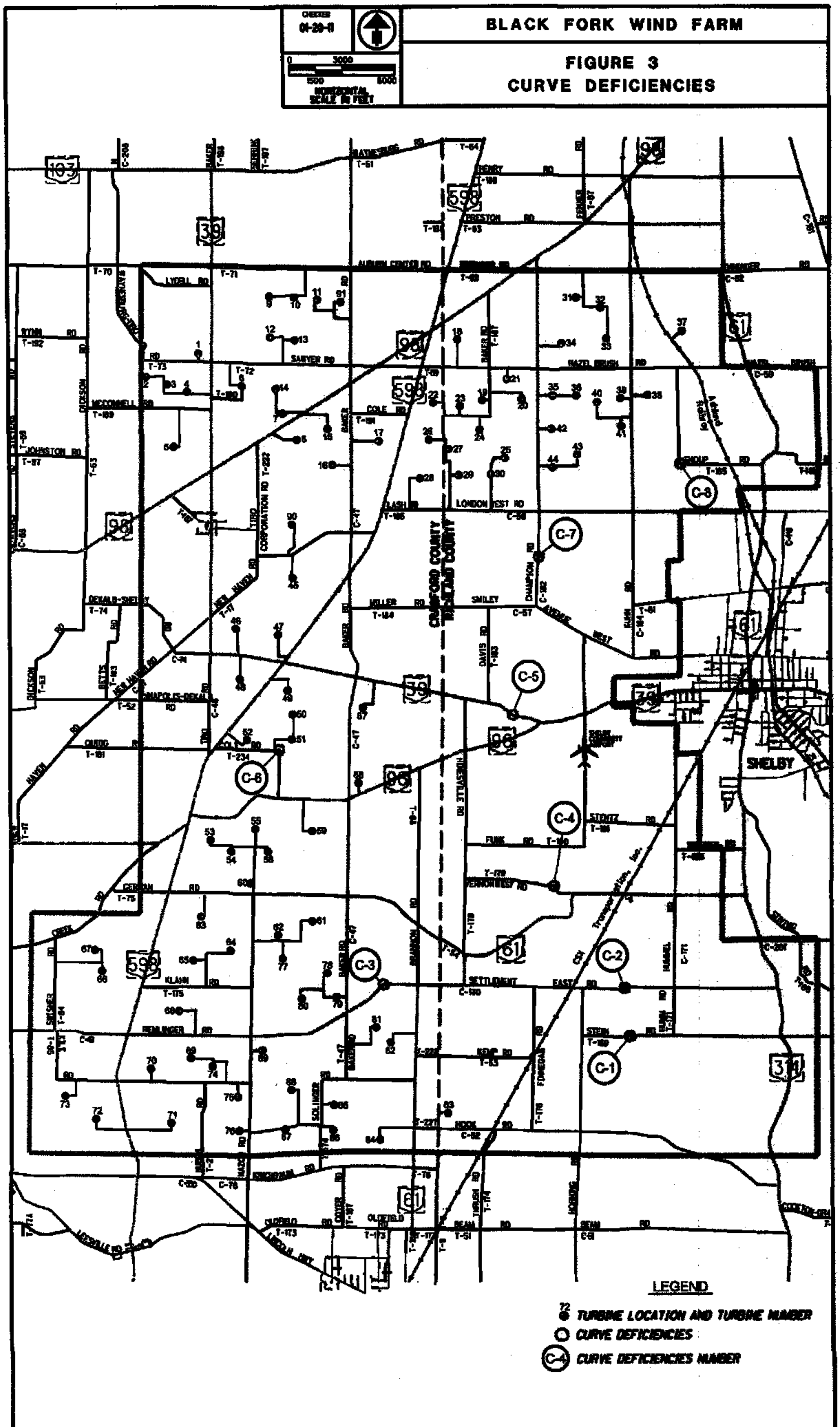
Underground telephone lines are located throughout the project and should not impact movement of the transport vehicles. Isolated intersections have telephone pedestals which may create a conflict.

3. Miscellaneous Obstructions

The review of the roadway network also identified miscellaneous obstructions which may cause conflict with movements of the transport vehicles. These locations are delineated in Figure 4. The obstructions are located at intersections and encroach on the 148 foot radius requirement for pavement. The obstructions include local cemeteries at three locations which may preclude roadway widening on those quadrants. Two locations have farm fence which would require relocation if roadway widening was necessary at the intersections. Two other locations included trees which would need to be removed if roadway widening was required at the intersections.

BLACK FORK WIND FARM

FIGURE 3
CURVE DEFICIENCIES

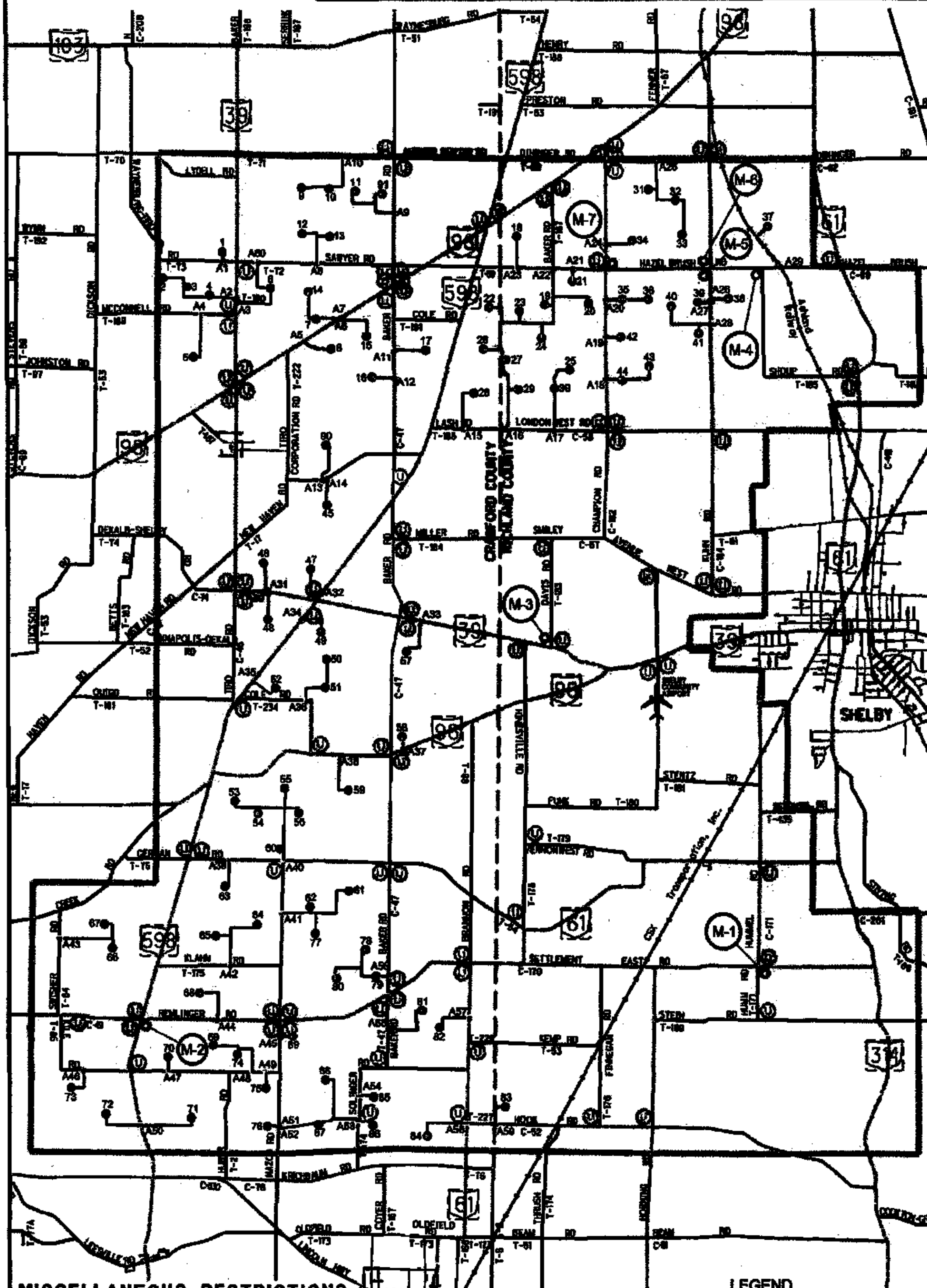


CHECKED 01-20-11

0 1500 3000 6000 HORIZONTAL SCALE IN FEET

BLACK FORK WIND FARM

FIGURE 4 - UTILITY POLES AND MISCELLANEOUS OBSTRUCTIONS



MISCELLANEOUS RESTRICTIONS AT INTERSECTIONS

REF. NO.	DESCRIPTION
M-1	CEMETERY
M-2	CEMETERY AND 30" TREE
M-3	CEMETERY
M-4	FARM FENCE
M-5	FARM FENCE
M-6	30" TREE
M-7	ROW OF 6" PINE TREES

LEGEND

72 TURBINE LOCATION AND TURBINE NUMBER

A21 ACCESS POINT AND ACCESS NUMBER

(U) UTILITY POLE

O MISCELLANEOUS OBSTRUCTIONS

(M-4) MISCELLANEOUS OBSTRUCTIONS NUMBER

CM-151\Exhibit 4-Utility Poles.dgn Sheet 01/21/2011

4. Stream Crossing Structures

The entire roadway network within the project was reviewed to identify all bridge structures. The Ohio Department of Transportation maintains an inventory of all structures (with a span greater than 10 feet) on all public roads and requires the local jurisdiction to inspect the structures annually.

Each structure within the project boundaries was assigned a reference number (as shown in Figure 5) and listed in the attached table by road, county, Structural File No. (SFN), span, roadway clear width and General Appraisal. Following is a description for each heading:

SFN – a unique number assigned to each structure when it is initially inventoried and identifies that structure on the state inventory system.

SPAN – the clear span of the structure measured along the roadway centerline.

CLEAR WIDTH – the clear width of the travelled roadway measured between guardrails or bridge parapets.

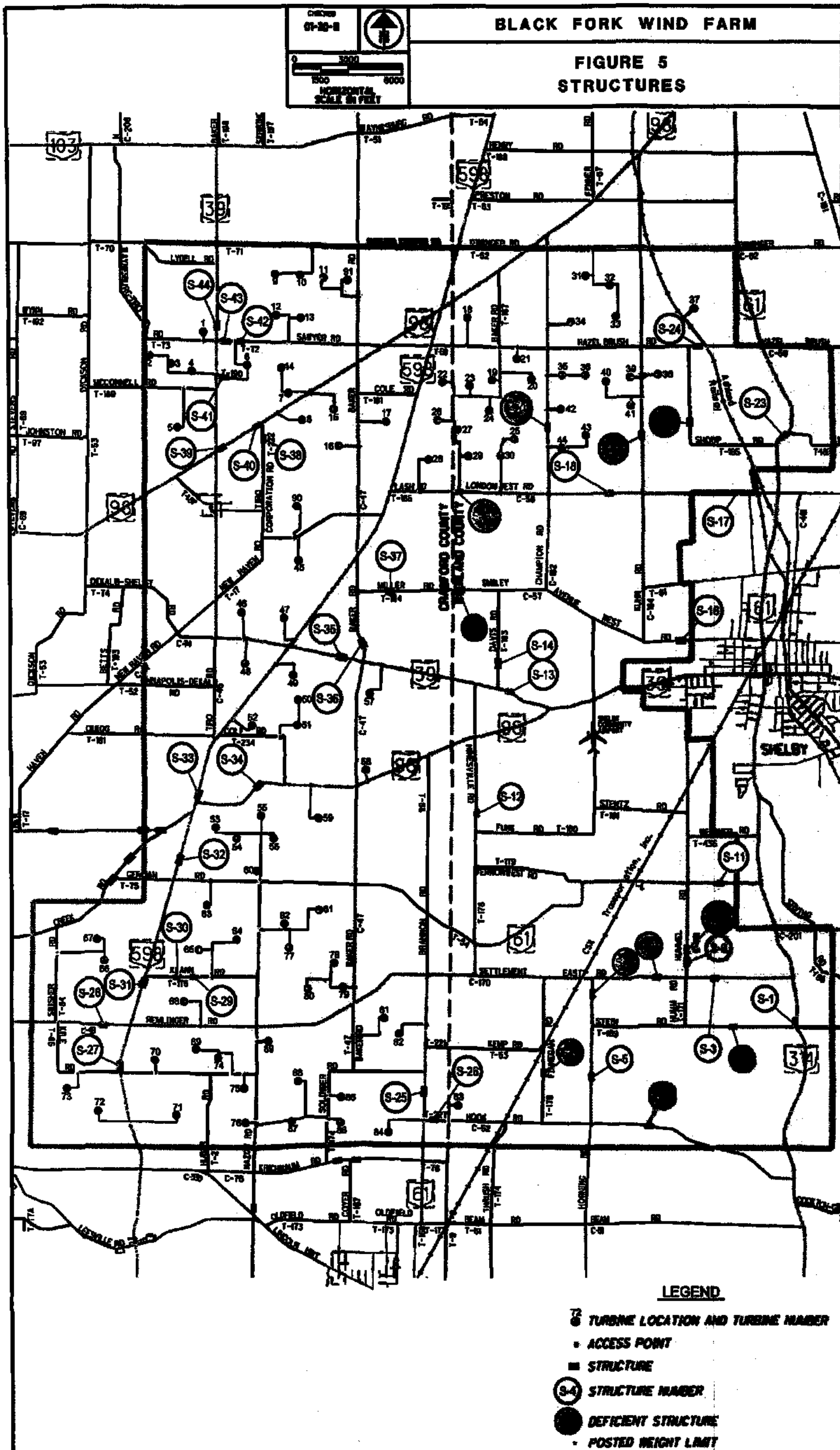
GENERAL APPRAISAL – a numeric coding for the overall condition of the bridge on a scale of 0-9. A 9 coding indicates the bridge is "as built" and 0 is a failed condition. A bridge with a coding of 4 indicates "poor condition". The alpha coding indicates operational status of the bridge. An "A" indicates open with no restriction. A "P" indicates the bridge is posted for reduced load limits.

Within the project boundaries, the structure breakdown is as follows, by jurisdictional authority:

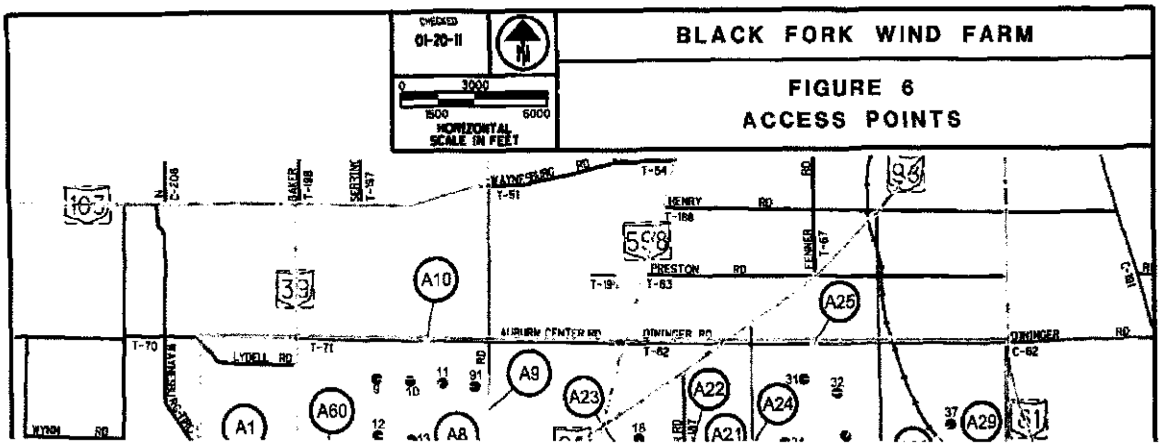
Crawford County Engineer	10
Richland County Engineer	18
Ohio Department of Transportation	14

Seven structures in Richland County are posted with weight limit restrictions. In addition, six structures within the project boundaries have a General Appraisal rating of 4 or less, which indicates the structure is in poor condition. ODOT will provide an analysis of the structures on the state routes for their loading capabilities during the permit routing process for overweight vehicles. After determination of the routing for the oversized vehicles, a detailed structural analysis of all structures on the selected County and Township roads will be required. A detailed analysis of all of the structures within the project boundaries is not recommended until the most feasible routes are determined.

Structures which have a posted weight limit reduction or structures which may be found to be deficient through analysis would have to be replaced or temporarily supported to accommodate the anticipated loadings during construction of the project.



CM-151\Exhibit 5-Structures.dgn Sheet 01/21/2011



REF. NO.	ROAD	COUNTY	STRUCTURAL FILE NUMBER	SPAN	POSTED WEIGHT LIMIT	CLEAR WIDTH	GENERAL APPRAISAL
S-1	SR 314	RICHLAND	7030096	18		> 24	5A
S-2*	STEIN RD (T-169)	RICHLAND	7030037	11	30T	22.5	5P
S-3	SETTLEMENT EAST RD (C-170)	RICHLAND	7030266	10		25	4A
S-4	HOOK RD (C-52)	RICHLAND	7034768	15		23	8A
S-5	HORNING RD	RICHLAND	7030762	25		27.5	6A
S-6*	FINNEGAN RD (T-176)	RICHLAND	7030649	20	30T	17	5P
S-7*	HORNING RD	RICHLAND	7030592	12	30T	24	6P
S-8*	SETTLEMENT EAST RD (C-170)	RICHLAND	7030207	10	20T	25	5P
S-9	HUMMEL RD (C-171)	RICHLAND	7033222	17		24	4A
S-10*	HUMMEL RD (C-171)	RICHLAND	7030312	20	15T	23	5P
S-11	SR 61	RICHLAND	7003129	38		> 24	6A
S-12	HINESVILLE RD (T-178)	RICHLAND	CULVERT	< 10		27.5	-
S-13	SR 39	RICHLAND	7001967	16		> 24	8A
S-14	DAVIS RD (T-183)	RICHLAND	7030452	16		> 24	9A
S-15	SMILEY AVE WEST RD (C-57)	RICHLAND	7033397	16		20	8A
S-16	SMILEY AVE WEST RD (C-57)	RICHLAND	7032986	14		> 24	9A
S-17	LONDON WEST RD (C-58)	RICHLAND	CULVERT	< 10		> 24	-
S-18	LONDON WEST RD (C-58)	RICHLAND	7033044	33		> 24	6A
S-19*	LONDON WEST RD (C-58)	RICHLAND	7034040	30	20T	18.5	3P
S-20*	CHAMPION RD (C-182)	RICHLAND	7030819	24	30T	21	5P
S-21	KUHN RD (C-184)	RICHLAND	7030924	38			3A
S-22	SHOUP RD (T-185)	RICHLAND	7030975	33		17	6A
S-23	SR 61	RICHLAND	7003196	35		> 24	7A
S-24	HAZEL BRUSH RD (T-59)	RICHLAND	7035802	11		30	4A
S-25	SR 61	CRAWFORD	1702130	44		> 24	6A
S-26	HOOK RD (T-227)	CRAWFORD	1746839	22		24	7A
S-27	SR 598	CRAWFORD	1703706	12		> 24	8A
S-28	REMLINGER RD (C-49)	CRAWFORD	1740342	18		24	7A
S-29	KLAHN RD (T-175)	CRAWFORD	1745743	10		N-A	7A
S-30	KLAHN RD (T-175)	CRAWFORD	1745697	10		N-A	8A
S-31	SR 598	CRAWFORD	1703722	16		> 24	5A
S-32	SR 598	CRAWFORD	1703749	4		> 24	5A
S-33	SR 598	CRAWFORD	1703781	18		> 24	4A
S-34	SR 96	CRAWFORD	1702351	43		> 24	8A
S-35	SR 39	CRAWFORD	1702025	18		> 24	7A
S-36	BAKER RD (C-47)	CRAWFORD	1740016	22		26	7A
S-37	MILLER RD (T-184)	CRAWFORD	1746170	23		24	7A
S-38	CORPORATION RD (T-222)	CRAWFORD	1746782	18		> 24	7A
S-39	SR 98	CRAWFORD	1702789	22		> 24	6A
S-40	SR 98	CRAWFORD	1702807	16		> 24	6A
S-41	T-190	CRAWFORD	1746235	12		N-A	8A
S-42	SAWYER RD (T-72)	CRAWFORD	1742493	32		24	7A
S-43	SAWYER RD (T-72)	CRAWFORD	1742442	12		24	8A
S-44	SR 39	CRAWFORD	1701983	25		> 24	6A

STRUCTURES WITH WEIGHT REDUCTIONS OR LESS THAN 24' CLEAR WIDTH

* POSTED WEIGHT LIMIT

BLACK FORK WIND FARM	STRUCTURES (BRIDGES OVER 10' SPAN)

5. Existing Pavement Conditions

The entire roadway network within the project boundaries were reviewed for pavement width, pavement surface and pavement condition. The inventory of the existing pavement is listed in the attached table. The "General Requirements" for public roads requires a minimum running width of 16 feet and a minimum clear width of 24 feet. All of the roadway network within the project boundaries are currently hard surfaced with either asphalt or a built up chip seal treatment. The base under the surface treatment has not been cored to determine the structural make-up. It is assumed that most of the roadways were originally an aggregate base which has been built up over time.

After selection of the routing for the oversized transport vehicles, a detailed analysis of the pavement structure should be done to determine the load bearing capacity and associated impacts to the existing pavement resulting from transporting the oversized vehicles.

The roadways in this area are frost susceptible and the load bearing capacities are greatly reduced in the spring (February thru May). It is common for many of the local roads to have temporary weight reductions posted during this time. The impact of construction traffic could possibly vary considerably according to the time of year.

Construction activities anticipated for this project typically produce the largest stresses on pavements at the point of sharp turning movements. Therefore, it is anticipated that each "access point" or location where the Project Site Roads meet the public roads, will be most prone to pavement failure. These areas may require structural improvements on the public roads prior to construction activities for the project. It is recommended that these locations be subject to a detailed pavement analysis.

ROAD	COUNTY	PAVEMENT WIDTH	SURFACE	CONDITION
STEIN	RICHLAND	20'	CHIP SEAL	GOOD
HORNING	RICHLAND	18'	ASPHALT	FAIR
SETTLEMENT EAST	RICHLAND	18'	CHIP SEAL	FAIR-POOR
HUMMEL	RICHLAND	19'	CHIP SEAL	GOOD
HOOK	RICHLAND	18'	CHIP SEAL	FAIR
KEMP	RICHLAND	17'	CHIP SEAL	GOOD
FINNEGAN	RICHLAND	18'	CHIP SEAL	GOOD
BRANNON	CRAWFORD	16'/19'	ASPHALT	FAIR
KRICHBAUM	CRAWFORD	18'	CHIP SEAL	GOOD
SOLINGER	CRAWFORD	14'/18'	ASPHALT	FAIR
BAKER	CRAWFORD	18'/20'	ASPHALT	FAIR
HINESVILLE	RICHLAND	21'	CHIP SEAL	FAIR
GERMAN	CRAWFORD	16'	CHIP SEAL	FAIR
REMLINGER	CRAWFORD	19'	ASPHALT	FAIR
KILE	CRAWFORD	11'/13'	CHIP SEAL	FAIR
NAZOR	CRAWFORD	16'/18'	CHIP SEAL/ASPHALT	FAIR
LASH	CRAWFORD	18'	CHIP SEAL	POOR
LONDON WEST	RICHLAND	20'	CHIP SEAL	POOR
SHOUP	RICHLAND	16'	CHIP SEAL	POOR
COLE	CRAWFORD	17'	CHIP SEAL	POOR
SMILEY	RICHLAND	20'	CHIP SEAL	FAIR
MILLER	CRAWFORD	18'	CHIP SEAL	FAIR
FUNK	RICHLAND	22'	CHIP SEAL	FAIR
DAVIS	RICHLAND	18'	CHIP SEAL	FAIR
CHAMPION	RICHLAND	18'	CHIP SEAL	POOR
HAZEL BRUSH	RICHLAND	18'	CHIP SEAL	FAIR
SAWYER	CRAWFORD	15'	CHIP SEAL	FAIR
McCONNEL	CRAWFORD	15'	CHIP SEAL	POOR
BAKER	RICHLAND	16'	CHIP SEAL	FAIR
KUHN	RICHLAND	20'	CHIP SEAL	FAIR
SR 39	CRA/RIC	25'	ASPHALT	FAIR
SR 98	CRA/RIC	24'	ASPHALT	FAIR
SR 96	CRA/RIC	26'	ASPHALT	FAIR
SR 61	CRA/RIC	24'	ASPHALT	GOOD
SR 598	CRA/RIC	23'	ASPHALT	GOOD
SR 314	RICHLAND	24'	ASPHALT	FAIR

BLACK FORK WIND FARM

PAVEMENT INVENTORY

ROADWAY INFRASTRUCTURE CONCERNS OF LOCAL JURISDICTIONAL AGENCIES

The Crawford and Richland County Engineers are responsible for maintaining their roadway system in a safe condition for the travelling public. The local Township Trustees maintain jurisdictional authority on their roadway system. The County Engineers provide annual bridge structure inspections for all structures (not including state routes) on the County and Township roadway network. The respective County Engineers will also act as the liaison for the Township Trustees and support them in protecting their roadway infrastructure.

An important element during the construction phase of the project will be to create and maintain open communication of the project activities. The County Engineers and Township Trustees represent all the residents in the project area and need to be informed on a timely basis of any issue which may impact the residents. As with any construction project involving public roadways, it is critical to properly and safely maintain traffic. Any construction activity which occupies public roadways must comply with the Ohio Manual of Uniform Traffic Control Devices to adequately provide a safe work zone for the traveling motorists and the construction workers. Any road closures and associated detours would need to have prior approval of the local jurisdictional agency.

A major concern of the local jurisdictional agencies is the potential impact to pavement and bridges from transporting heavy loads during construction. The designated routes for the construction activities should utilize the state highway system to the maximum extent possible. Careful planning will be required to identify the routing to each "access point" to minimize impacts to the local roadway system. After designation of the routing, it is imperative that the transport vehicles do not deviate from the assigned routes. The transport vehicle movements will be closely monitored to ensure compliance.

Another issue of concern for the local jurisdictional agencies is to coordinate the required roadway improvements. Some improvements will need to be completed prior to beginning construction activities, some interim improvements may be required during construction, and final improvements may be needed to restore the roadway after completion of construction activities. The main concern is to maintain the pavement in its current condition and relieve the County and Township of expending funds or efforts to repair any pavement damaged by construction activities.

CONSTRUCTION ACCESS FOR PROJECT

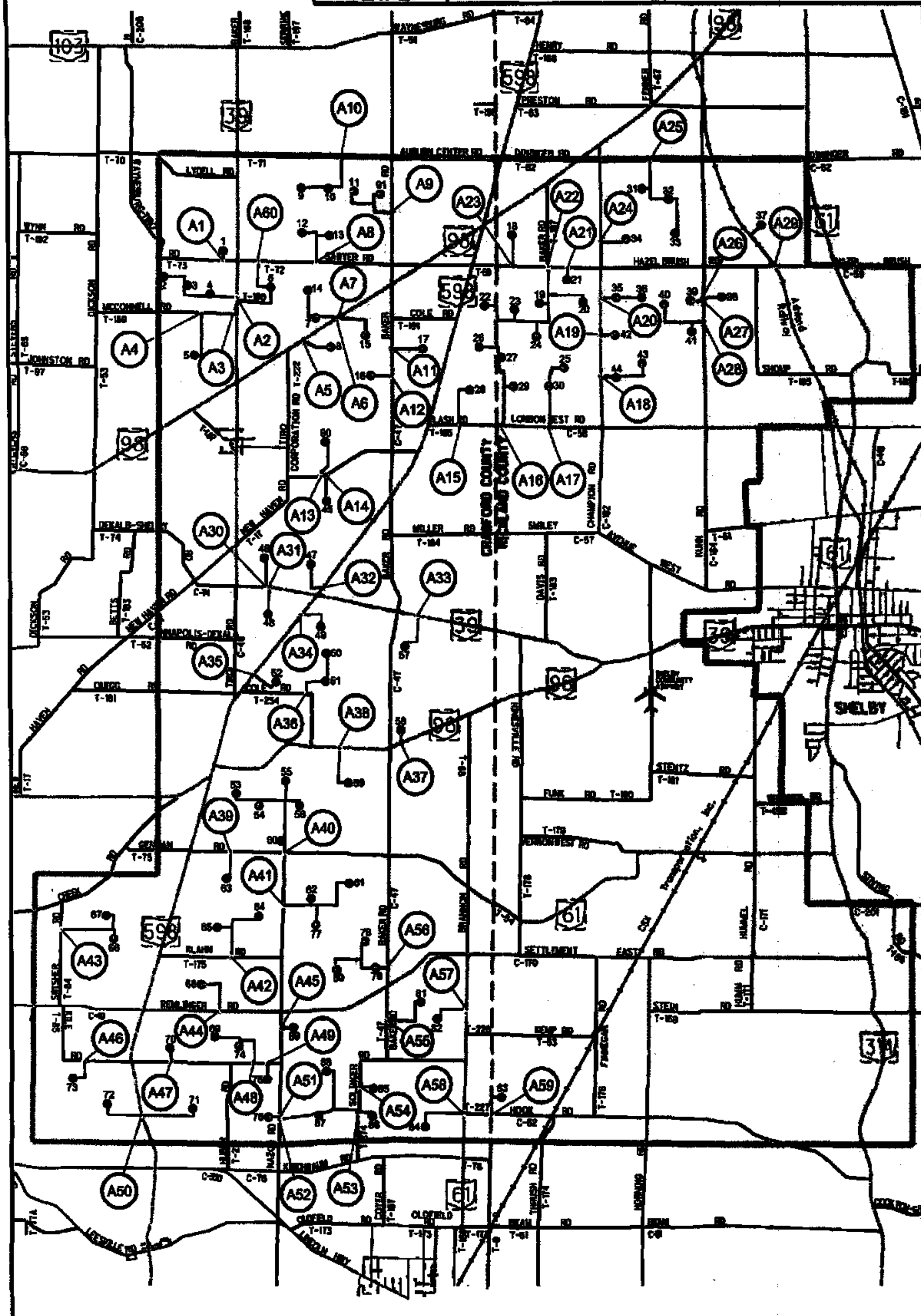
Black Fork Wind Energy, LLC provided base map information which delineated the project boundaries and the locations for the wind turbine towers. From the information provided, "access points" were identified where transport vehicles would exit the public roadway system for access to each wind turbine site. It was determined that 60 "access points" would be required to complete the construction for the indentified wind turbines. These locations are shown in Figure 6- Access Points. Therefore, 60 routes will be required to route transport equipment and materials for each wind turbine or groupings of wind turbines. Each wind turbine or grouping of wind turbines will require a Project Site Road which will be constructed beyond the public roadway system.

A major challenge for this project will be selecting the routes which will require minimal improvements and result in the least impact to the public roads. Specific routing for each "access point" cannot be determined until the source of the major wind turbine components is identified. The focus of this study is identifying feasible options for transporting oversized loads within the project boundaries. A critical factor in determining this routing is the route selection by the Ohio Department of Transportation (ODOT) to arrive at the project boundary. The routing by ODOT will be dictated by the origin of the loads into Ohio. ODOT will issue permits for each oversized vehicle and approve the movements on the state highway system. Upon receipt of the ODOT routing, a detailed routing within the project boundary using county and township roads can be selected to arrive at each "access point".

HORIZONTAL SCALE IN FEET

BLACK FORK WIND FARM

FIGURE 6
ACCESS POINTS



LEGEND

72 TURBINE LOCATION AND TURBINE NUMBER

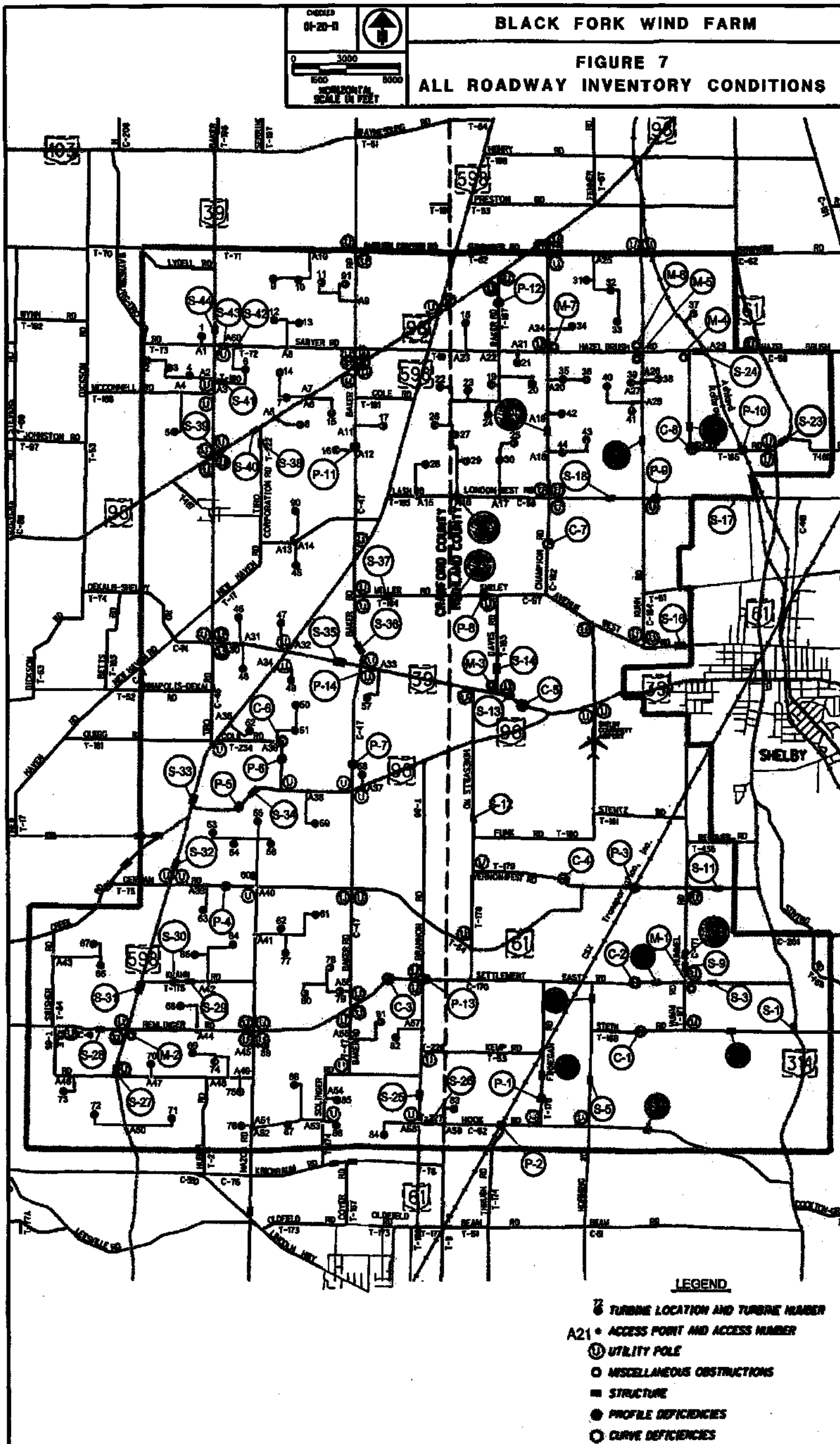
+ ACCESS POINT

(A48) ACCESS POINT NUMBER

CM-151\Exhibits 6-Access Points.dgn Sheet 01/21/11

BLACK FORK WIND FARM

FIGURE 7
ALL ROADWAY INVENTORY CONDITIONS



CM-151\Exhibits 7-All.dgn Sheet 01/21/2011

PROPOSED PRELIMINARY ROUTING FOR CONSTRUCTION ACCESS

Based upon information compiled from the Transportation Study, preliminary selection of routing for construction access was developed. The following factors were considered during selection of routing:

- Maximize use of State Routes
- Minimize use of local roads
- Minimize intersection improvements required for turning movements and utilize parcels already under lease for necessary widening
- Minimize bridge structure crossings
- Minimize length of roadways traveled

Current plans for the Black Fork Wind Farm include construction of 91 wind turbines. They will be grouped and configured to require 60 access drives from the public roadway system. The proposed preliminary routing for construction access to each wind turbine is shown in Figure 9. This routing would have the following impacts on the existing local roadway system:

1. 8 bridge structure crossings
   - *London West Rd. – S-19 – RIC Co. 20 Ton Weight Limit
   - *Champion Rd. – S-20 – RIC Co. 30 Ton Weight Limit
   - Hazel Brush Rd. – S-24 – RIC Co.
   - Hook Rd. – S-26 – CRA Co.
   - Remlinger Rd. – S-28 – CRA Co.
   - Klahn Rd . – S-29 – CRA Co.
   - Klahn Rd . – S-30 – CRA Co.
   - Sawyer Rd. – S-43 – CRA Co.

   *Clear width less than 24' requirement

2. Curve Improvements
   - Remlinger Rd. – C-3

3. Profile Improvements
   - German Rd. – P-4
   - SR 96 – P-5
   - Baker Rd. – P-11

4. Truck Traffic

   Construction of each wind turbine would require the following estimated deliveries via truck:

Concrete	30
Rebar	2
Roadbase Aggregate	10
Backhoes & Cranes	8
Turbine Equipment	9
Collection Cabling	20

Restoration 5

84 Total Estimated Trucks

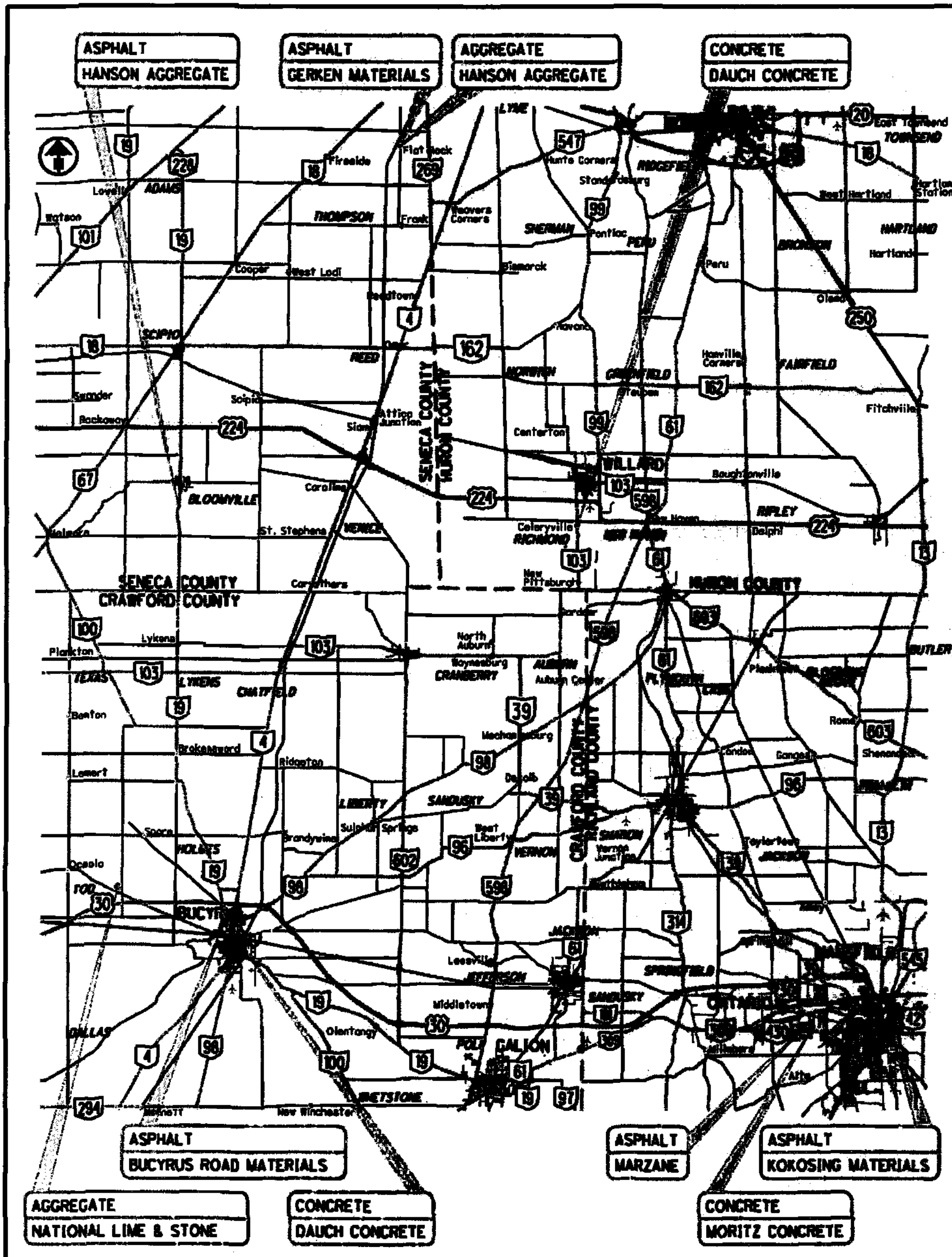
67 of the 84 truck trips (80%) would be legal weight (80,000 lb) or less loads. It is estimated 17 loads per turbine would require oversize/overweight permits.

ODOT traffic counts indicate an average daily truck volume of 80 for each of the state routes (SR 39, 61, 96, 98 and 598) within the project boundaries. Therefore, the total truck trips required for construction of each wind turbine is approximately equal to a single day volume currently using the state routes.

It should be noted that within the project boundaries are several significant grain storage facilities. These facilities receive and transport fully loaded truck/trailer combinations on many of the local roads. With the estimated storage capacity of 3,000,000 bushels, this could equate to approximately 6,000 trips of 80,000# loads on the local roads annually.

5. Intersection Improvements

Each intersection where turning movements are necessary for the wind turbine transport vehicles will require widening improvements. The transport vehicles require a minimum inside turning radius of 148' with an additional clear area of 49' inside of roadway radius for overhang. The improvements may be a combination of temporary and permanent pavement. Temporary pavement (aggregate) and extension of roadway culverts (in ditch line) would be typical. Black Fork Wind Energy LLC would be responsible to obtain temporary easements or work agreements to perform this work outside of existing roadway right of way. In most cases, the additional areas required would be adjacent to leased parcels. Coordination with each utility pole owner, impacted by the required improvements, would be the responsibility of Black Fork Wind Energy LLC.

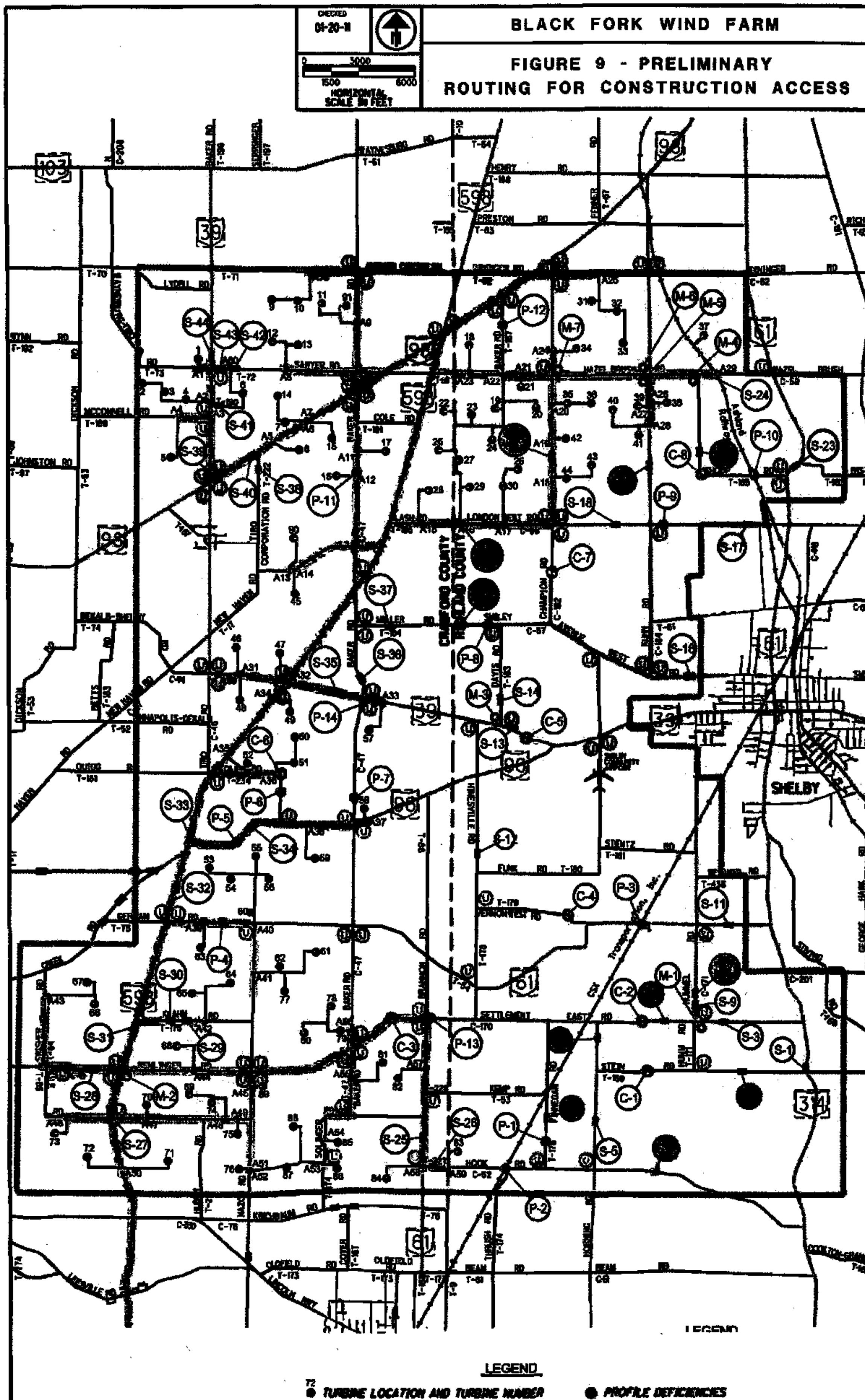


BLACK FORK WIND FARM

FIGURE 8
MAP OF LOCAL MATERIALS SUPPLIERS

BLACK FORK WIND FARM

FIGURE 9 - PRELIMINARY ROUTING FOR CONSTRUCTION ACCESS



LEGEND

- TURBINE LOCATION AND TURBINE NUMBER
- ACCESS POINT AND ACCESS NUMBER
- UTILITY POLE
- MISCELLANEOUS OBSTRUCTIONS
- STRUCTURE
- PROFILE DEFICIENCIES
- CURVE DEFICIENCIES
- POSTED WEIGHT LIMIT
- ROADWAYS USED FOR CONSTRUCTION ACCESS

CM-151\Exhibit 9-Preliminary Routing.dgn Sheet 01/21/2011

SUMMARY AND RECOMMENDATIONS

All of the roadway network within the project boundaries have been reviewed and inventoried, and shown in Figure 7. Information has been collected and assembled to be used as the basis for selecting the most feasible routing for transporting equipment and materials during construction of the Black Fork Wind Farm. Locations have been identified which could potentially restrict movement of the anticipated transport vehicles. In most instances, roadway improvements can be completed to accommodate these vehicles. The biggest challenge will be to provide the necessary pavement area at each intersection for the required turning radii. None of the existing intersections meet the necessary minimum requirements. Complicating this issue is the presence of utility poles at many of the intersections.

A critical element in moving this project forward will be early coordination with ODOT regarding permit routing of the oversized transport vehicles. ODOT's routing to the project boundaries must be known before the internal routing can be determined. Identification of ODOT's routing will reduce or eliminate many of the possible combinations of local road use and thereby minimize the required roadway improvements.

Another element which could impact the local roadway system is the location of major material supply sources for the project. Figure 8 provides mapping of existing local aggregate, asphalt and concrete sources which may be utilized for this project. Any proposed temporary facilities, such as a concrete batch plant, should be identified early in the process to factor the concentrated movement of required transport vehicles within the project area.

The next phase of the Transportation Study for construction of the Black Fork Wind Energy Project should include the following:

- Identification of ODOT permit routing for oversized vehicles to the Project
- Identification of designated routing of oversized vehicles on County and Township Roads within the project boundaries
- Detailed load rating analysis for structures on the local designated routes
- Detailed analysis of pavement structure on the local designated routes
- Detailed preconstruction video on the local designated routes to document existing conditions
- Identification of aerial utility crossings which are less than 20 feet
- Coordination with utility pole owners for necessary relocations required because of conflicts with turning movements
- Detailed design plans for roadway improvements for existing deficiencies in profile and curvature on the local designated routes

This report was prepared based upon KEM's understanding of the proposed project activities and from information provided by Black Fork Wind Energy, LLC regarding transport vehicle weights and configurations. The findings are considered preliminary and can be used as guidelines for further planning for construction of the wind farm. Further consultation and coordination with each affected county and township will be required prior to the construction phase.

EXHIBIT "A"

SWT-2.3-93

General Requirements, Project Site Infrastructure Layout and Public Roads

GR-2300-02 Rev 08c

Table of Contents

1. Introduction

This document contains information about the minimum requirements for the Project Site construction area and roads, as well as public roads to be used for delivery of the Units. The Project Site infrastructure for the working compound, storage areas and crane hardstandings are also described. The requirements are set forth in order for the Purchaser to meet the methods and logistics that Siemens knows from experience have been proven to work for the SWT-2.3-93 Wind Turbine Generator and Tower (max hub height 80m (262.5 ft)) transportation and installation world wide.

Non-conformances to these specifications can cause major problems for transportation, mounting and handling of the Unit components. Therefore, any changes or deviations must be agreed and accepted by Siemens. Any non-compliances, deviations and additional requirements must be handled in accordance with the requirements set forth in the Agreement

1.1. *Overall Requirements and Notes:*

- Generally, in addition to specified load bearing, slope and other requirements set forth herein for the public access roads, Project Site roads and crane hardstandings, Purchaser shall design, construct and maintain the Project Site roads and crane hardstandings so that they are functional and free of (i) muddy ruts, tracks, trenches, clumps and build ups, (ii) standing water and (iii) pot holes which may impede the safe and efficient use of such roads and hardstandings by heavy cranes, oversize trucks and Siemens personnel under all normally expected weather conditions (e.g. rain, snow, sleet, freeze/thaw conditions, etc.) at the Project Site. In most cases, this will require that Purchaser apply the application of gravel, crushed stone, temporary pads or other capping materials to the Project Site roads and crane hardstandings to maintain the required compacted surface area.
- All known road access restrictions must be mentioned and listed.
- Specifications of trucks and cranes may vary according to the commercial conditions and the availability of the transportation and crane equipment at the time of installation. However the subcontracts with crane and transportation Subcontractors will be based upon the specified requirements in this document, but loads and the specified restrictions may change according to transport and crane Subcontracts.
- Purchaser shall be responsible to maintain the roads (removing pot holes, ruts, trenches, tracks, clumps and excessive mud build ups, landslides, etc.) and keep the Project Site fully accessible and functional as required herein during the complete Unit erection, installation and Commissioning period.
- Safety is the ruling factor in all situations. All deliveries shall be managed by the Siemens' Project manager and coordinated with the Purchaser's Project manager.

Note: Imperial units of measurement included in this document are soft conversions of metric units and are provided only for reference.

2. Road Requirements for Wind Turbine Generator, Tower and Crane Equipment

2.1 Loads

The maximum gross weight for any transport vehicle shall be related to the nacelle delivery and shall equal approximately 195 metric tons (215 short tons) (worst case scenario). The maximum axle load shall be approximately 14 metric tons (15.4 short tons) per axle.

Depending on the type of crane equipment chosen for the Project, loads imposed on roads and hardstandings may vary.

> Depending upon the degree of disassembly of the cranes, mobile cranes / conventional cranes will have axle loads varying from 14 metric tons (15.4 short tons) up to 30 metric tons (33 short tons).
>
> Crawler cranes (standard) moving fully rigged will have a total load of up to 600 metric tons (661 short tons) giving a load of up to 200 kN/m² (4,180 lbs/ft²).

The speed of transportation on the Project site roads is normally 5-10 km/h (3-6 mph).

Note: The specified loads are only valid for straight, level roads and do not take uneven roadway, road rise or curves into account. All specified axle loads are exclusive of safety factors. It is the road designer's responsibility to incorporate adequate safety factors into the design of the roads *according to the national standards.*

Where gates and/or cattle guards straddle the roads, these shall have an opening width of at least 7.5m (24 ft) is required on straight sections and at least 9.5m (30 ft) is required on curved sections.

2.2. Examples of Transportation Methods / Equipment.

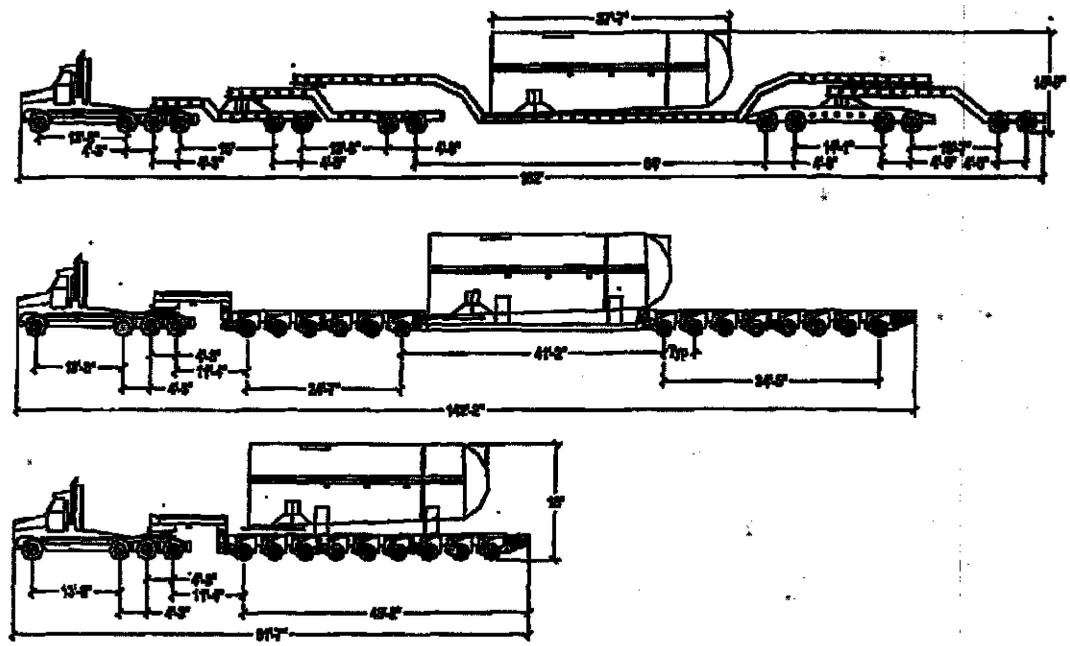


Figure 1 - Nacelle Transport - Indicative

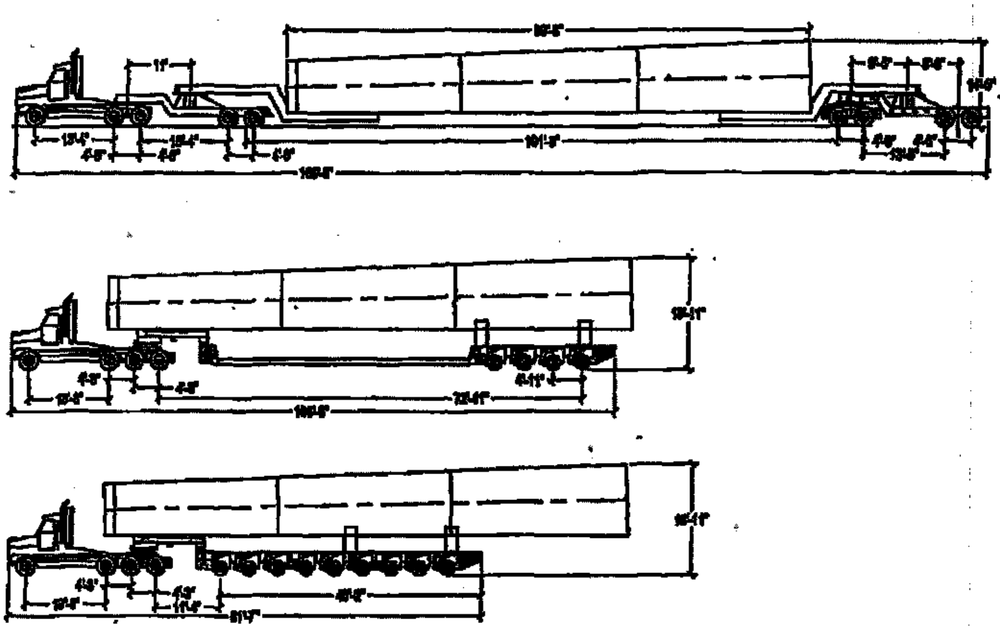


Figure 2 - Tower Top Transport – Indicative (depending on final Tower design)

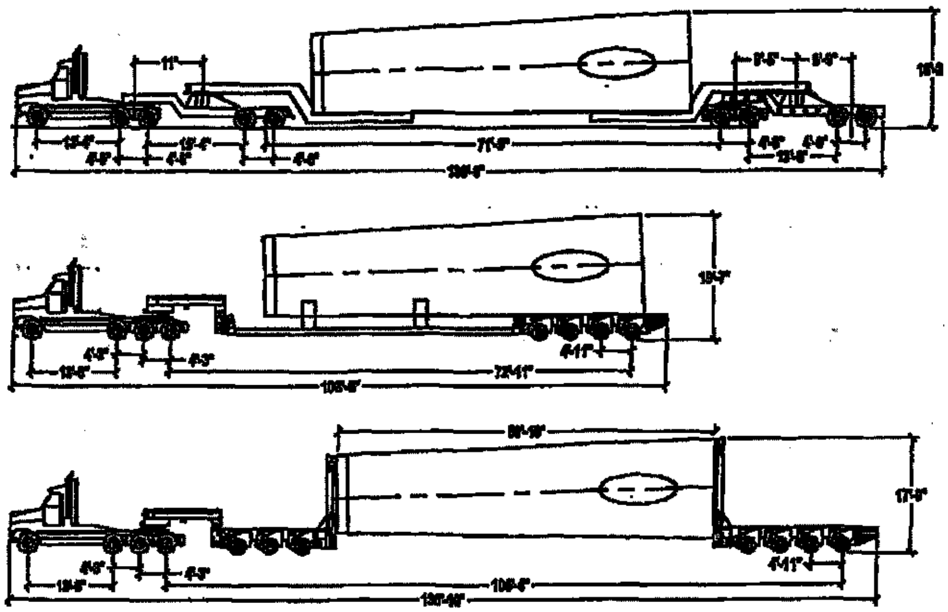


Figure 3 - Tower Base Transport – Indicative – Same methods can be used for Tower mid sections (depending on final Tower design)

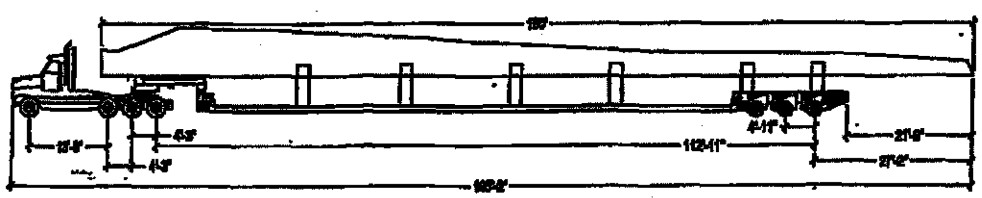


Figure 4 - Single Blade Transport (45 m blade) - Indicative

2.3. Gradients

Assuming a reasonably straight road without any bends prior to a steeper section that would slow down the transport vehicle, the maximum allowable gradient for the roads is 1:20 or (5%), which requires a well compacted road surface with sufficient road grip for the transport vehicle to move under its own power, without specific prior approval of Siemens. Up to a 1:10 or (10%) gradient may be acceptable with advance approval of Siemens. Such approval may require variations in the type of transportation equipment to be used and special arrangements maybe required, e.g. added pulling power or paved portions of road surfaces to allow for safe and viable transport, which variations shall be the responsibility of Purchaser.

2.4. Curves and intersections

Curves and intersections shall be constructed according to the following requirements which should permit the transport vehicles to operate safely on the roads. In cases where the transport equipment needs to perform reverse maneuvers in order to access certain crane hardstanding locations, additional room may be required in any given location and this will be analyzed on a case by case basis. In addition, the inside radius must be included on both sides of an intersection unless prior approval is obtained from Siemens.

Important: Curves sharper than 90 degrees must be custom built and discussed in detail with reference to the actual transport equipment to be used. Road rise is not acceptable in curves with a radius less than 45m (148 ft).

The distance between curves must be more than 45m (148 ft).

The following figures show types of curves and T-intersections. The hatched areas on the figures are areas that have to be cleared of all obstacles to allow overhang.

Cattle guards must be set back from any intersection by at least 55m (180ft).

Requirements for Curves with inner Radius R= 45m (148 ft) Width of road : Bs = minimum *7m (23 ft), L1, L2: approximately* 10m -15m *(33 ft – 49 ft)*			
Max. curvature	< 20°	<60°	<90°
Cleared areas B_Y	0m (0 ft)	3m (10 ft)	4m (13 ft)
B_I	0m (0 ft)	11m (36 ft)	15m (49 ft)

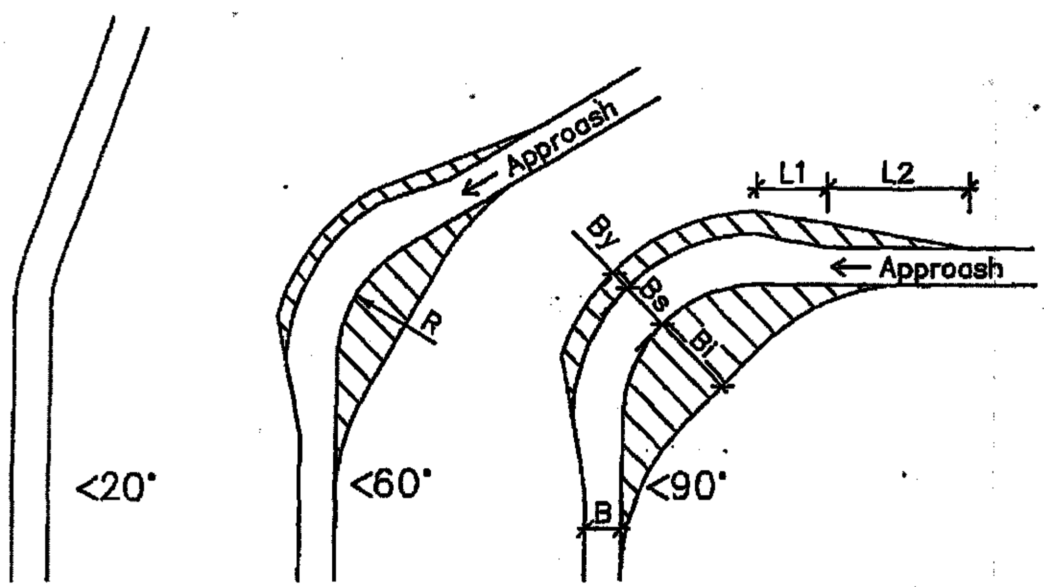


Figure 5 - Curves more than 20 degrees or an internal radius less than 75m, shall have a minimum running width, Bs, of 7m (23 ft). Minimum allowable inner radius 45 m (148 ft). The areas with hatching should be cleared and level.

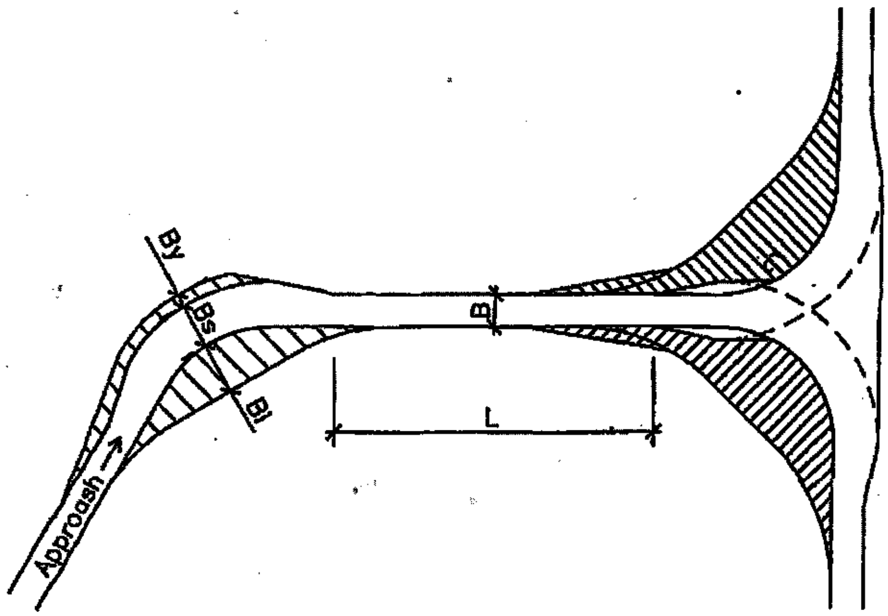


Figure 6 - Example of road curve followed by T-intersection (L= app. 45m (148 ft)). The areas with hatching should be cleared and level.

2.5. Sectional View

For transport of the Unit components, the effective running width of the road must be a minimum of 5m (16 ft) exclusive of shoulders on straight sections of the road.

If a crawler crane is chosen for the Project, it will be able to move between Unit crane hardstanding locations fully assembled. This requires an effective running width of the road of a minimum of 10m (33 ft) exclusive of shoulders on straight sections of the road. Alternatively, a road with a 5m (16 ft) effective running width plus a 5m (16 ft) levelled track with a bearing capacity of a minimum of 200kN/m^2 (4,180 lbs/ft^2) may be used.

The maximum allowable cross-fall roadside to roadside (inclusive of additional track for crawler cranes) over the running width is 1:50 (2%). If the road is constructed using a "roof" profile, an increased cross-fall of 1:25 (4%) can be accepted as long as a vehicle (width 2.5 - 3m (8 – 10 ft)) will not incline more than 1:50 (2%) while driving in the center of the road.

If a mobile crane / conventional crane is chosen for the Project, it will be disassembled as much as required when moving from one Project Site location to another. It will require an effective running width of the road of a minimum of 5m (16 ft) exclusive of shoulders on straight sections of the road.

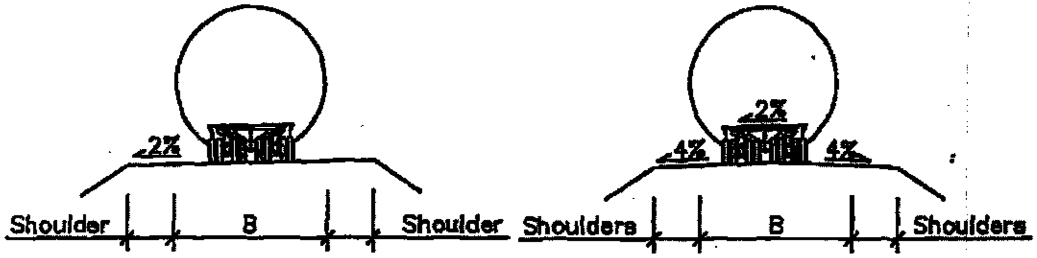


Figure 7 - Roof profile. The effective running width, B must be a minimum of 5m (16 ft) exclusive of shoulders on straight sections of the road.

It is important to construct the road in a way that the total effective running width has the bearing capacity specified in Section 2.1, Loads. This means that drainage ditches, shoulders, etc. have to be designed to ensure that the effective running width of 5m (16 ft) is kept. The design has to include all stability issues during all conditions of use. For special critical curves, for example curves on hillsides, shoulders must be marked with cones or similar devices.

The height clearance on the public roads which shall be used to transport the components of the Units to the Project Site must be at least 6m (20 ft). The height clearance on the Project Site roads must be at least 9m (29 ft), with consideration given to the height of the nacelle including the wind vane.

2.6 Elevation View

The vertical radius on roads, both in the convex and concave direction (hills and hollows/dips), should not be less than 500m (1,640 ft) to ensure that the vehicles can pass without touching the road surface.

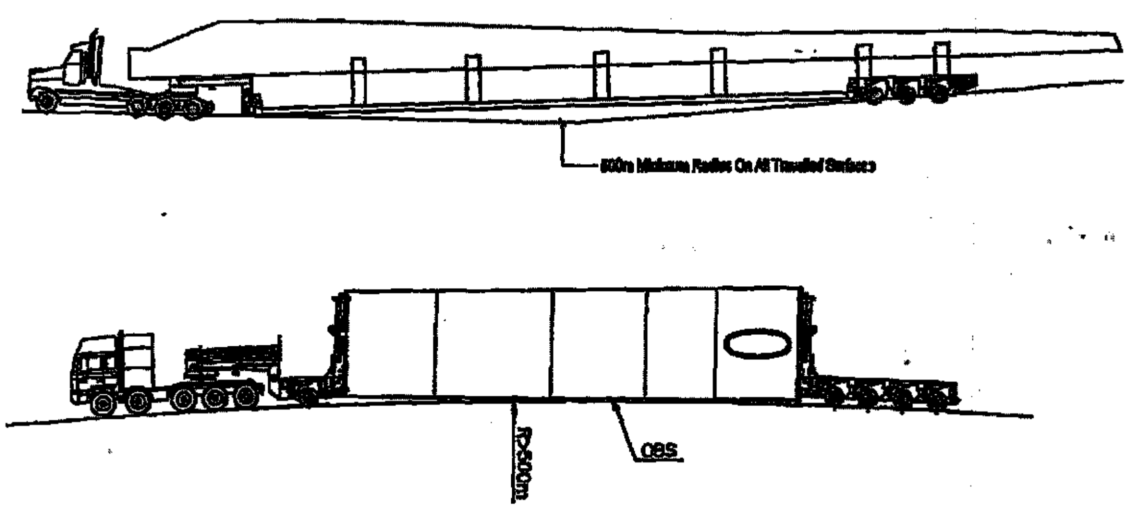


Figure 8 - The vertical radius, R on the road should not be less than 500m (1,640 ft).

3. Passing and turning areas on Site for Wind Turbine Generator, Tower and Crane Equipment

Passing areas for oversize vehicles and crane equipment should be made at approximately 500m (1,640 ft) intervals if the road width is less than 10m (33 ft). Crane hardstandings can be used in fulfilling this requirement for passing.

During crane movement, offloading of the Unit components and erection of the Units, the roads will be blocked for all other traffic. Therefore, to permit full access to all parts of the Project Site at all times, the roads should be laid out as a loop that allows access to each Unit location from both sides. Where dead-end roads cannot be avoided, turning areas are required.

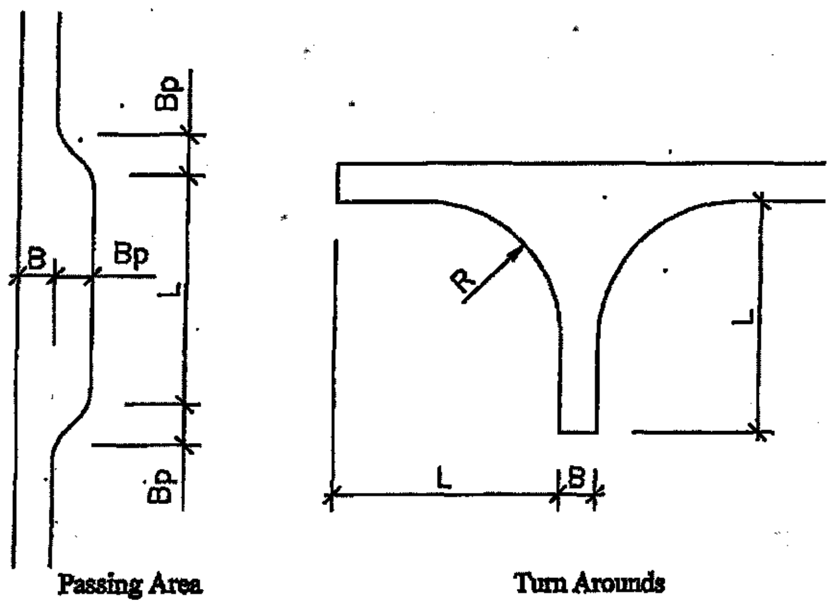


Figure 9 - Passing and turning areas.

Radius turning area	*R*	*Min 34m (112 ft)*
Length of passing and turning areas	*L*	*64m (210 ft)*
Width of road	*B*	*5m (16 ft)*
Width of passing area	*Bp*	*5m (16 ft)*

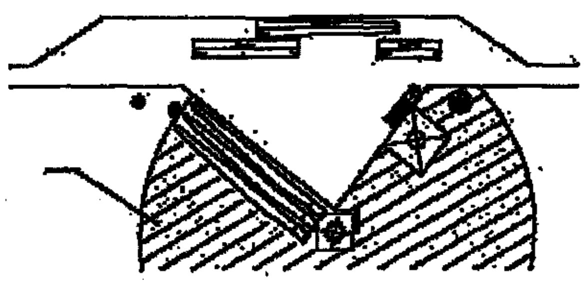
4. Wind Turbine Generator Construction Area

Depending of the Project Site conditions, and taking the commercial conditions, as well as the availability of the equipment at the time of installation, into consideration, a minimum of two (2) types of main cranes can be chosen by Siemens.

- Crawler crane: For this SWT-2.3-93 Wind Turbine Generator, depending on the hub height, a Demag CC2800 could be the choice for the main crane, allowing the crane to move from one crane hardstanding location to another fully assembled, but such selection is subject to availability and the assumptions on which the Siemens erection and installation price is based.

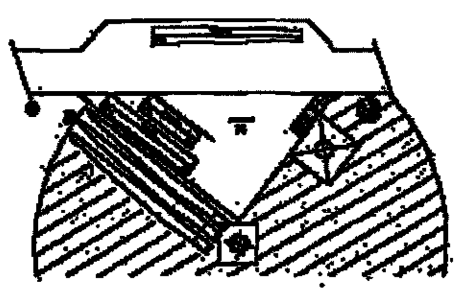
- Mobile crane / conventional crane: For this SWT-2.3-93 Wind Turbine Generator, depending on the hub height, a *Liebherr LG1550* could be the choice for the main crane. Such crane will be fully / partly disassembled when moving from one crane hardstanding location to another, but such selection is subject to availability and the assumptions on which the Siemens erection and installation price is based.

The logistics and deliveries depend on the actual Project Site conditions, type of crane, transport facilities, etc. These are changed and adjusted according to the Project as the Project progresses. All details on the Project Site must be clearly agreed and planned at an early stage of the Project. It is important to note that the crane hardstanding is also normally used as a storage and working area for the Unit components, parts, tools, containers, etc. See the figures below.



Example of storage of WTG components on the hard standing (mobile crane / conventional crane)

Figure 10 - Example of storage of Wind Turbine Generator and Tower parts on the crane hardstanding with mobile / conventional crane. The areas with hatching should be cleared and level.



Example of storage of WTG components on the hard standing (crawler crane)

Figure 11 - Example of storage of Wind Turbine Generator and Tower parts on the crane hardstanding with crawler crane. The areas with hatching should be cleared and level.

In addition to the cranes, the following items will typically be positioned on the hardstanding:

- 2 - 20 ft containers

- 10 ft container (shelter)
- 5 ft power unit

The items are not definitive and will depend on the logistics on the Project Site.

4.1 Assembly Area – Hub

One (1) hub and three (3) blades are assembled on the ground to one (1) complete rotor prior to mounting on the Tower. The rotor assembly requires a cleared area for the hub including blades with a maximum gradient of 1:30. Obstacles near the assembly area for the hub are to be removed according to agreement with Siemens. At hillsides, the rotor is preferably positioned down-hill from the road / crane hardstanding.

A platform for the hub with dimensions of a minimum of 9m X 9m (30 ft X 30 ft) and a minimum bearing capacity of 80kN/m² (1,640 lbs/ft²) is required in a location allowing the rotor assembly to take place without the blades blocking the road.

As an alternative to rotor assembly on the ground, single blade mounting can be performed. If this method is included in the erection and installation price and chosen by Siemens for the specific Unit location or the specific Project, a platform for the hub will no longer be necessary.

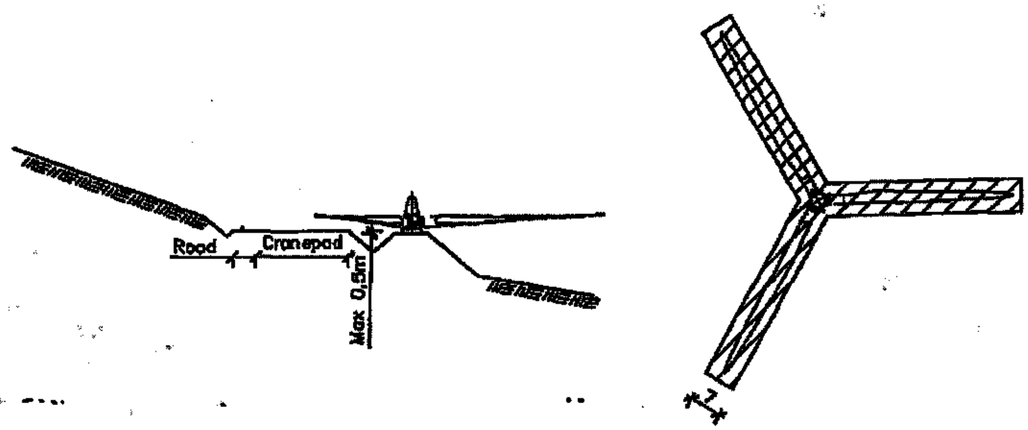


Figure 12 - Cross sectional view of typical lay-out and requirements for assembly of the rotor on the ground. The hatched area on the right figure must be free of obstacles and have a maximum gradient of 1:30.

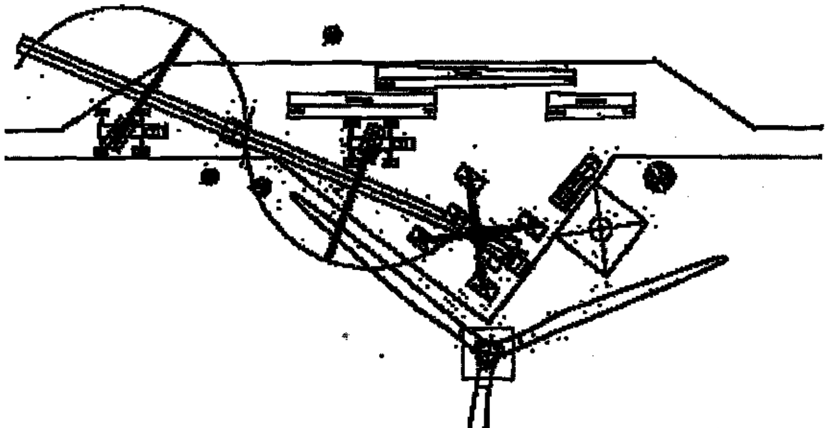
4.2 Hardstandings and Construction Area

The hardstanding area for a mobile crane / conventional crane or a crawler crane and the tailing crane should be made as a triangle of 50m X 37.5m (164 ft X 123 ft), in one level, with a maximum gradient of 1%. The bearing capacity should not be less than 200kN/m² (4,180 lbs/ft²). It should be possible to position the main crane with a distance from the center of the slew point to the center of the Unit foundation of 18m-26m (59 ft X 85 ft), depending on the type of crane.

The level of the crane hardstanding, H, should not be less than approximately 1m (3.25 ft) below the top of the Unit foundation and not more than 2m (6.5 ft) above the top of the Unit.

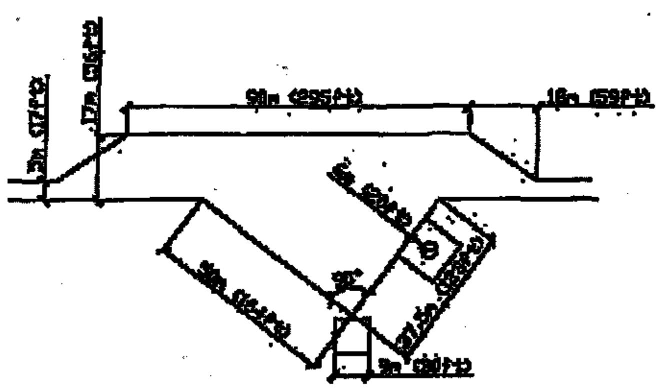
Figure 13 - Cross sectional view of Unit foundation and crane hardstanding.

If a mobile crane / conventional crane is chosen as main crane, it will at each Unit location require an area for the assist crane and a trestle to support the boom in a "horizontal" position. This area should be made as an extension of the storage area opposite the road from the crane hardstanding.



Example of crane hard standing – assembling a mobile crane / conventional crane.

Figure 14 - Example of crane hardstanding – assembling a mobile / conventional crane.



Example of hard standing for mobile crane / conventional crane - Dimensions

Figure 15 - Example of crane hardstanding for a mobile / conventional crane - Dimensions.

If a crawler crane is chosen as main crane, it will, depending on the road lay-out, be able to move fully rigged between Unit locations. At locations where de-rigging / rigging of the crane is needed, a fairly level and straight section of road of a minimum of 100m (328 ft) with a minimum width of 10m (33 ft) is required on either side of the crane hardstanding.

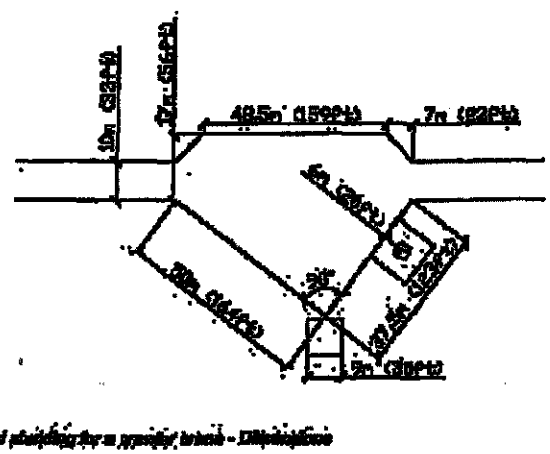


Figure 16 - Example of crane hardstanding for a crawler crane - Dimensions.

	Dimension	Maximum Fall	Bearing Capacity
Hardstanding – Main crane	90° triangle 50m X 37.5m (164 ft X 123 ft)	1:100 (1%) in all directions	≥ 200kN/m² (4180 lbs/ft²)
Crawler crane Tower storage area	48.5m X 17m (159 ft X 56 ft) (road included)	1:100 (1%) in all directions	≥ 200kN/m² (4180 lbs/ft²)
Mobile / conventional crane Tower storage area	48.5m X 17m (159 ft X 56 ft) (road included)	1:100 (1%) in all directions	≥ 200kN/m² (4180 lbs/ft²)
Rotor assembly area	9m X 9m (30 ft X 30 ft)	1:100 (1%) in all directions	≥ 80kN/m² (1640 lbs/ft²)

5. Requirements for storage

A storage area (lay down area) is required with the following specifications:

- It should be possible to transport components from the storage area to the Project Site without any approval by Purchaser and in a way so that the Siemens Site manager can activate transport with short notice. The entrance roads to the storage area must fulfill the requirements described in Section 2.

- The size of the area required for the Project will vary according to the actual logistics and Project Site requirements. An area of $1500m^2$ ($16,000 ft^2$) per Unit can be used as a guideline.

6. Compound Area

In addition to the temporary and permanent Project Site facilities to be provided by Purchaser for use by Siemens, a compound area must be provided with at least one and one half (1 1/2) acres of space for the following items, which are to be considered as typical, but will depend on the size and logistics of the Project Site:

- Parking area for a minimum of fifteen vehicle
- 20 ft container for tools
- 40 ft container for spare parts
- 20 ft container for Hazardous Materials
- 10 ft power station
- Fuel area for forklifts

The list above is valid for Project Sites where up to fifty (50) Wind Turbine Generators are to be installed.

7. Trial Run

At the expense of Purchaser, a transportation trial run shall be carried out at the earliest time following completion of the Project Site roads. The type and configuration of the vehicle used for the trial run shall be agreed between Purchaser's Project manager and Siemens' Project manager. Any areas which require modification or upgrading based upon the trial run shall be agreed between Purchaser's Project manager, Siemens' Project manager and the Siemens transportation Subcontractor, and shall be completed at the expense of Purchaser prior to commencement of Delivery of the Unit components.

O

Cultural Resource Analysts, Inc., Archaeological and Architectural Work Plans

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February 9, 2011

Mr. David M. Snyder
Ohio Historical Preservation Office
1982 Velma Avenue
Columbus, OH 43211-2497

RE: Black Fork Wind Energy LLC's Architectural Work Plan and Phase I Archeological Survey Work Plan

Dear Mr. Snyder:

Enclosed are the Work Plans for completing a Phase I Archeological Survey and Architectural Survey for the proposed Black Fork Wind Energy Project in Crawford and Richland Counties. Black Fork Wind Energy, LLC plans to submit these work plans as part of our Ohio Power Siting Board (OPSB) permit application within the next few weeks.

If you have any questions regarding this project or require additional information, please feel free to contact me at (434)202-6708. We look forward to your feedback and to working with the Ohio Historical Preservation Office during the development of this project.

Sincerely,

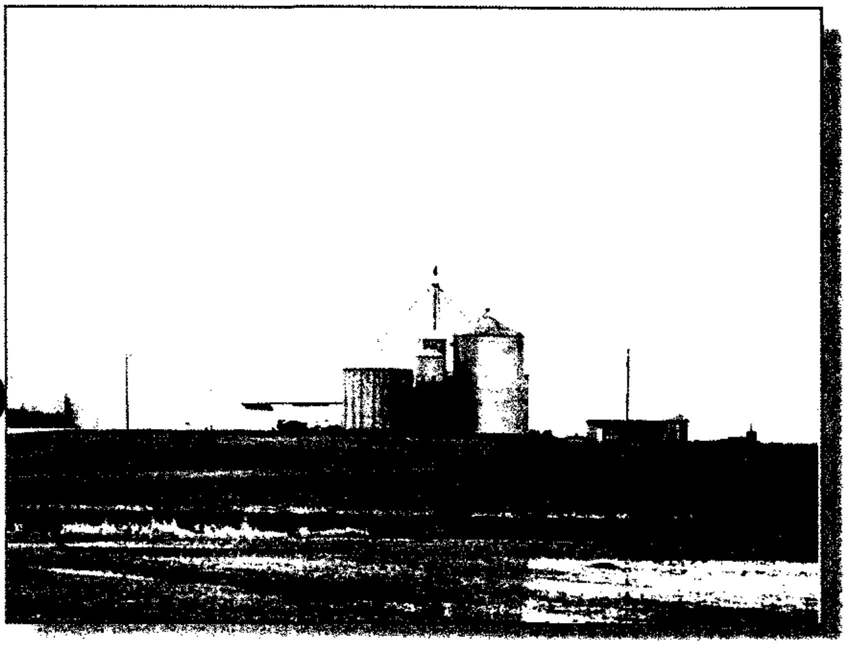
Scott A. Hawken

Scott A. Hawken

Enclosures: *Work Plan for Completing a Phase I Archaeological Survey*
Work Plan for Completing an Architectural Survey

Contract Publication Series WV11-001

WORK PLAN FOR COMPLETING AN ARCHITECTURAL SURVEY FOR THE PROPOSED BLACK FORK WIND FARM IN CRAWFORD AND RICHLAND COUNTIES, OHIO



by

Elizabeth G. Heavrin

Prepared for

Element Power US, LLC

elementpower

Ohio Power Siting Board

Prepared by

cultural resource analysts, inc

Lexington, KY | Hurricane, WV | Berlin Heights, OH
Evansville, IN | Longmont, CO
Mt. Vernon, IL | Sheridan, WY | Shreveport, LA

Contract Publication Series WV11-001

WORK PLAN FOR COMPLETING AN ARCHITECTURAL SURVEY FOR THE PROPOSED BLACK FORK WIND FARM IN CRAWFORD AND RICHLAND COUNTIES, OHIO

By

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CRA Project No.: W10E005

Karen E. Hudson

Karen E. Hudson
Principal Investigator

February 2, 2011

Lead Agency: Ohio Power Siting Board

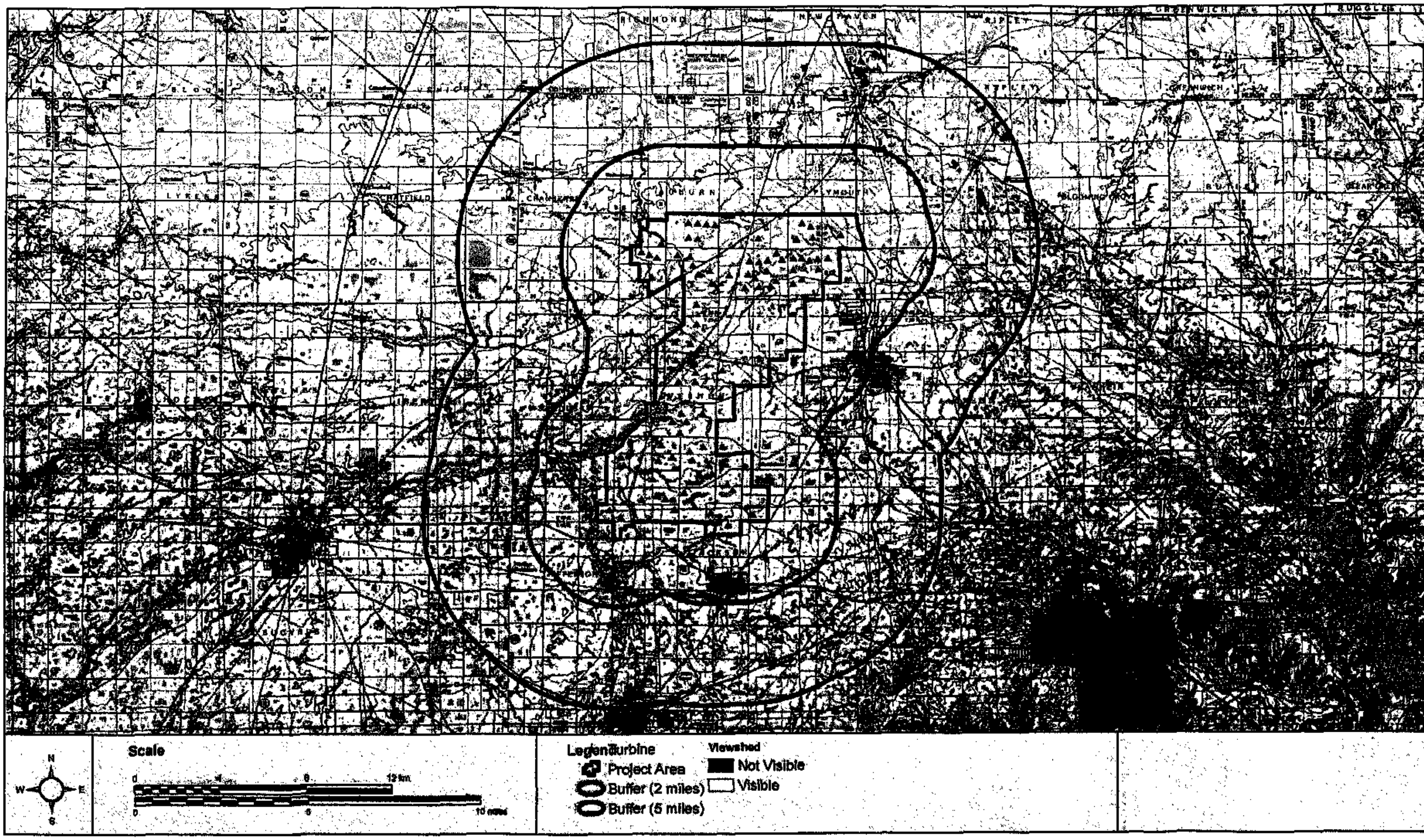

Figure 2. Topographic map depicting the Project Area and Survey Area.

TABLE OF CONTENTS

LIST OF FIGURES

I. INTRODUCTION

Cultural Resource Analysts, Inc. (CRA), developed the following work plan for the completion of an architectural survey to comply with Ohio Power Siting Board (OPSB) requirements for the construction of the up to 91 turbine Black Fork Wind Farm (Project) in Crawford and Richland Counties, Ohio. The work plan establishes a survey methodology for the identification and evaluation of character-defining historic resources with potential to be impacted by this project. The work plan was written at the request of Element Power US, LLC.

Project Location and Description

Black Fork Wind Energy, LLC (Applicant), a subsidiary of Element Power US, LLC, proposes to construct and operate the Project, a wind-powered electric generation facility to be located in Richland and Crawford Counties, Ohio (Figure 1). The Generation Facility will consist of up to 91 wind turbines and will have a maximum nameplate capacity of 200 megawatts (MW). In addition to the turbines, the Generation Facility will also include access roads, electrical collection lines, construction staging areas, a concrete batch plant, a substation, switchyard, and an operation and maintenance (O&M) facility.

Currently, the Applicant intends to utilize up to 91 Vestas V100 turbines (or comparable machines), each with a 1.8 MW nameplate capacity. The total generating capacity for these turbines is 163.8 MW. While the Vestas V100 turbine is the preferred turbine model, the Applicant has considered a variety of other turbine models, ranging from 1.6 MW up to 2.3 MW turbine models. The project layout will be the same regardless of the final turbine selection. Each Vestas V100 turbine will consist of an enclosed monopole support tower, a nacelle at the top of each tower containing the electrical generating equipment and transformer, and a three-bladed rotor 100 m (328 ft) in diameter and centered 80 or 95 m aboveground. The maximum height of each turbine will be 130 to 145 m (424 to 476 ft) when the rotor blade is at the top of its rotation. If an alternative turbine is selected, the rotor diameter could be 101 m (331 ft) and the hub height could be up to 100 m (328 ft).

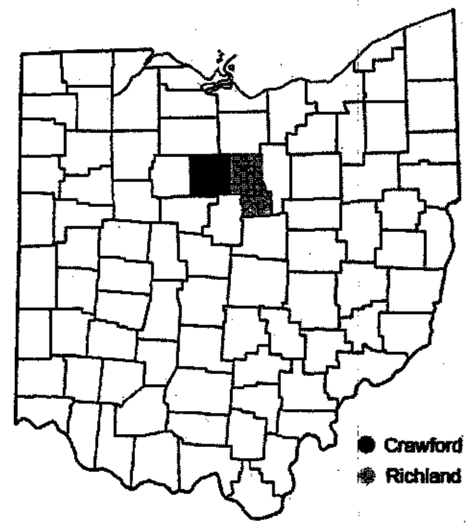

Figure 1. Map of Ohio showing the locations of Crawford and Richland Counties.

Based upon guidance from the OPSB and the OHPO, a 5 mi buffer surrounding the Project will be investigated to identify the presence of historic resources that have the potential to be impacted by this Project. For the purpose of this work plan, the polygonal area in which up to 91 turbines will be located is referred to as the Project Area, and the entire Project Area and surrounding 5 mi buffer is called the Survey Area. The Survey Area encompasses the eastern portion of Crawford County, including the communities of Tiro, New Washington, Sulphur Springs, North Robinson, Leesville, Crestline, and the northern outskirts of Galion, and the western portion of Richland County, including the communities of Plymouth, Shiloh, Shelby, and Bethlehem. The Project Area where the turbines are to be sited is very rural and includes the small rural community of West Liberty (Figure 2).

Purpose of this Study

The Project will be regulated by the OPSB under Chapter 1551 of the Ohio Revised Code and Chapters 4906-1 to 4906-17 of the Ohio Administrative Code. Chapter 4906-17-08 (D) Cultural Impact directs the identification of historic landmarks located within 5 mi of the proposed facility. Research to identify known historic resources within the Survey Area revealed that previous cultural resource investigations in this area have been fairly limited in number and geographic coverage. A field survey will be required to identify character-defining historic resource types in the Survey Area and to assess the potential impacts of the proposed project on these aboveground resources.

In November 2010, the Applicant retained CRA to prepare a work plan for an architectural survey for the project. During early December, CRA staff familiarized themselves with the proposed project by conducting a windshield survey of the Project Area, updating the literature review for the Survey Area completed in 2009, consulting historic maps of the Survey Area, and completing additional research at the OHPO and the Marvin Memorial Library in Shelby. In addition, on September 22, CRA and the Applicant participated in a meeting with OHPO to clarify the purpose, goals, and expectations for the architectural survey. The results of these efforts are summarized in the following sections.

II. BACKGROUND INVESTIGATIONS

Before developing a project-specific methodology, CRA completed a records review, windshield survey, and additional historic research to gain a better understanding of the Project Area and develop a local context to aid in the identification of character-defining historic resources.

Records Review

In August 2009, CRA conducted a records review for this project. This study provided a general overview of known aboveground resources located in the Survey Area and included in the Ohio Historic Inventory (OHI) and National Register of Historic Places (NRHP) files at the OHPO. The preliminary records review identified 296 aboveground resources including 15 individual buildings and 1 district listed in the NRHP, 47 contributing elements of the listed district, 11 resources that have been determined eligible for NRHP listing, 106 OHI resources that have been determined not eligible for NRHP listing, and 117 OHI resources for which NRHP eligibility has not been evaluated. In addition, the Ohio Genealogical Society (OGS) has recorded 88 cemeteries within the Survey Area. While the records review conducted in 2009 only listed those OHI properties located in the Project Area, an update of the records review conducted in December 2010 identified all of the OHI properties located in the larger Survey Area. Including those properties previously mentioned, there is a total of 326 OHI properties located in the Survey Area that have been determined ineligible or for which eligibility has not been assessed. No additional NRHP-listed or eligible properties were identified at this time. Tables listing these resources are included as Appendix A. Maps and photographs depicting the NRHP-listed and eligible properties observed by CRA in 2009 are included as Appendix B. Additional information regarding the current condition of these properties, particularly the Shelby Historic District, is included in the discussion of the 2010 windshield survey.

Following a review of the OHI and NHRP files, CRA visited the OHPO to examine all available historic/architecture reports for previous investigations in the Survey Area. It was discovered that a countywide survey was conducted in Crawford County during the summer of 1985 (Kane and Wilson 1985). It is estimated that the survey covered approximately18 percent of the county, with a concentration in the communities of Galion, Crawford County's largest city, and Bucyrus, the county seat. The survey report includes an overview of the county's history, discussion of each of the major thematic associations identified by the OHPO, a summary of the survey results for each of the townships and towns studied, and brief discussion of some important property types in the area. This information was utilized in the development of the historic context section of this report. No similar countywide survey was identified for Richland County.

Most of the other survey work that has occurred in the area has been associated with the relocation of U.S. Route 30 through southern Crawford County and central Richland County. The *Literature Review and Reconnaissance Survey for the Proposed Relocation of U.S. Route 30 through Crawford and Richland Counties, Ohio* completed in 1996 by Archaeological Services Consultants, Inc. (Gibbs et al. 1996) includes a historic context of the area, a brief overview of the 131 pre-1944 architectural resources identified, and more detailed descriptions of six properties that are potentially eligible for listing in the NRHP.

Three additional survey reports were identified in OHPO's files. These include *RIC-CR 133-0.96 PID 20159 Lexington-Springmill Road Phase I History/Architecture Survey Report Troy Township Richland County, Ohio* (Darbee 1999); *Phase I Cultural Resources Survey of Approximately Twenty-Two Acres of Land for a Proposed Economic Development Project in the City of Crestline, Jackson Township, Crawford County, Ohio* (Haywood 2005); and *Phase I Cultural Resources Survey for the Proposed Ethanol Plant Near the City of Shelby in Plymouth and Cass Townships, Richland County, Ohio* (Haywood 2006). These surveys covered relatively small areas and did not yield significant information that aided in the development of this work plan.

Windshield Survey

Following the records review, CRA conducted a windshield investigation of the Survey Area in order to gain a better understanding of the character of the area, begin to identify potentially important property types, and develop appropriate survey strategies for identifying important historic places that may be impacted by the proposed project. An architectural historian drove most of the rural roads within the Project Area and visited each of the towns located in the 5 mi buffer. Observations from the windshield survey are described below, while recommended survey strategies are included in the Research Design and Methodology section.

Project Area

The Project Area is highly rural in character. It includes no major towns and only three small communities. The landscape ranges from very flat to gently rolling. Most of the properties that are over 50 years of age are farmsteads (Figure 3). Some newer houses are found in the rural regions, but there are no significant concentrations of modern development. Although observed in late autumn when there were no crops in the fields, it appears that corn is the primary agricultural product of this area. Large grain bins are found on many of the farmsteads (Figure 4). Older barns are generally of the English or three gable types (Figure 5). Most of the residences observed appear to date after 1850 during the boom years when the railroads brought great growth and prosperity to this region. The most distinguished houses often exhibit Italianate massing and detailing, typical of this period (Figure 6). I-houses, including examples with two front doors, and gabled ells are common forms. An earlier and rarer house type found in the area is the New England one-and-a-half, sometimes exhibiting Greek Revival influences. Common early twentieth-century residences were also observed, including American foursquares and bungalows. The majority of the residences are of frame construction and have experienced typical alterations including the application of vinyl or aluminum siding. In addition to residences, small rural cemeteries, often situated on the top of a small rise, are common features of the rural landscape (Figure 7).

Figure 3. A two-door I-house and English barn located on Route 61 east of Bethlehem.

Figure 4. Typical grain bins located near the intersection of Route 39 and Baker Road.


Figure 5. A typical three-gable barn located on Leestown Road near its intersection with Old Lincoln Highway.

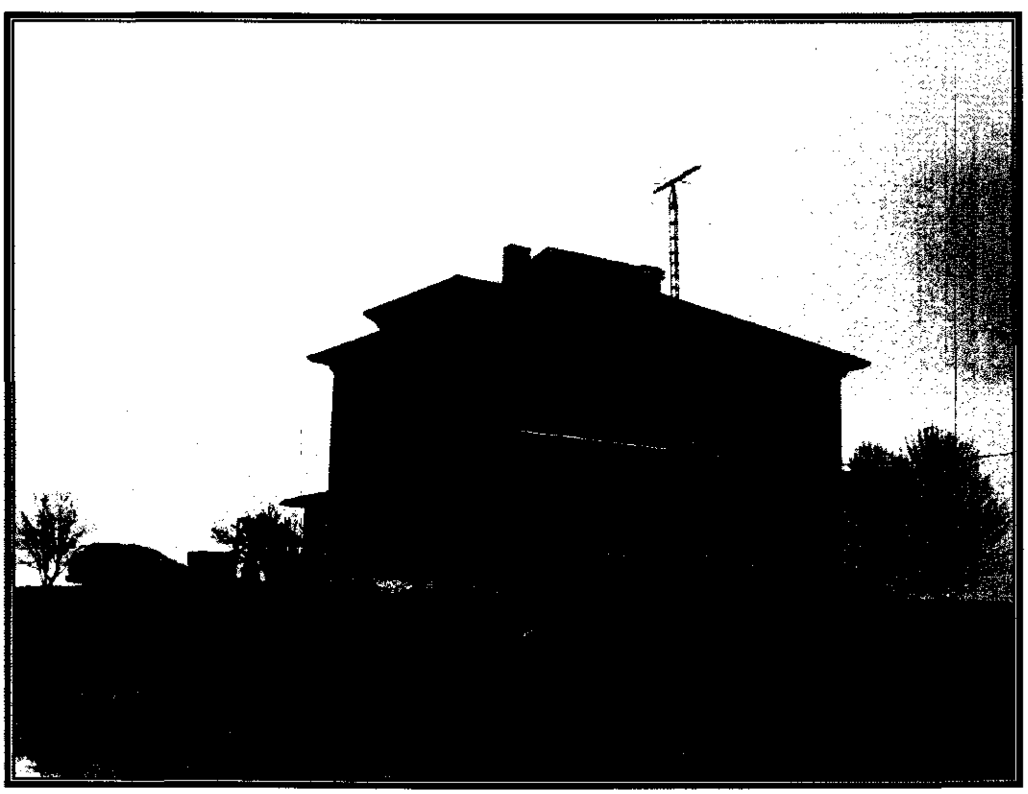
Figure 6. An Italianate house located near the intersection of Kuhn and London Roads.

Figure 7. A rural cemetery located at the intersection of Settlement and Hummell Roads.

West Liberty: West Liberty is a tiny community at the intersection of Routes 598 and 96 on the west edge of the Project Area. Today the community consists of a few residences, most of which lack integrity, and the one-story, front-gable, framed Vernon Township Hall (Figure 8).

5 mi Buffer

Most of the area included in the 5 mi buffer displays an agricultural character similar to the Project Area. In much of Richland County and in the part of Crawford County around Sulphur Springs, the topography of the buffer area is more dramatically rolling than that of the Project Area, while the other sections are generally flat. A number of notable communities are located in the buffer area, ranging in size and character from small crossroads communities, to substantial villages, to small cities. Each is described below.

Bethlehem: The small community of Bethlehem is located east of the Project Area in Richland County. It consists of the Sacred Heart of Jesus Church and associated buildings. The impressive 1895 Gothic structure is listed in the NRHP (Ref. # 86000035) and serves as a monumental feature on the landscape.

Tiro: The community of Tiro is located directly west of the Project Area in Crawford County. It is oriented in a linear manner along Route 39 at its intersection with the Pennsylvania railroad lines (Figure 9). Today the community is primarily residential with two churches and one commercial building. Most of the residences are gabled ells or two-story blocks with hip roofs, reflecting the community's primary period of growth after 1874. The community as a whole appears to lack integrity due to the predominance of replacement materials on the residences.

Shelby: The city of Shelby is located east of the Project Area in Richland County. The city is located at the junction of the Sandusky, Mansfield & Newark Railroad (later part of the Baltimore and Ohio Railroad) and the Cleveland, Columbus, and Cincinnati Railroad (later part of the New York Central Railroad). Shelby Steel Tube Co., established in 1891 as

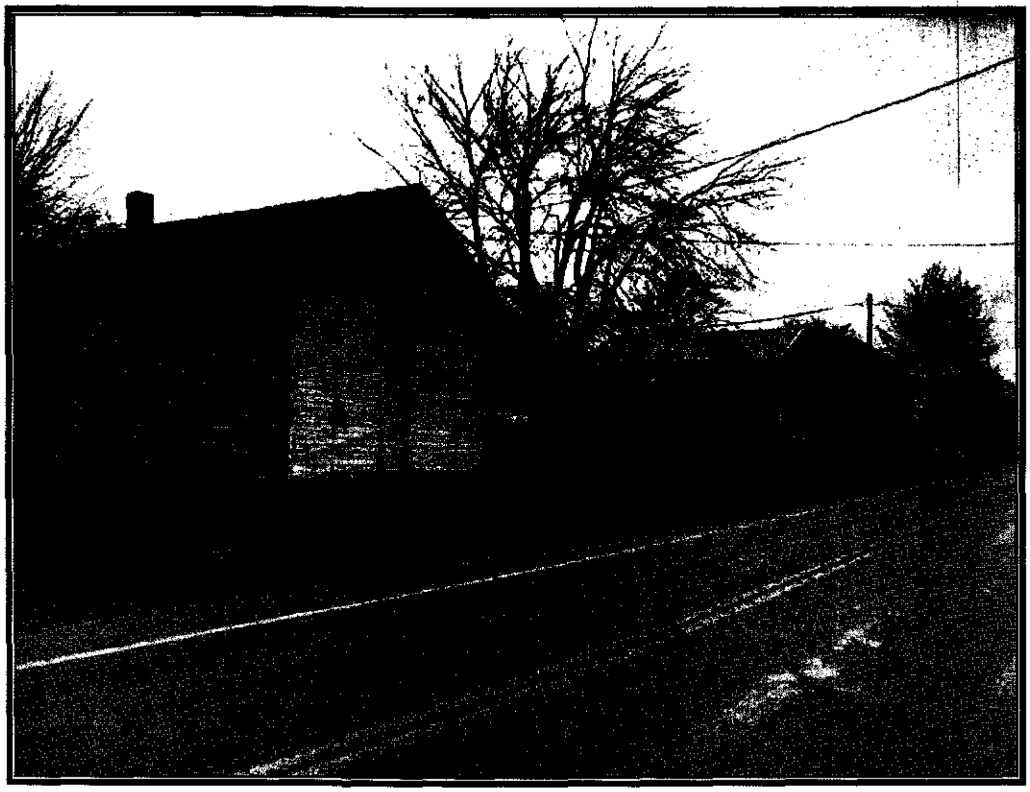

Figure 8. Overview of West Liberty showing the Vernon Township Hall.

Figure 9. View north near the intersection of Main Street and Hillborn Avenue in Tiro.

the first manufacturers of seamless steel tubes, has long been the city's largest employer (Barlow 1979). Today Shelby consists of a large historic commercial center surrounded by nineteenth and early twentieth-century residential development. The city also features some new commercial development, including a few buildings on the fringes of the historic district and a suburban commercial corridor along Mansfield Avenue; newer residential development on the outskirts of town; and modern amenities including a hospital and an airport, both on the west side of the city.

The Shelby Center Historic District, as described in the 1979 nomination, consists of 47 contributing buildings. As stated in the nomination,

> The Shelby Center Historic District is a grouping of primarily late nineteenth century commercial buildings that survive largely intact...Few communities in North Central Ohio have such a concentration of late nineteenth century buildings, while larger cities, such as nearby Mansfield, have demolished so many of their older commercial buildings that it is impossible to achieve the sense of a nineteenth century commercial environment, as exists today in Shelby. What is particularly remarkable about downtown Shelby is its density of development [Barlow 1979].

Although Shelby has experienced some changes since the time when this as written, it remains a dense collection of historic commercial architecture (Figures 10–11). Since 1979, it appears that only four of the contributing buildings have been demolished, including the Dutch Inn building (RIC0044605), H. J. Birer building (RIC0010505), Browning building (RIC0044205), and Seltzer Electric building (RIC0043405). A parking lot, a modern City Hall, an Edward Jones Investment building, and a Memorial Park now occupy these spaces. Among the surviving buildings, many have experienced alterations to their historic storefronts including changes in fenestration and the addition of fixed awnings. Some of these changes predate the NHRP nomination. Although many of these alterations have been insensitive in nature, preliminary observations suggest that district as a whole retains sufficient historic materials and design features to remain clearly identifiable as a locally significant late nineteenth-century commercial center (Figure 12).

The 1979 nomination remarks that the city of Shelby certainly contains additional historic resources that lie outside of the boundaries of the district, but that these resources are scattered and generally lack the significance of the central commercial district. Field observations in 2010 support this claim. While the downtown core is surrounded by extensive nineteenth and early twentieth-century residential development, there is no distinct concentration of particularly grand or architecturally noteworthy dwellings that would merit consideration as a NRHP district. Almost all of the residences are of frame construction, and most have experienced typical alterations including the application of vinyl or aluminum siding and the replacement of window sashes (Figure 13).

Crestline: The city of Crestline is located south of the Project Area in Crawford County. Crestline was established in 1851 after the coming of the railroad to this region; it later became a division terminal of the main line of the Pennsylvania system and a stop on the Cleveland division of the New York Central lines, making it a major rail hub (Ferree 1912). As described in the 1985 survey of Crawford County, urban redevelopment projects, including construction of a large railroad overpass, have destroyed most of the historic commercial buildings in Crestline's downtown (Figure 14). Today the central intersections of Main Street with Thoman and Seltzer Streets are marked by modern commercial development including a McDonalds, drug stores, and gas stations (Figure 15). Only a few scattered historic commercial buildings survive on Seltzer Street (Figure 16). Crestline does maintain a number of impressive churches, including the NHRP-listed Methodist Episcopal Church (Ref. # 78002031), the NRHP-eligible Calvary Reformed Church (Ref. # 65004828), and First United Methodist Church (Ref. # 65004829), all located on Thoman Street. The city also appears to retain extensive nineteenth and early twentieth-century residential neighborhoods surrounding the downtown (Figure 17). Additional fieldwork would be required to identify any potential residential historic districts in Crestline.

Figure 10. Overview of the Shelby Center Historic District from the intersection of Main and Gamble Streets.

Figure 11. Overview of the Shelby Center Historic District on E. Main Street near the railroad tracks.

Figure 12. View toward the proposed Project Area taken from near the western edge of downtown Shelby.

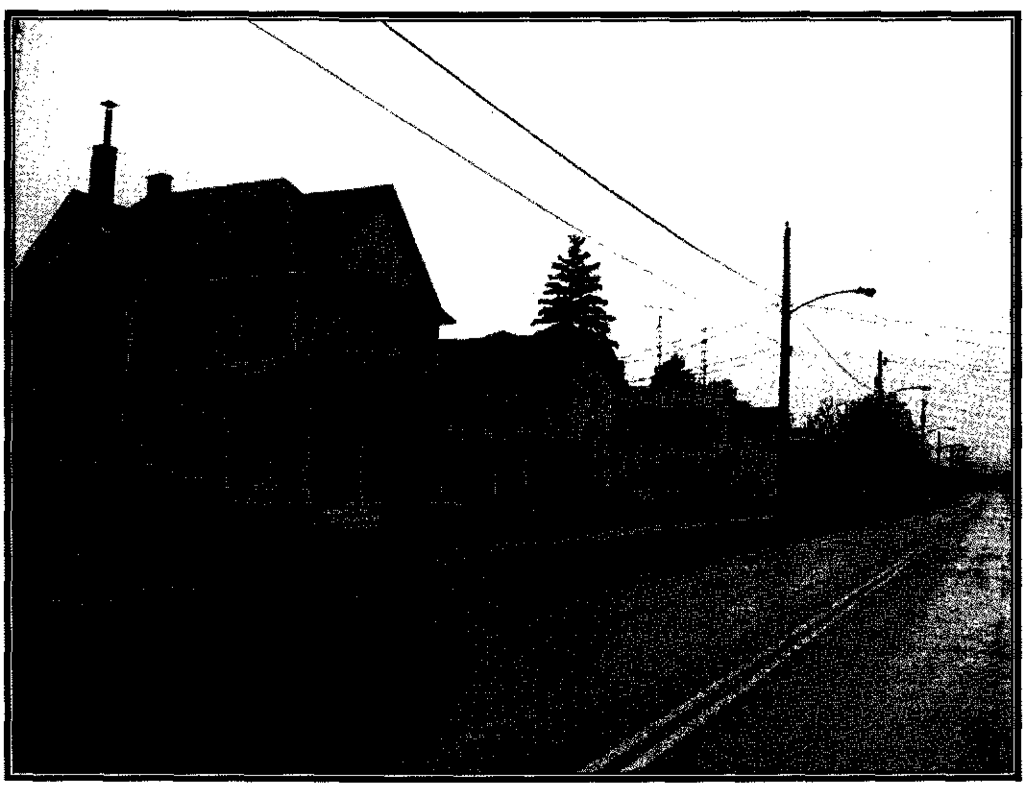

Figure 13. An overview showing typical residences in Shelby located on E. Main Street.

Figure 14. View of the railroad overpass located on Thoman Street in downtown Crestline.

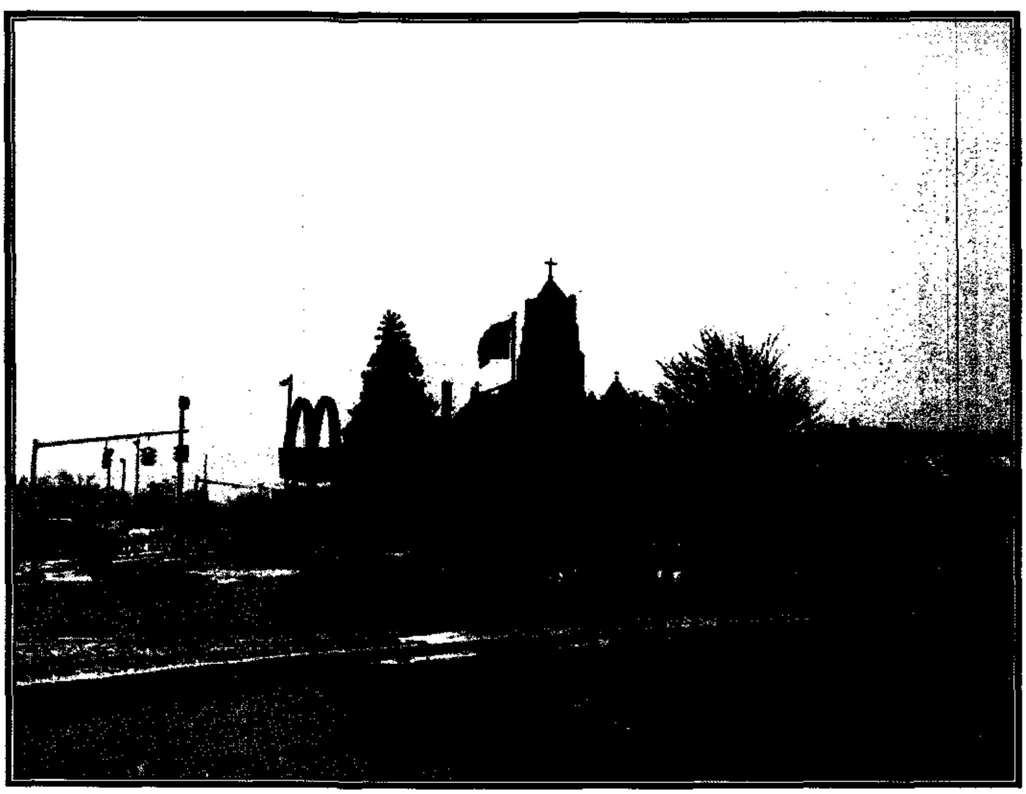

Figure 15. View east near the intersection of Main and Thoman Streets in Crestline.

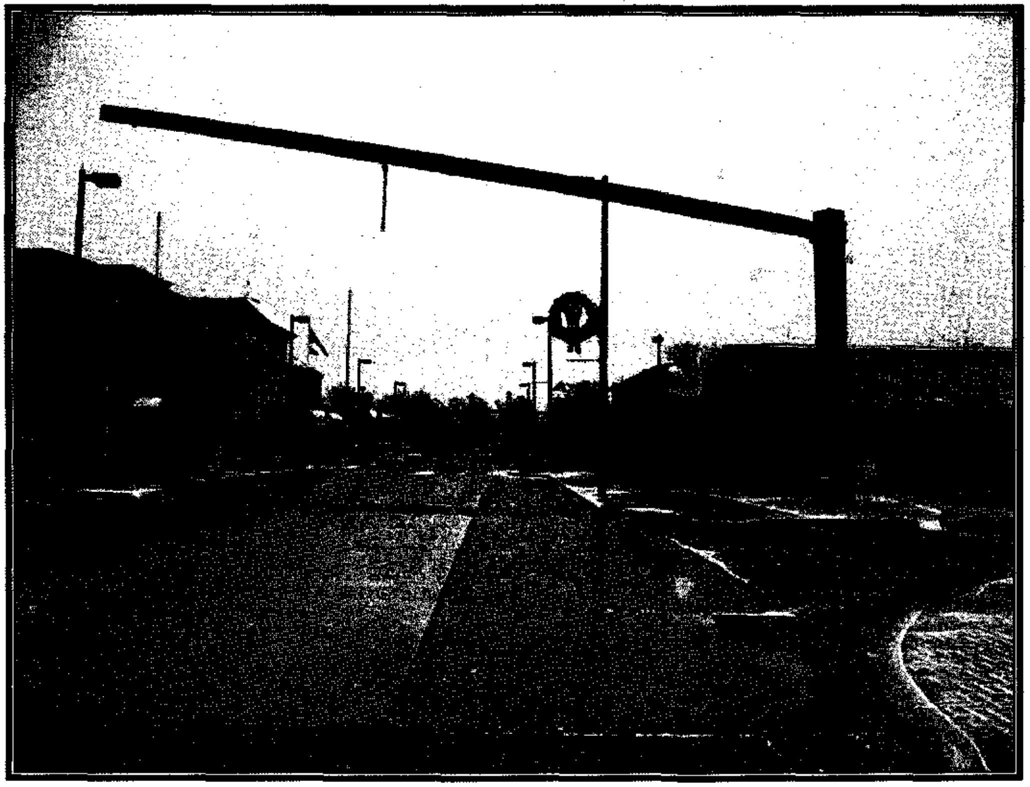

Figure 16. Overview of surviving commercial buildings on Seltzer Street in Crestline.

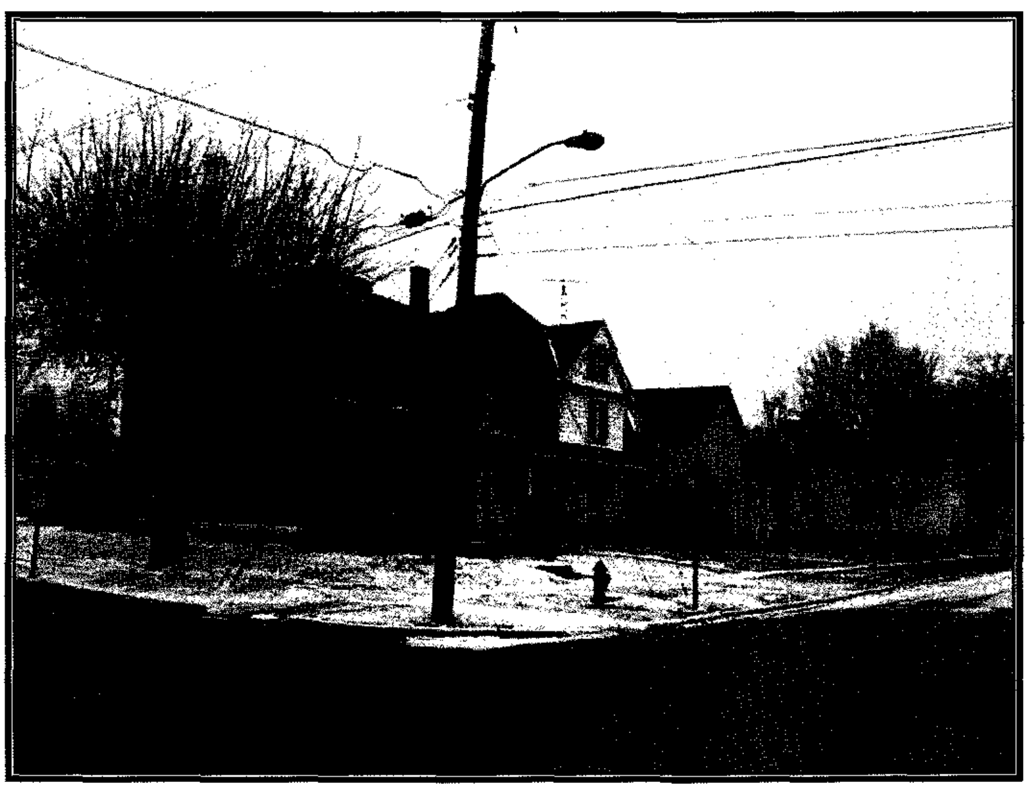

Figure 17. View of residences located near the intersection of Wiley and Bucyrus Streets in Crestline.

Galion: The city of Galion is located directly south of Crestline on the southern edge of the 5 mi buffer. Galion was one of the earliest settlements in Crawford County and later became a major railroad center. The 1985 survey of Crawford County surveyed 124 properties in Galion and identified two potential NRHP-eligible historic districts: a residential district containing many fine Italianate houses located on Harding Way west of Union Street, and a commercial district including the public square located on Harding Way between Union Street and the Conrail lines (Kane and Wilson 1985:9-10). Neither of these areas falls within the Survey Area for the current project. The small area in north Galion that does fall within the survey boundaries contains modest mid-twentieth-century houses. This area does not appear on the map of Galion depicted in the 1912 Atlas of Crawford County (Hopley 1912). Based on information available through the Crawford County Auditor's website, most of these residences were constructed in the decade following World War II (Figure 18).

Leesville: The village of Leesville is located west of Crestline at the intersection of Route 598 and Leesville Road. Established in 1829, the town was an important trading post in the early years of settlement of Crawford County (Ferree 1912). Unlike most of the other communities in this area, Leesville is not situated on a railroad line, so it did not flourish in the mid to late nineteenth century as did nearby Crestline and Galion. The small village contains four NRHP-listed properties including the J&M Trading Post (Ref. # 79002811), J&M Trading Post Annex (Ref. # 79002809), Leesville Town Hall (Ref. # 79002810), and Col. Crawford's Capture Site (Ref. # 79002812) (Figure 19). The community also includes an early twentieth-century school building and a collection of vernacular houses, including several I-houses (Figure 20). While the NRHP-listed properties appear to retain integrity, most of the residences have experienced typical alterations including the application of vinyl or aluminum siding and replacement window sashes.

Figure 18. View toward the proposed project location from Market Street near the edge of the 5 mi buffer on the northern outskirts of Galion.

Figure 19. View near the intersection of Leesville Road and Route 598 including the J&M Trading Post.

Figure 20. Overview of residences on Leesville Road.

North Robinson: The village of North Robinson is located west of Leesville where the Penn Central line crosses Route 602. Laid out in 1861, the small community contains a village hall and fire department building, the North Robinson United Church, large grain bins situated by the railroad tracks, and several modest frame dwellings (Figure 21). The church is the finest building in town, while most of the dwellings have experienced typical alterations including the application of vinyl or aluminum siding and replacement window sashes. An early twentieth-century school building is located on the campus of modern elementary, intermediate, and high schools just south of town.

Sulphur Springs: The community of Sulphur Springs, originally called Annapolis, is located approximately half way between North Robinson and New Washington in Crawford County near the western boundary of the 5 mi buffer. The community is roughly triangular in shape, bounded by Route 98 to the northwest, Sandusky Street to the South, and East Street to the east. Founded in 1833, it contains houses representing a variety of stylistic influences including Greek Revival, Gothic Revival, and Italianate. Two-door dwellings were also observed (Figure 22). Other notable buildings include the brick Our Mother of Perpetual Help church, the frame Hope United Church of Christ, and a small early twentieth-century service station (Figure 23). Although some individual buildings lack integrity, Sulphur Springs evokes a strong sense of place due, in part, to its inwardly focused orientation on the rolling landscape.

New Washington: The village of New Washington is located north of Sulphur Springs at the intersection of Routes 103 and 602. Located on the Mansfield, Coldwater, and Lake Michigan Railroad, later part of the Pennsylvania system, New Washington was founded in 1833 and incorporated in 1874. In 1912 it was the fourth town in Crawford County in terms of wealth and population (Ferree 1912). Most of the village's buildings date to the period following the coming of the railroad in the mid-nineteenth century through the flourishing of the poultry hatchery business in the early twentieth century (Kane and Wilson 1985:11). These include a central commercial district, a number of churches, and houses ranging from the modest to large, finely detailed examples (Figures 24-25). The storefronts of many of the commercial buildings have been insensitively altered, and many of the dwellings exhibit replacement materials, but several resources possessing historic integrity survive. Large grain bins and some other industrial buildings are located near the railroad tracks. Mid to late twentieth century residential development is found on the outskirts of town along the roads leaving the village, while a few newer commercial establishments are located near the center of the community.

Plymouth: The village of Plymouth is located north of Shelby on the border of Richland and Huron counties at the intersection of Routes 61/98, 603, and Baseline Road. The town, founded in 1815 and incorporated in 1834, is located on the Baltimore and Ohio Railroad in a prosperous agricultural region (Andrea 1873, Richland County Chapter 70 1965:18). Early maps of the town indicate the location of a public square at the central intersections of the village (Mesnard 1891); this is still indicated today by the arrangement of nineteenth and early twentieth-century commercial buildings oriented to the intersection (Figure 26). Although some of the storefronts have experienced unsympathetic alterations, many of the commercial buildings retain historic integrity, and the feeling of the commercial center is enhanced by historic streetlights (Figure 27). Many of the finest houses surrounding the downtown core exhibit Italianate massing and detailing, reflecting the town's growth following the coming of the railroad.

Shiloh: The village of Shiloh is located southeast of Plymouth on Route 603 at its intersection with the Penn Central line. The town was established at this site on the Cleveland, Columbus, Cincinnati, and Indianapolis Railroad in 1852 as New Salem. It was renamed Salem in 1863 following Grant's victory at Shiloh, Tennessee (Richland County Chapter 70 1965:25-26). Today the village contains one block of late nineteenth and early twentieth-century commercial development located either side of the railroad tracks, a number of Italianate and vernacular style residences lining Route 603 and its cross streets, and the Mount Hope Lutheran Church (Figures 28–29).

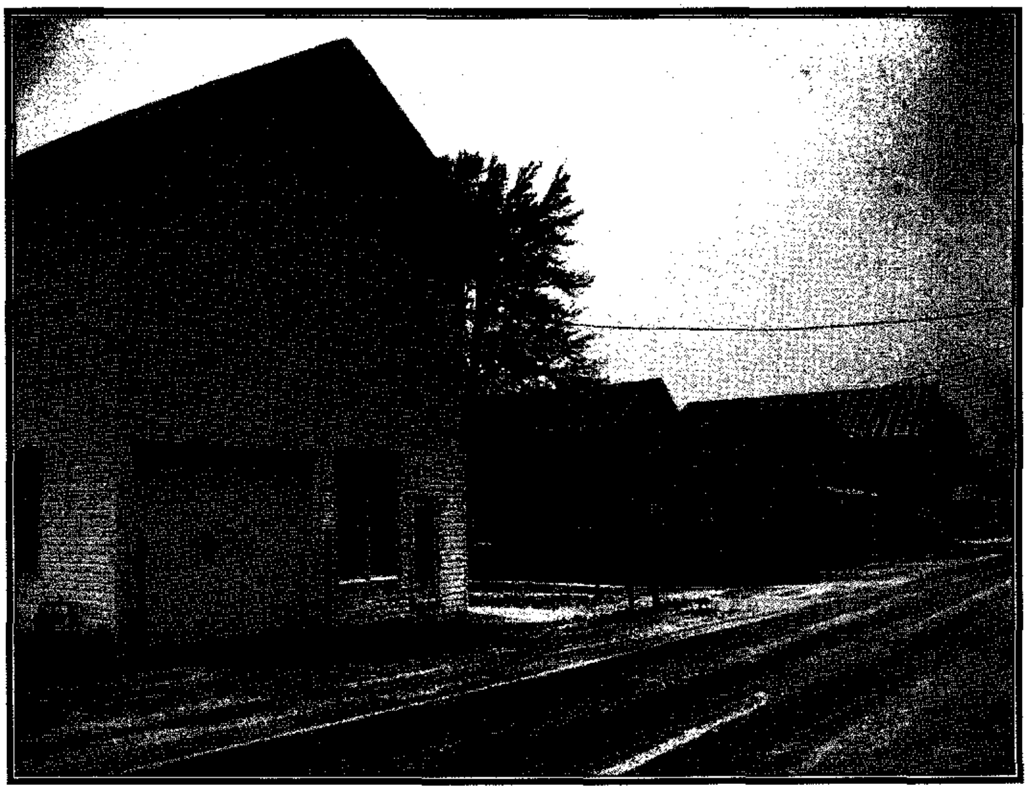

Figure 21. View of residences and the Village Hall near the intersection of Main Street and the railroad tracks in North Robinson.

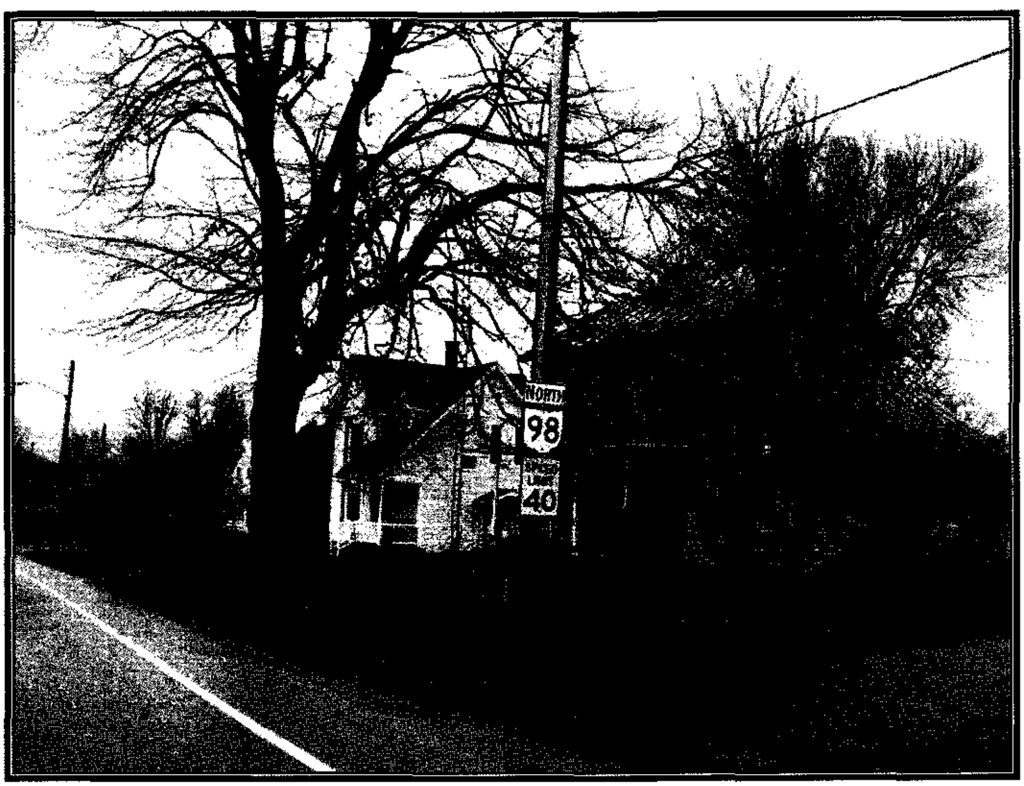

Figure 22. View of residences including a two-door I-house located on Route 98 in Sulphur Springs.

Figure 23. View of residences and the Our Mother of Perpetual Help church located on South Street in Sulphur Springs.

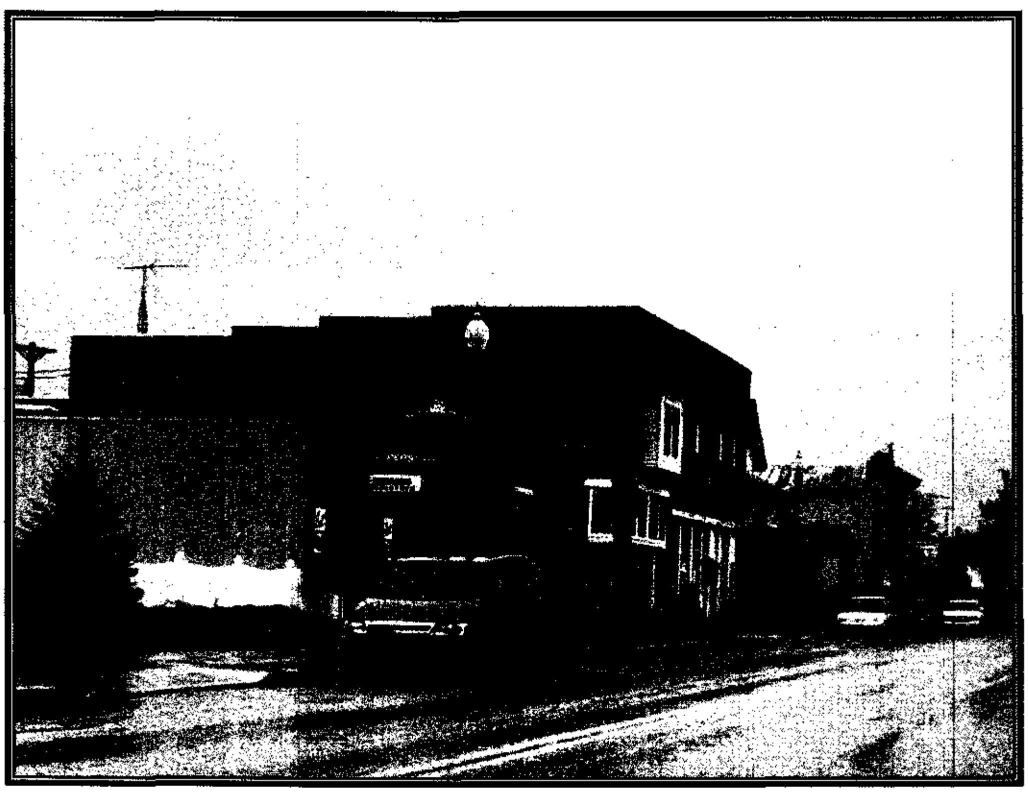

Figure 24. View of commercial buildings on Main Street in New Washington.

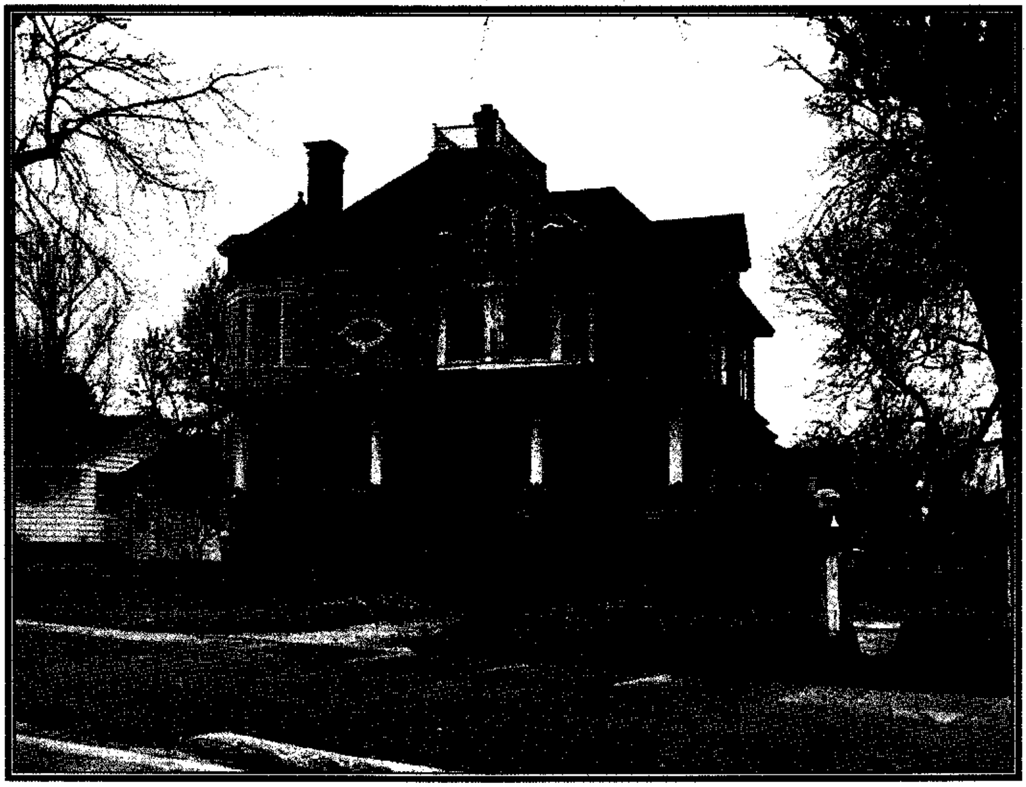

Figure 25. Example of a fine late nineteenth-century residence located at the intersection of Main and Center Streets in New Washington.

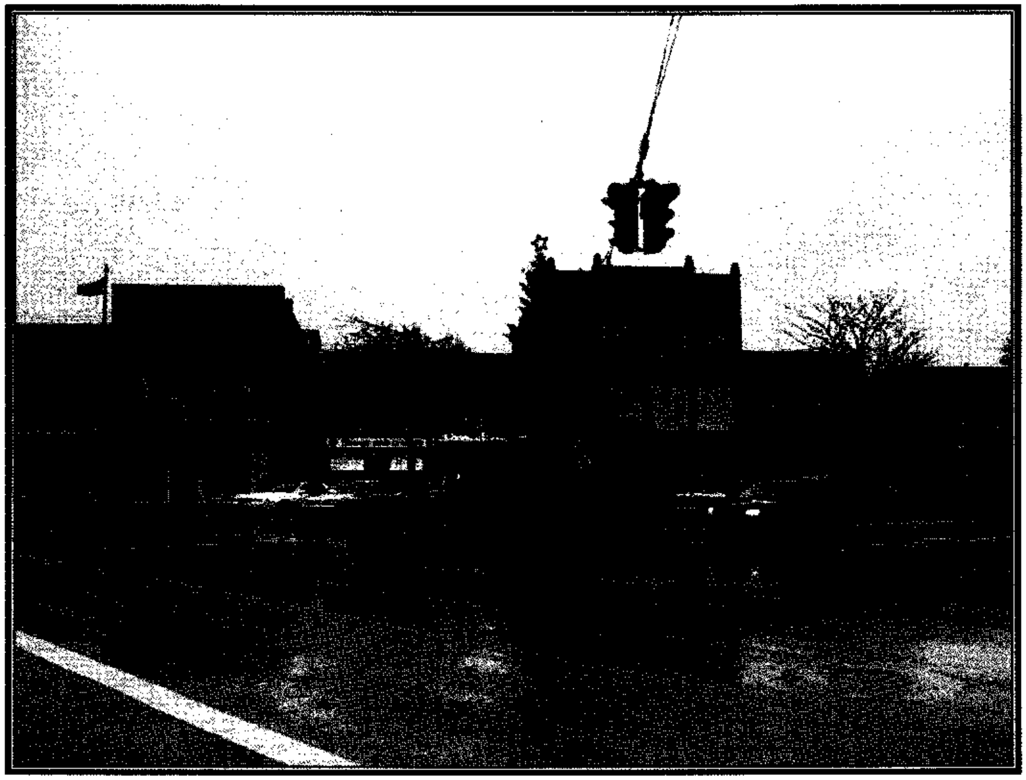

Figure 26. View of commercial buildings oriented diagonally to face the town square in Plymouth.

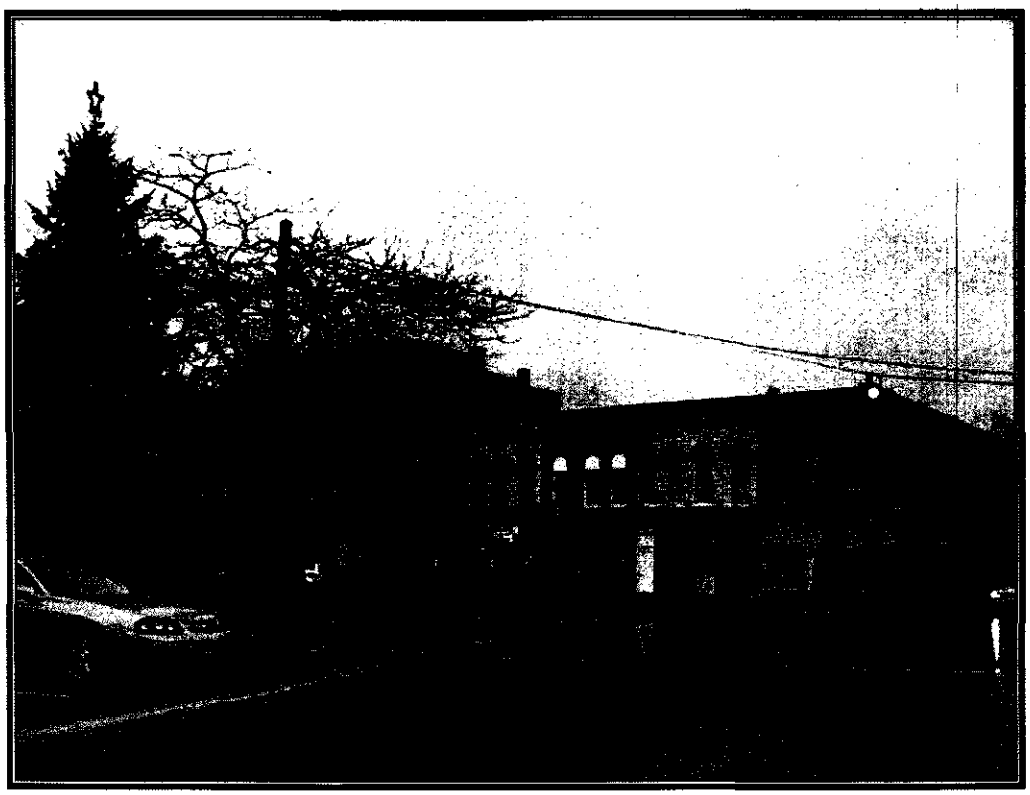

Figure 27. View of commercial buildings and historic streetlights in Plymouth.

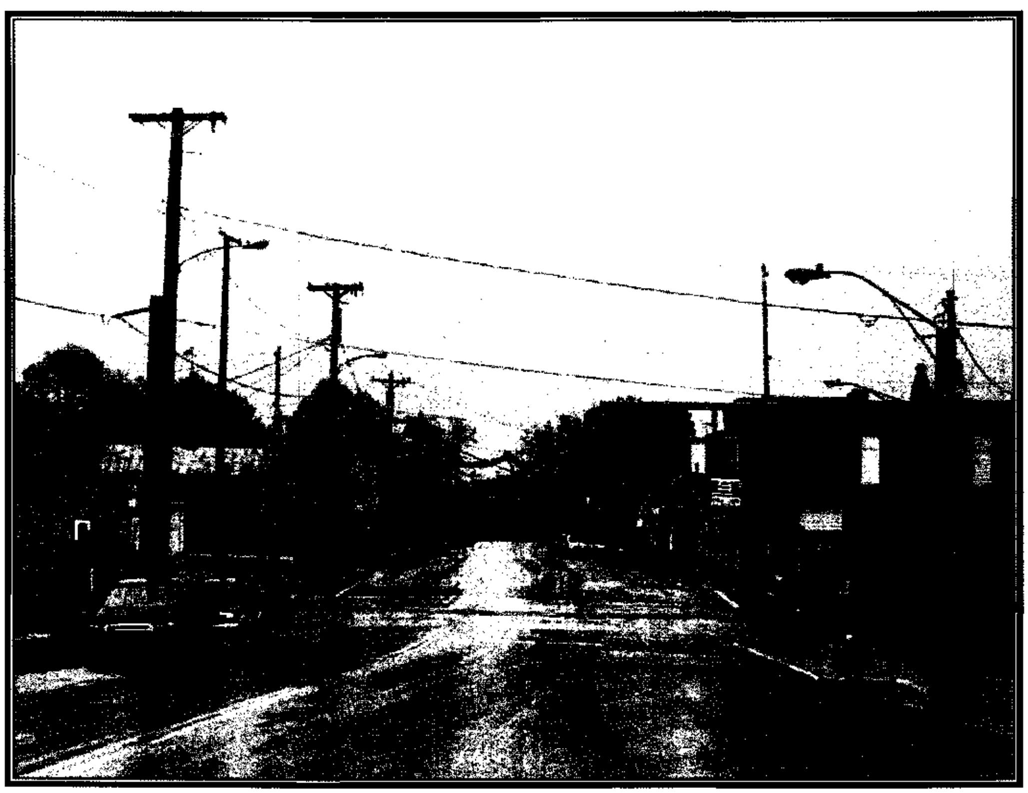

Figure 28. Overview of commercial buildings located on Main Street near the railroad tracks in Shiloh.

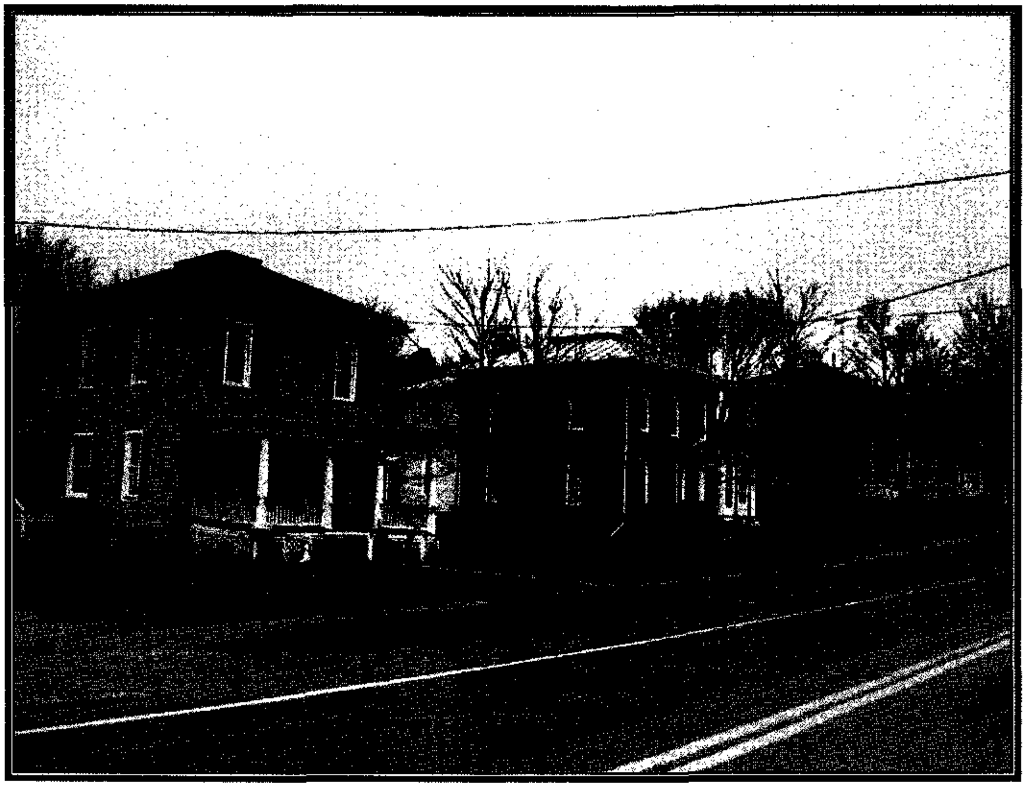

Figure 29. Italianate residences located on Main Street west of the commercial center of Shiloh.

Historic Context

Overview of Crawford and Richland County History

Prior to European settlement of northern Ohio, the area was occupied by the Wyandotte, an Iroquoian-speaking group called the Huron by the French, who hunted throughout the region and established some permanent settlements there. Notable among these settlements are Sanyendeand (Sandusky), which served as a French trading post and Wyandotte summer village from about 1755 to 1764, and Junadot, occupied on and off from 1737 until its destruction by the British in 1763 (Gibbs et al. 1996:18). The Wyandotte generally aligned with the French, whose principal interest was trade, rather than the British, who were interested in expanded settlement. They fought with the French during the French and Indian War, continuing aggressions against British settlers after the European conflict was settled. However, during the American Revolution the Wyandotte allied with the British to attack American settlements in the region. The majority of the Delaware Indians also fought against the Americans. British and Indian conflicts with the Americans continued in northern Ohio through the War of 1812, after which all of the land in the region was ceded to the United States (Gibbs et al. 1996:22-23).

Richland County, originally part of Wayne County, was established by the state of Ohio on January 7, 1813. Mansfield, which was to become the county seat, was founded five years earlier (Haywood 2006:8). The first settlers in the area that was to become Crawford County arrived during the same period, although the county was not formally established until 1820 following the "new purchase" of lands in northwestern Ohio from the Native Americans (Haywood 2005:5). Many of the earliest settlers in both counties were New Englanders who were first exposed to the region during the War of 1812 when they passed through north-central Ohio on their way to the Upper Sandusky headquarters (Kane and Wilson 1995:1-2). These early military road helped open the area to settlement, but development of the region was slow. Population growth accelerated in the 1830s with an influx of Pennsylvania Germans and German immigrants who established productive farms in Crawford and Richland Counties, growing wheat, corn, and clover, and raising livestock (Gibbs et al. 1996:28-29). Commercial centers grew around grist and saw mills that were essential for creating the products of everyday life.

The populations and economies of both counties expanded rapidly in the second half of the nineteenth century thanks to several major railroad lines passing through the area, opening new markets for the region's farmers and spurring industrial growth (Kane and Wilson 1985:1). The Cleveland, Columbus, and Cincinnati Railroad was completed through Galion in 1851; the Pennsylvania and Ohio Railroad was completed through Crestline in 1852; and the Sandusky, Mansfield, and Newark Railroad was completed through Mansfield in 1853 (Gibbs et al. 1996:29-30). Other important lines include the Pittsburg, Fort Wayne, and Chicago; the Bellefontaine and Indianapolis; and the Atlantic and Great Western. Later many of these lines were incorporated into the Pennsylvania, Baltimore and Ohio, and New York Central systems.

The enormous influence of the railroads on the region is perhaps best exemplified by the city of Crestline, which grew from a tiny farming community in 1850 to a city of 1,487 people in 1860 after the county's three major railroad lines passed through the community (Kane and Wilson 1985:22). Railroad shops in towns such as Crestline employed many people, and industrial development expanded. By 1860 Crawford County had 116 industrial establishments, and by the late nineteenth century, notable products included engines, horse powers, saw mills, and brick-making machines (Kane and Wilson 1985:11). The fortunes of many of these communities declined in the twentieth century as the influence of the railroad waned, but the region still maintains some industry, including the Shelby Steel Tube Co., founded in 1891.

Thematic Associations

Agriculture: Both Crawford and Richland counties are well suited for agriculture. The northeastern portion of Crawford County was one of the last areas in the region to come under cultivation because it was a covered with marshland; however, this area was noted for production of cranberries before the marshes were drained to make way for field crops and pastures (Kane and Wilson 1985:3). Corn, wheat, and oats were important crops in both counties in the nineteenth century; approximately 25,000 acres of each were planted in Richland County in the early 1870s. Livestock was also important to the region during that period, with 9,685 horses, 22,504 cattle, 230 mules, 69,274 sheep, 28,634 hogs recorded in Richland County (Andrea 1873). The area was also known for fruit production. Johnny Appleseed, a resident of Richland County, first promoted the planting of fruit trees here in the early nineteenth century. By the 1870s, the Richland Horticultural Society was actively involved in promoting the cultivation of fruit including strawberries, raspberries, and grapes, which did well in the region (Graham 1880). By the 1930s, major agricultural products included grains, cattle, milk, horses, and hay. Dairying decreased in the later part of the twentieth century, while production of hogs increased. Grains remained important as modern agricultural methods dramatically increased yields (Kane and Wilson 1985:4).

Potential property types associated with this theme include farmsteads dating from approximately 1830 through the early twentieth century. The majority will date to the second half of the nineteenth century. Some farms may contain important historic landscape features such as orchards. Based on initial observations, Italianate farmhouses are quite common. Historic barn types include three-gable barns and English barns. Modern grain bins are common additions. Large grain bins and grain elevators are found in some towns on the railroad lines.

Commerce: The first Europeans to engage in commercial activity in this region were fur traders. Later, in the early years of permanent settlement, whiskey was a popular traded commodity. Early businesses in the area included gristmills, sawmills, and blacksmiths, all providing basic services necessary for the establishment of an agriculture-based society. As roads were established through the region, taverns were opened to serve travelers. Commercial activity expanded exponentially following the arrival of the railroads in the 1850s. The commercial centers of the region's cities and villages were constructed during this period to house the businesses that developed in response to the railroad (Kane and Wilson 1985:5).

Potential property types associated with this theme include mid-to-late nineteenth-century and early twentieth-century brick commercial buildings located in communities that expanded rapidly in this period. As with residential architecture, the Italianate style is common. More modest frame commercial buildings may be found in smaller rural communities.

Education: The first schools in the region were established shortly after settlement and were run on a subscription basis. By the 1840s public schools were organized at the township level with one-room schoolhouses located throughout the township to serve rural residents. An 1896 law allowed for centralized township schools, and a 1914 law established the county as the prime unit for school control allowing for more flexible district boundaries that crossed township lines. Union schools were established in areas with growing populations, and these high schools began offering vocational training to better serve the needs of the students. In more rural areas schools were slow to consolidate, and the last one-room schoolhouses in Richland County did not close until 1952 during the period of countywide consolidation (Kane and Wilson 1985:7; Kane and Stacy 2002).

Potential property types associated with this theme include one-room schoolhouses dating to the mid-nineteenth century ("little red schoolhouses"), larger union schools dating to the early twentieth century (two- to three-story brick buildings), and large consolidated schools dating to the mid-twentieth century. A noteworthy example is the Morton One Room School Historical Museum, located just west of Shelby.

Ethnic/Immigration: Early settlers in the area came from New England and the Mid-Atlantic region. In the 1830s, the majority of the immigrants arriving in both counties were from Germany; immigration from this country continued throughout much of the nineteenth century. The first African American settlers in Crawford County arrived from Virginia in 1828, but they were later expelled because they could not meet a bonding requirement. Later, Quakers, Free Presbyterians, and Western Methodists in Crawford County assisted at least 500 slaves escape to freedom on the Underground Railroad. Leesville and Tiro are believed to be stations (Kane and Wilson 1985:9-10). The recent windshield survey revealed the presence of Amish and/or Mennonite residents in Richland County. To date no information has been identified regarding the history of these groups in the region. Holmes County, located two counties east of Richland, is the center of the Amish community in Ohio.

Potential property types include houses with two front doors suggesting Pennsylvania German influence; New England one-and-a-half and upright and wing houses suggesting New England influence; properties associated with the Underground Railroad; properties associated with the Amish or Mennonites.

Manufacturing/Industry: The first industries established after settlement included grist and saw mills, tanneries, potteries, oil mills, and carding mills. Quarries were also established early on, including those in Jefferson Township near Leesville and Lykens Township in Crawford County. In the 1850s, the railroads ushered in a period of industrial growth, and by 1860 Crawford County had 116 industrial establishments. By the 1880s, the area was known for its engines, horse powers, saw mills, threshers, and brick-making machines. Near the end of the nineteenth century, the first seamless tubes produced in the United States were manufactured by the Shelby Steel Tube, Co. Industrial growth continued throughout the twentieth century, but much of the new development was concentrated in the population centers of Bucyrus, Galion, and Mansfield (Kane and Wilson 1985:11-12; Stanfield 1976:29-30).

Potential property types associated with this theme include industrial facilities constructed in railroad towns after 1850.

Military: The last notable armed conflict to occur in Crawford or Richland County was the "Battle of the Plains" fought between Col. Crawford's retreating army and British and Indian forces during the Revolutionary War. A monument outside of Leesville marks the site of Col. Crawford's capture. During the War of 1812 troops passed through this region on their way to headquarters at Upper Sandusky, but no military engagements occurred here. Thousands of soldiers from the area served in the Union army during the Civil War, and soldiers from the counties have served in all subsequent U.S. wars. Groups such as the Soldiers' Ladies Aid Society, established in 1861, and the Soldiers and Sailors Relief Commission, established in 1891, have long supported Crawford County's soldiers. During World War II, the Crawford County fairgrounds were leased to the federal government for Camp Millard, which was disbanded in 1946 (Kane and Wilson 1985:13).

Potential property types associated with this theme include sites associated with early Indian and British conflicts; war memorials; and National Guard armories.

Politics/Social Welfare: Crawford and Richland Counties were established in the 1810s, but current county boundaries were not in place until 1848. In these formative decades, the seat of Crawford County was established at Bucyrus, and that of Richland County was established at Mansfield. The first public buildings constructed were a courthouse and a jail. Between 1833 and 1840, sixteen towns were platted in Crawford County. The dates of establishment of the cities and villages within the Survey Area are included in the section describing the results of the windshield survey. As the counties grew throughout the nineteenth century, new public buildings were constructed to serve the needs of an increasing population and a more complex civil society. At the same time, organizations such as the Grange, the YMCA, and fraternal lodges such as I.O.O.F. and the Masons were formed to serve the interests of the community and their members (Kane and Wilson 1985:14-16, 18).

Potential property types associated with this theme include city and township halls, firehouses, grange halls, and fraternal organization lodges.

Religion: The first preachers in Richland and Crawford Counties were circuit riders who held services in schools, homes, or outdoors in the years before permanent churches were erected. Methodists were the first and most prominent denomination to be established in the region. They were followed by Presbyterians, Lutherans, Baptists, and Catholics. Many of these groups constructed their first churches in the region between 1830 and 1840. The church played a central social and educational role in many people's lives during this period, and church aid societies and missionary societies served an important role in the local community. The Lutheran church flourished in the region by mid-century as the German population increased, and by 1859 there were 23 Lutheran churches in Crawford County. Many of the region's Catholics were also from Germany. By the late nineteenth century, many of the counties' early churches were replaced with larger brick buildings to serve growing congregations (Kane and Wilson 1985:17; McQuillin and Gillis 1985; Mattox and Howe 1978; Stanfield 1976:22).

Potential property types associated with this theme include churches dating to the mid-to-late nineteenth century during the period of population and economic growth in the region when congregations were expanding. Many of the churches observed are substantial brick buildings with some stylistic ornamentation; a few examples are quite ornate. Some earlier church may survive, particularly in more rural regions.

Arts and Recreation: Throughout much of the nineteenth century, social life and recreational activities generally revolved around church and agricultural activities. Taverns, constructed along major roadways and in trading centers, provided rest and recreation to travelers.

Entertainment halls were constructed in larger cities in the region in the mid-nineteenth century as commercial centers grew following the arrival of the railroad. In 1899, an amusement park called Saccaium Park was established in Crawford County between Galion and Bucyrus; the park flourished in the 1920s, but no remnants survive today. During the same period, semi-professional sports teams were popular in the area, and facilities for amateur athletics were constructed in the counties' population centers (Kane and Wilson 1985: 18-20).

Potential property types associated with this theme will likely date to the early-to-mid twentieth century and may include parks, golf courses, theatres, and libraries located in or near the larger towns in the Survey Area. In rural areas, some early taverns may survive as residences.

Transportation/Communication: Much of the growth of Crawford and Richland Counties is closely related to the development of the region's transportation networks. The earliest roads through the region were Indian trails and military roads cut during the War of 1812. Additional roads constructed during the settlement era connected commercial centers and linked the region to Lake Erie, one of the major routes for transporting goods to east coast markets. Stage coaches transported people along the region's turnpikes, while wagon trains hauled goods north to the lake. The first railroads in the region reached Plymouth in 1845, Mansfield in 1846, and eastern Crawford County in 1850. Several additional lines were constructed in the 1850s, many of which became parts of the Pennsylvania, New York Central, and Baltimore and Ohio systems. The railroads provided a reliable form of transportation to the east coast, the Great Lakes, and Chicago and other growing western cities, spurring increased agricultural production and industrial activity. To serve local passengers, electric streetcars were constructed in Mansfield in the 1880s, and interurban lines linked the counties' major population centers to one another and to the northern Ohio cities of Cleveland and Sandusky. The electric lines were shut down in the 1930s as automobile traffic increased. One of the most important modern roads through the region is the Lincoln Highway (U.S. 30) which passes through southern Crawford County and central Richland County. The Lincoln Highway Association, founded in 1913, was dedicated to establishing a toll-free transcontinental highway suitable for automobile traffic. In Ohio, two routes following established roadways were considered for inclusion in the highway system. Both of these routes passed through Mansfield and the Survey Area, and both were incorporated into the national road system as U.S. Route 30 north and U.S. Route 30 south. Despite its national prominence, the impact of this road on the region was small compared to the impact of the railroads in the nineteenth century. Later, Interstate 71 was constructed through Richland County in 1950s, diverting through-traffic past the county's cities and towns (Gibbs et al. 1996:31-34; Kane and Wilson 1985:21-24; Stanfield 1976:15-17).

Potential property types associated with this theme include railroad resources and Lincoln Highway resources.

III. RESEARCH DESIGN AND METHODOLOGY

In accordance with the OPSB directive, this work plan is designed to ensure that the architectural survey for the proposed Project achieves the following goals:

1. To identify buildings, structures, sites, objects, and districts located within five miles of the proposed Project Area that are of cultural or architectural significance.
2. To assess the effect of the proposed project on the preservation and continued meaningfulness of these historic places.
3. To develop recommendations for mitigating any adverse effects to historic properties.

To achieve these ends, established professional guidelines, such as *Guidelines for Local Surveys: A Basis for Preservation Planning: National Register Bulletin #24* (National Park Service 1985) and *How to Complete the Ohio Historic Inventory* (Gordon 1992) provide the basis for all of the methods proposed in this work plan. Given the large area that must be considered when conducting architectural surveys for wind farm projects, these guidelines have been interpreted and applied in a manner intended to be achievable in scope, comprehensive in approach, and appropriate for addressing the particular goals of this project.

In addition, recognizing that a successful survey should acknowledge and address the concerns of the people who live in the Survey Area, the work plan also includes specific measures for involving the public so local understandings of historical significance and cultural meaning are considered throughout the entire process. Since successful public involvement should begin before the surveyors enter the field and continue through mitigation, CRA's methodology for engaging the public is discussed first. This is followed by sections explaining CRA's approach to each phase of the cultural historic work to be performed: Archival Methods, Field Methods, Data Analysis and Determinations of Eligibility, and Impact Identification and Mitigation

Public Involvement

The Applicant has already begun public outreach initiatives for this project, so CRA's public involvement strategy will be a continuation of their efforts, specifically focusing on historic resources. CRA's architectural historians will coordinate with potential consulting parties and conduct interviews with local informants to better understand how local residents view their history, heritage, and historic resources. These public involvement efforts will continue throughout the entire project.

Consulting Parties. Potential consulting parties will include local governments and community organizations with a demonstrated legal, economic, or preservation interest in the project. Organizations that may have specific interest in the architectural survey include, but are not limited to, the Richland County Historical Society, the Crestline Historical Society and Shunk Museum, the New Washington Historical Society, and the Galion Historical Society. A letter was sent to these four groups on December 21, 2010, inviting them to participate in the cultural resources review process (Appendix C). As the consulting process moves forward, CRA will utilize follow-up phone calls, emails, and personal meetings, as necessary, to provide these groups with information about the proposed project and to seek input regarding the identification and evaluation of historic properties. The goals, priorities, initiatives, and concerns of these organizations, as related to architectural history and the execution of this project, will be considered throughout the process. Consulting parties also will be particularly important in developing appropriate mitigation measures, as discussed later in this document.

Local Informants. Although CRA will not attempt to contact every property owner, the architectural historians will seek information from local informants with personal knowledge of the area. This will be achieved through informal conversations with local citizens encountered while conducting fieldwork and scheduled meetings with individuals identified by the consulting parties as important sources of information.

During the windshield survey, CRA discovered that northwestern Richland County is home to a number of Amish and/or Mennonite families. At this time it is not clear whether these groups lived in this area historically, or if they have moved here more recently from nearby Holmes County, the center of the Amish community in Ohio. In either case, public involvement efforts will include measures to seek input from members of this community.

Through these discussions with consulting parties and local informants, CRA hopes to answer the following questions:

1. What buildings, structures, sites, objects, and districts do local groups and individuals identify as historically significant places? For example, are there any places associated with an important local person or event that are not well documented beyond the local community?
2. What buildings, structures, sites, objects, and districts do local groups and individuals

identify as locally meaningful places? For example, what places are tied to their sense of local identity and/or serve as important reference points in the landscape?

3. What specific historic resources or property types are local people particularly interested in preserving? How might these properties be impacted by this project?

This information will inform the survey process by helping CRA's architectural historians see the local built environment through the eyes of the people who live there, thus influencing what resources are surveyed and how the significance of these resources is evaluated. By developing a better understanding of how the local community values its historic resources, CRA will be able to assess project impacts and recommend mitigation measures in a manner that addresses the interests, needs, and concerns of the people of Crawford and Richland Counties.

Archival Methods

As described in *How to Complete the Ohio Historic Inventory*,

> Historical research involves gathering and organizing pertinent information on the development, history, and ethnography of the historic properties of the community. Research provides the basis for identifying and evaluating surveyed structures. By establishing the background information needed to tie a property or a group of properties to larger historic themes and periods, research places everything in its historic context.
>
> *Historic context* is an organized body of information about a historic theme during a particular time and in a particular area...This information serves as a framework for analyzing individual properties or groups of related properties to determine which associations or physical features make them historically significant [Gordon 1992: 16].

In short, the development of a comprehensive historic context based on thorough archival research is essential to properly identify historic properties in the field and analyze survey results in the office. Archival research also provides the foundation for developing this survey work plan.

After establishing the Survey Area and goals for this project, CRA's architectural historians undertook preliminary archival research to identify important historical themes and property types likely to be identified by the field survey. The results are presented in the previous section of the work plan. This preliminary historic context is based on an examination of OHI files, NRHP nominations, and survey reports on file at the OHPO. Historic maps, early county histories, and information from the local history files at the Marvin Memorial Library in Shelby also provide a basis for understanding local development patterns. This information was used to develop a basic overview of county history and to identify which of the 10 primary thematic associations identified by OHPO are particularly important to the study area and likely to be well represented in the local building stock. The preliminary context thus provides the basis for the proposed field survey methods.

Upon completion of the field survey, CRA will complete additional archival research to refine the historic context (or contexts) for the study area. Based on field observations and information obtained from public involvement efforts, this research will be more tightly focused on those themes and property types that appear most important for interpreting the survey results. The final historic context will provide the basis for evaluating the significance of important property types and noteworthy historic places identified by the survey. It will also introduce themes that may become the focus of recommended mitigation projects.

Field Methods

The archival research will be followed by field investigations. The Survey Area will be defined as the Project Area containing the proposed turbines and a 5 mi buffer surrounding the Project Area. This Survey Area should adequately factor any direct, indirect, and reasonably foreseeable future impacts of the proposed project on historic resources. Given the large area included in the 5 mi radius, it would be neither practical nor particularly useful to document every property within this buffer that is 50 years of age or older. Thus, a project-specific field methodology is recommended to facilitate the identification of significant historic places that have the potential to be impacted by the proposed project.

Viewshed analysis indicates that the turbines will be visible throughout most of the 5 mi Survey Area. As shown in Figure 2, there are some small areas in the northeastern, southeastern, and western parts of the 5 mi buffer where no turbines will be visible due to topography. In the portions of the Survey Area where the turbines are visible, the perception of the turbines will vary depending on a property's distance from them and the characteristics of the surrounding landscape. For the properties located closest to the Project Area, the turbines may become a part of their immediate setting, perhaps impacting people's perceptions of individual properties and the landscape as a whole. For properties located farther from the Project Area, the turbines will become a part of their surrounding viewshed, in some cases appearing only as distant features on the horizon. In addition, it is anticipated that the visual impact will be less for those resources located in urban areas because their site lines and defining characteristics are typically oriented toward, or associated with, the interior of the city rather than the surrounding rural landscape. Consequently, specific guidelines are recommended to determine which properties to record based on their locations in the Survey Area and potential for effects.

Summary of Field Methods

The survey teams will drive every road in the Project Area and 5 mi buffer area to identify all aboveground resources that meet the criteria described in the following sections. For each property to be recorded, field documentation will take place from the public right-of-way and will include site mapping, digital photography, and completion of OHPO's Section 106 Review Project Summary Form Documentation Table. Each surveyed site will be marked using a single GPS point that will be taken at the edge of the property at the approximate mid-point of the property's street frontage. Site locations will also be marked on topographic maps. Each site will be documented with adequate photographs to convey the property type, character, and setting, and to show the location of associated barns and outbuildings. Photographs will conform to NRHP standards for digital photography. Utilizing an iPad to facilitate digital data collection, the field surveyor will complete the documentation table to gather information in six categories: Location, Building Description, Owner Information, UTM Coordinates, Building History, and Preparer Information (Figures 30 and 31). Additional fields will be included on the form to identify associated historical themes, and notes on the numbers and types of support structures will be included in the "further description" section. Properties will be identified using the established styles, types, and thematic associations included in *How to Complete the Ohio Historic Inventory* (Gordon 1992).

The field survey will be completed by three teams of two people. Each team will include an architectural historian who meets the Secretary of the Interior's professional qualification standards for architectural history. This person will be responsible for identifying survey sites, recording GPS locations, and completing the documentation table. A field technician will assist the architectural historian by driving from site to site and taking photographs as instructed by the architectural historian. Survey data will be reviewed for quality and completeness at the conclusion of each field session. Each evening, photographs and survey data will be saved to an external hard drive to serve as a backup until the data are downloaded to CRA's computer network upon return to the office.

S106 Data Entry Form

Section 106 Review Project Summary Form

Documentation Table Data Entry Form

OHIO HISTORY

Ohio Historic Preservation Office
1982 Velma Avenue
Columbus, OH 43211-2497
614/298-2000

Preview Project Summary Form Table

1. Project Number (if applicable):
2. Photo ID:
3. Reference Number:
4. OHI Number (if known)
5. Check box if property is potentially eligible for the National Register of Historic Places:

6. Present Name of Property:
7. Address:
8. City or Township:
9. County:

Building Description

14. Present Use:
15. BuildingType:
16. Architectural Style:
17. Foundation Material:
18. Wall Construction:
19. Exterior Wall:

Owner Information

24. First Name
25. Last Name
26. Mailing Address:
27. City, State and Zip:

10. Zone:
11. Easting:
12. Northing:
13. Quadrangle Name:

Building History

20. Original Date of Construction:
21. Alteration Date:
22. Alteration Type:
23. Condition of Property:

Preparer Information

28. First Name:
29. Last Name:
30. Organization:
31. Recording Date:

32. Sources:

33. Further Description:

Figure 30. Section 106 Review Project Summary Form: Data Entry Form.

Section 106 Review Project Summary Form Documentation Table — Page 1 of 1

Project Number:

Photo ID	Ref. Number County Quad. Name	Present Name Property Address	UTM Coord.	Owner Information	Present use Building Type Architectural Style	Foundation Material Wall Construction Exterior Wall	Year Built/Altered Alterations Current Condition	NRHP Elig.
							/	☐
Additional Sources of Information:				Further Description		OHI Number:	Preparer Information	

Figure 31. Section 106 Review Project Summary Form: Documentation Table. Data Analysis and Identification of Character Defining Historic Resources

Survey Guidelines: Project Area

The Project Area will be subject to a more intensive field survey than the surrounding buffer area. Throughout the Project Area, all aboveground resources that are at least 50 years old will be recorded using digital photography, GPS, and OHPO's Section 106 Review Project Summary Form Documentation Table as described above.

Rural Properties in the 2 mi Buffer

The survey of the rural area with a 2 mi radius of the Project Area will record those resources that meet the following criteria:

a) Properties for which the viewshed is an important character-defining feature;

b) Properties specifically identified by consulting parties;

c) Properties of exceptional architectural merit that possess a high degree of both integrity and significance; examples of common types or styles, such as Italianate, must exhibit noteworthy design elements, not just typical massing and common details;

d) Properties that date to the area's early (pre-railroad, pre-1850s) history; given their rarity, standards of integrity will not be quite as high as for late nineteenth century-buildings, but buildings must retain important character-defining elements that clearly date them to this early period;

e) Properties with clear associations with particularly important local events or people;

these might include exceptionally well-preserved farmsteads, early or unique agricultural outbuildings, properties related to railroad history, or properties with documented historical associations (such as those marked by roadside signs).

Rural Properties in the 2 mi to 5 mi Buffer

For the rural portions of the Survey Area located 2 to 5 mi from the project area, only those properties that meet criteria a and b will be recorded. It is recommended that the entire Project Area be surveyed before beginning fieldwork in the 2 mi and 5 mi buffer areas so that these guidelines can be refined based on the findings of the initial fieldwork.

Urban Properties in the 2 mi and 5 mi Buffers

The potential for impacts in urban areas is significantly less than in rural areas. Thus, the following methodologies are recommended for each of the following communities located outside of the project area:

Sulphur Springs, North Robinson, Leesville, Bethlehem, and Tiro are crossroads villages located within the buffer area. These communities are generally inward focused, but given their small size, they do maintain a relationship to the surrounding rural landscape. It is recommended that the field survey include overview photographs of each community to provide sufficient information to access its potential as a district. Individual buildings will be surveyed based on the criteria established for other resources in this buffer area (focus on extraordinary examples); not all buildings will be surveyed.

Shelby and Crestline are small cities located east and south of the Project Area. Shelby has a NRHP-listed commercial district; Crestline's commercial center is almost entirely destroyed by urban renewal. Crestline does maintain extensive residential neighborhoods. Effects are unlikely given the urban orientation of these environments. Unless the consulting parties raise any additional concerns, it is recommended that only NRHP-listed or eligible properties be surveyed in order to provide documentation verifying these preliminary assessments of effects.

Plymouth, Shiloh, and New Washington are located within the 2 mi to 5 mi buffer. The villages are inwardly focused to a small-town urban environment with commercial centers surrounded by residential development. Based on initial observations, each of these communities does contain a historic downtown area and notable historic residences that may be considered locally important places. However, views are constrained to the street corridors which generally are not oriented toward the Project Area. The qualities of setting that are important for appreciating these communities are found in the immediate urban landscape, not in the surrounding rural landscape. It appears that turbines, if visible, would be perceived as a part of the distant background, not an intrusion on the villages themselves. The potential for effects is extremely low, so it is recommended that no additional survey work is required in these areas. The field survey will assess effects on the one NRHP-listed property located in Shiloh and two historic properties located in Plymouth to provide documentation verifying these preliminary assessments of effect.

Galion: This is a small city located on the edge of the 5 mi buffer. Only a small portion of the town (mostly post-WWII housing) falls within the buffer. Given the density of development and urban orientation of the landscape, it is recommended that there is no potential for adverse effects, and the area should be excluded from the survey.

Data Analysis and Identification of Character Defining Historic Resources

After completing the archival and field investigations, all survey data will be analyzed to identify character-defining historic resources and to assess the impacts of the proposed project on these historic resources. Documentation tables completed in the field will be reviewed for accuracy, completeness, and style. The information from the forms will be exported to

Excel for data analysis and also linked to GIS data to enable spatial analysis of site distribution. CRA will create the following datasets to assist in data analysis and to present the survey findings to OHPO:

1. GIS data coverage defining the Project Area and 2 mi and 5 mi survey buffers.
2. GIS data locating each of the proposed tower locations.
3. GPS data locating by single point each building, structure, object, or site identified during the survey.
4. GIS layers with linked documentation tables and photographs.

When assessing survey data, the goal of a typical Section 106 compliance survey is to determine whether or not the proposed project will have an adverse effect on any historic properties that are listed or eligible for listing in the NRHP. In general, in order for a property to be eligible for listing in the NRHP, it must be at least 50 years old and possess both historic significance and integrity. Significance may be found in three aspects of American history recognized by the National Register Criteria:

A. Association with historic events or activities;

B. Association with important persons; or

C. Distinctive design or physical characteristics.

A property must meet at least one of the criteria for listing. Integrity must also be evident through historic qualities, including location, design, setting, materials, workmanship, feeling, and association. Determining NRHP eligibility requires detailed field documentation and property-specific archival research. Given the large area included in the Project Area and survey buffer for the proposed project, it is impractical to evaluate the NRHP eligibility of every surveyed property. More to the point, it is not necessary to determine the eligibility of every surveyed property in order to achieve the goals of the survey.

As mandated by OPSB, the survey is intended to identify historic landmarks that may be impacted by the proposed project, and if such resources exist, to develop a plan for their continued preservation and meaningfulness. Based on previous consultation with David Snyder of OHPO, "historic landmarks" should not be interpreted to mean "historic properties" (NRHP-listed or eligible properties), but rather it should include those places and property types that define the historic character of the region and that are important to local people. For the purpose of this survey, these properties will be referred to as "character-defining historic properties." These are the properties that make this area unique and whose loss would have an adverse effect on the continued meaningfulness of the historic landscape. NRHP criteria should help guide the identification of such places, but they do not need to be rigidly applied to the evaluation of each property in order to draw meaningful conclusions about the presence or absence of character defining historic properties within the viewshed of the proposed project.

Thus, rather than present an individual determination of eligibility for each property recorded, the writer will discuss the character-defining features of important property types (such as farmsteads, schools, and religious properties), present common and exceptional examples of each type, link each property type to established historic themes, and situate the type within the larger historic context. Individual resources of extraordinary importance will be discussed if individual consideration is merited (if, for example, the viewshed is particularly important to the property's historic character), as will places such as villages and potential districts that stand out on the landscape. An OHI form will be completed for a representative example of each important property type identified.

Impact Identification and Mitigation

Following the identification of character defining historic resources, impact assessments will utilize Survey Area viewshed mapping, photomontages, observations from the field, the historic context, and input from the consulting parties, to determine if the proposed project will threaten or compromise the continued preservation and meaningfulness of the historic landscape. Direct, indirect, and reasonably foreseeable future impacts will all be considered. The discussion of impacts will focus on important property types and geographic locations rather than individual properties. Given the nature of the proposed project, indirect visual effects are most likely, as the introduction of dozens of large wind turbines to the area may alter people's perceptions of the traditional rural character of the landscape and alter the settings of character-defining historic resources. Due to established setback requirements for turbine locations, direct effects to aboveground resources are not anticipated.

Although the proposed project will introduce a new type of development to this area, a number of modern elements are already present in the area as a result of technology, modern development, and agribusiness. Some of the existing features found throughout the 5 mi Survey Area include cellular communication towers, power lines, major transmission lines and substations, grain elevators, large silos, water towers, and radio towers (Figure 32). These existing modern features and the changing character of the local landscape will be taken into consideration when evaluating the impact of the proposed project.

The proposed new turbines are expected to be visible in varying degrees within the Survey Area. Each resource's individual view of one or more turbines will depend largely on its directional orientation, surrounding vegetation, topography, and whether or not it is situated in a rural portion of the Survey Area or within one of the towns or cities. Photomontages have been developed to illustrate different views of the proposed turbines from various points within the Project Area (Figures 33-35). Images such as these will be useful for judging the scale and visual impact of the proposed turbines within the rural parts of the Survey Area. It is anticipated, however, that a large number of the historical resources in the Survey Area are located within the boundaries of a town or city. It is expected that the visual impact will be less for these resources because their site lines and defining characteristics are more often than not oriented toward, or associated with, the interior of the city, rather than the surrounding rural landscape or environment.

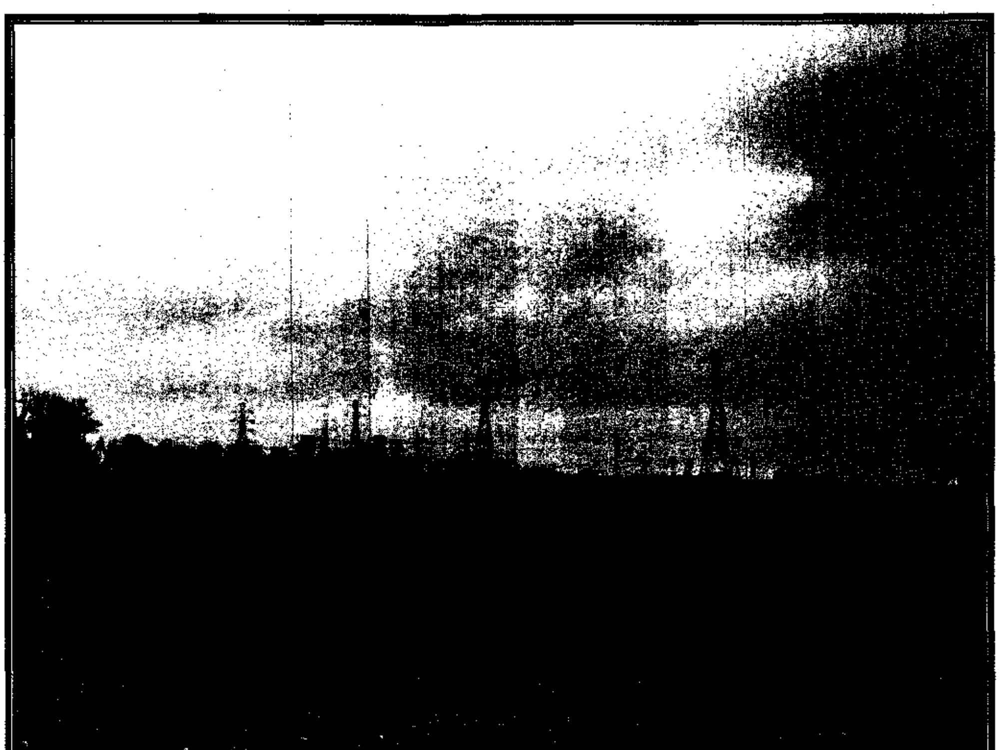

Figure 32. View of a large substation and transmission line located south of Shelby off of Route 61.

Figure 33. Photomontage A. View south-southeast on Route 39. Distance to the nearest visible turbine is 468 m (0.29 mi).

Figure 34. Photomontage B. View south near the intersection of Routes 598 and 98. Distance to the nearest visible turbine is 1,026 m (0.63 mi).

Figure 35. Photomontage C. View northeast near the intersection near the intersection of Route 598 and County Highway 76. Distance to the nearest visible turbine is 1,930 m (1.20 mi).

If the survey yields the determination that character-defining historic places will be adversely impacted by the project, mitigation measures will be developed through discussion with consulting parties such as local historical societies, the OPSB, and the OHPO. Given the nature of this project, CRA anticipates that an off-site mitigation strategy to address the impact to the Survey Area as a whole rather than address impacts to individual buildings will be most appropriate. It is recommended that all mitigation efforts should occur within the Survey Area and address the particular values and concerns of the local community. The ultimate goal of the mitigation efforts will be to promote the preservation and continued meaningfulness of character-defining historic resources in the Survey Area.

Report Preparation

In summary, the final report will consist of the following sections:

1. Introduction;
2. Project Background and Scope: describing the proposed project and applicable cultural resource regulations;
3. Environmental Setting: describing the Project Area;
4. Research and Survey Methodology: referencing the work plan, which will be included as an Appendix;
5. Public Involvement: summarizing consultation efforts and input from consulting parties;
6. Historic Context: expanding upon the context included in the work plan, as necessary;
7. Inventory of Historic Resources: providing descriptions of character-defining property types and evaluating the effects of the project on each type;
8. Mitigation Plan: proposing creative mitigation projects to address the effects of the wind farm.

The report will include appropriate mapping and photographs to support the text and the author's conclusions. In addition, CRA will submit electronic copies of the Section 106 Review Project Summary Form Documentation Table with data on each property documented, digital photographs of each property documented, GIS data for each property documented, and OHI forms for representative examples of each property type.

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APPENDIX A:

PREVIOUSLY RECORDED HISTORIC RESOURCES

Table 1. Ohio Historic Inventory Structures within the Survey Area Determined Not Eligible or Eligibility Not Assessed.

OHI_NUM	NAME(S)	ADDRESS
CRA0000714	Leesville Stone Quarry	CR 229
CRA0000914	Bender House / Ruhl House	1547 Fairview Rd
CRA0001315	Crestline Conservative Baptist / Calvary Reformed Church	Thoman & John
CRA0001413	Harold Guinther Barn / Bowers Ebert Kies	4638 Crestline Rd
CRA0001617	Milligan House	1305 Biddle Rd
CRA0001717	Shoemaker House	6511 Brandt Rd
CRA0001814	Neff House	Leesville Rd
CRA0001915	Deems House	Middletown Rd
CRA0004915	Train Station Depot / Union Station	Conrail & Penn Central RR
CRA0011915	Fraternal Order of Eagles / Schobers Opera House	E Bucyrus St
CRA0013504	United Methodist Church / Methodist Episcopal Church	SEC Center & Washington
CRA0013604	AC & Y Station	On RR 100 ft W of Center
CRA0013704	SJ Kibler & Brother Co	Center St
CRA0013804	Blacksmith Shop	Franklin St
CRA0013904	Crest Bending Inc / Uhl Hatchery	John St
CRA0014004		415 S Kibler St
CRA0014104	Shell Sponseller House	423 S Kibler St
CRA0014204		818 S Kibler St
CRA0014304		826 S Kibler St
CRA0014404		832 S Kibler St
CRA0014504	Farmers State Bank / Miller Merchandising Bldg	SEC Kibler & Mansfield
CRA0014604	Mathias Kibler House	SEC of Main & Kibler St
CRA0014704	Rosemary Huggins	130 E Main St
CRA0014804		203 E Main St
CRA0014904	Cecelia Moritz House / EA Whitcum House	SEC of E Main & East St
CRA0015004	Jacob Sheetz House	211 W Main St
CRA0015104	Jacob Bloom House	217 W Main St
CRA0015204	Ferguson House	Cor Franklin & W Main St
CRA0015304	John Sheetz House	221 W Main St
CRA0015404	C Kahler House	300-304 W Main St
CRA0015504	Bishop House / Jacob Sheetz House	303 W Main St
CRA0015604	Siefert Block / Siefert Farm Implement Sales	2nd bldg E of Kibler St
CRA0015704	Jacobs House	113 E Mansfield St
CRA0015804	St John's Lutheran Church	E Mansfield & Center St
CRA0015904	St John's Lutheran Church Parsonage	213 E Mansfield St
CRA0016004	Michelfelder Block / AH Schwemley Grocery	3rd bldg W of Kibler
CRA0016104		111 W Mansfield St
CRA0016204	Michelfelder Annex	4th bldg W of Kibner
CRA0016304		3rd bldg W of Kibler
CRA0016404	White House	118 W Mansfield St
CRA0016504	Michelfelder Shoe Store / Rich Karl Rug Shop	2nd bldg E of Monroe
CRA0016604	Golden Gems Senior Citizens	5th bldg W of Kibler
CRA0016704	Bernies Barber Shop	Cor W Mansfield & Monroe
CRA0016804	B & R Appliance	Cor W Mansfield & Monroe
CRA0016904	Sues Ceramics & Flowers / Hildebrand Drug Store	Cor Monroe & W Mansfield

OHI_NUM	NAME(S)	ADDRESS
CRA0017004	Fox Apartments / K of P Hall	2nd bldg W of Monroe St
CRA0017104		206-208 W Mansfield St
CRA0017204		210-212 W Mansfield St
CRA0017304	Village Upholstery	3rd bldg E of Franklin
CRA0017404	New Washington Post Office / Sheetz Block	2nd bldg E of Franklin St
CRA0017504	Buckeye Tavern / Kappus Block	2nd bldg E of Franklin St
CRA0017604	IGA Store / Sheetz Grocery Store	Cor W Mansfield & Franklin
CRA0017704		Cor Franklin & W Mansfield
CRA0017804		320 W Mansfield St
CRA0017904	St Bernard School / St Bernards Elementary School	Walnut St & W Mansfield
CRA0018004		401 W Mansfield St
CRA0018104	St Bernards Church	2nd bldg E of Poplar
CRA0018204	John Sheetz House / Tom Wenzlick House	502 W Mansfield St
CRA0018304	Pfeiger Barn	SEC Apricot & Monroe
CRA0018404	John Micelfelder House	222 Tiffin St
CRA0018505	Village Market	High St
CRA0018605	Store No 1	Main St
CRA0018705		117 S Main St
CRA0018805	Tiro Consolidated School	SR 39 at Southern Corp
CRA0018905	Tiro Tavern & Post Office	NWC SR 39 & Hilborn
CRA0019005		112 N Main St
CRA0019105		116 N Main St
CRA0019205	Tiro Town Hall	SEC Homer & Main
CRA0019305		214 N Main St
CRA0019405		216 N Main St
CRA0019505	Barn	216 N Main St
CRA0019605		314 N Main St
CRA0020008	Sulphur Springs Consol School	SR 98
CRA0020108	Bittikofer House	4597 Paris St
CRA0020208	Charles Heibertshausen	Paris St
CRA0020308	Sulphur Springs Gas Station	jct SR 98 & South St
CRA0020408	Sulphur Springs House #1	jct SR 98 & South St
CRA0020508	Sulphur Springs Store	SR 98
CRA0020608	Sulphur Springs Store #2	SR 98
CRA0020708	Sulphur Springs Post Office	NWC SR 98 & Ridgeton-Annapolis
CRA0020808	United Methodist Church	2nd bldg from SR 98
CRA0020908	St John's Lutheran Church / English Lutheran Church	1953 South St
CRA0021008	Sulphur Springs House #2 / J Keninger House	South St
CRA0021108	Sulphur Springs Store #3	Alley off Ridgeton-Annapolis
CRA0021208	Keller House / Matthew Blackford House	3400 SR 602
CRA0021310	Vernon Twp Dist 4 School	Baker Rd S of Remlinger
CRA0021410	Rletschlin House	Baker Rd N of German Rd
CRA0021510	Vernon Twp Dist 5 School	Baker Rd S of SR 96
CRA0021610	Betts Farm / William Cleland House	Betts Rd
CRA0021710	Betts Barn / William Cleland Barn	Betts Rd
CRA0021810	Tom Metzger House	SWC German Rd & Brannon Rd
CRA0021910	Cletus Young House / Francis Master Farm	Brannon Rd

OHI_NUM	NAME(S)	ADDRESS
CRA0022010	Smith House / Peter Huber House	Huber Rd
CRA0022110	Minck House / C Minck House	Kile Rd N Huber Rd
CRA0022210	Bilsing Farm	Kile Rd E of SR 98
CRA0022310	Starling House	Klann Rd W of Nazor Rd
CRA0022410	Metzger House	Miller Rd
CRA0022510	Hornung House / David Cahill House	New Haven Rd
CRA0022610	Cahill Barn	New Haven Rd
CRA0022710		5100-5171 New Haven Rd
CRA0022810	New Haven House / William McManis House	New Haven Rd
CRA0022910	Shull House / James Dickson House	New Haven Rd
CRA0023010	Dickson Barn	New Haven Rd
CRA0023110	Quigg House / George Eckstein Farm	Quigg 25 MI W of Tiro Rd
CRA0023310	Lambright House / Paul Glower House	Remlinger Rd
CRA0023410	Lambright Barn	Remlinger Rd
CRA0023510	Sutter House	Remlinger Rd
CRA0023610	Vernon Twp Hall	SR 586
CRA0023710	Howard Presler House	SR 39 1 House E of SR 598
CRA0023810	J Good House	SR 598 4th bldg N of SR 96
CRA0023910		NEC SR 598 & SR 96
CRA0024010		3629 SR 598
CRA0024110		SR 598 2nd House N of Creek
CRA0024210	Mitchell Weinmiller House	SR 586 S of Tiro Rd
CRA0024310	Mildred Flegm House	NWC Baker Rd & SR 598
CRA0037013	Whetstone Twp Dist 2	Parcher Rd
CRA0037715		302 W Bucyrus St
CRA0037815		311 Bucyrus St
CRA0037915		316 W Bucyrus St
CRA0038015		322-324 W Bucyrus St
CRA0038115		419 W Bucyrus St
CRA0038215		523 W Bucyrus St
CRA0038315	Crestline Pennsylvania Shops	Crestline Rd
CRA0038415		112 N Crestline St
CRA0038615	Golden Age Center	Seltzer & Union
CRA0038715	Holcker Hardware / R & H Holcker Block	Seltzer St
CRA0038815		506 N Seltzer St
CRA0038915		606 N Seltzer St
CRA0039015		607 N Seltzer St
CRA0039115		628 N Seltzer St
CRA0039215		718 N Seltzer St
CRA0039415	1st Presbyterian Church	Thoman St & Union St
CRA0039515	Crestline Middle School / Crestline High School	Thoman & Cross
CRA0039615		219 Thoman St
CRA0039715		223 Thoman St
CRA0039815	1st English Evan Lutheran Cch	Thoman & Cross
CRA0039915		309 N Thoman St
CRA0040015	St Joseph Rectory	Thoman St
CRA0040115	St Joseph School	Main St

OHI_NUM	NAME(S)	ADDRESS
CRA0040215	St Joseph Church	Main St & Thoman St
CRA0040315	Trinity Lutheran Church	Main & Thoman
CRA0040415		405 N Thoman St
CRA0040515		Thoman & North
CRA0040615	Crestline Tower	Pittsburgh-Chicago & Cleveland
CRA0040715	Babst House	723 S Thoman St
CRA0053614	N Robinson Consolidated School / Col Crawford-N Robinsn Element	Main St
CRA0053714	United Brethren Church	Main & Walnut
CRA0053814	North Robinson Town Hall	Main St
CRA0053914		5395 Bucyrus St
CRA0054014	N Robinson United Methodist / Evangelical United Brethren Church	Main & Bucyrus
CRA0054115	Crestline Post Office	244 Seltzer St
CRA0059613	Shumaker Farm	4321 Crestline Rd
CRA0059713	SchoolHouse / Whetstone Twp Subdistrict	Crestline Rd
CRA0059813	Schumaker House / H Liminger House	4828-4848 Crestline Rd
CRA0059913	Guinther Farm / R Walker	OFF of Crestline Rd
CRA0060013	Staiger House / Walker House	5036 Keiss Rd
CRA0060113	Wagner Farm / ME Ruth Farmstead	510 Keiss Rd
CRA0060213	Adams Farmstead / John Campbell House J Gearhardt	5188 Keiss Rd
CRA0060313		5367 Keiss Rd
CRA0060713	Rowlinson Farm / Eva Wagner Farmstead	4182 Leesville Rd
CRA0060913	Salem Cemetery	S side Lower Leesville Rd
CRA0061013	Cook Barn / J Koch Wagner	N side Lower Leesville Rd
CRA0061113	McNell House / Walker House	1898 Olentangy Rd
CRA0061213	Heckert Farm / J Sherrer House	1938 Olentangy Rd
CRA0061313	Phillips Farm / Hancock Philips	2051 Olentangy Rd
CRA0061413	Rank Farmstead / Elias Lavely Mary Chaifant	2060 Parcher Rd
CRA0061513	Cook Farm / J Koch	2675 Parcher Rd
CRA0061613	Ulmer Farm / Koch	2712 Parcher Rd
CRA0061713	SchoolHouse / Whetstone Twp Subdistrict	285 Parcher Rd
CRA0061813	Cook Farm / Odel JS Parcher Philip Koch	2882 Parcher Rd
CRA0061913	Schawk Barn / Keiffer Auck	3364 Parcher Rd
CRA0062013	Nigh Farm / Samuel Shook	1720 SR 19
CRA0062113	Yontz House	1884 SR 602
CRA0062213	Stirm Farm / John Campbell D McClure	1950 SR 602
CRA0062313	Stirm Farm	2092 SR 602
CRA0062514	Eichorn Barn / Waters Barn	1627 Beck Rd
CRA0062614	Nigh Farm / Hoker Farmstead	1929 Beck Rd
CRA0062714	Smith Cemetery	Biddle Rd
CRA0062814	Sautter House / Smith House	Biddle Rd
CRA0062914	Holsthouse House / Tracht House	1671 Biddle Rd
CRA0063014	Laforest Barn / Kile Barn	1859 Biddle Rd
CRA0063114	Schuster House / Westner House	1976 Biddle Rd
CRA0063214	English House / Holmes House	2001 Biddle Rd
CRA0063414	Seick Farm / Brokaw Farmstead	5614 Brandt Rd
CRA0063514	Swick House / Brokaw House	5614 Brandt Rd
CRA0063614	Shifley House / Tracht House	6362 Brandt Rd

OHI_NUM	NAME(S)	ADDRESS
CRA0063714	Hayse House / Shawber House	6562 Brandt Rd
CRA0063814	Ashcroft House	1859 Fairview Rd
CRA0063914	Reidel House / Schumaker House	1874 Fairview Rd
CRA0064014	DeGray House / Ashcroft House	1889 Fairview Rd
CRA0064114	Leavy House / Tracht House	1500 Galion-Leesville Rd
CRA0064214	Vose House / Kunkle House	1505 Galion-Leesville Rd
CRA0064414	Botdorf House / Nase House	1550 Knorr Rd
CRA0064514	Gladhill Cemetery / Hershner Cemetery	Middletown Rd
CRA0064714	Hoffman House / GN House	6799 Middletown Rd
CRA0064814	Wood House / J House	6822 Middletown Rd
CRA0064914	Jefferson Twp Subdist 5 Sch / Ashcroft Bldg	7010 Middletown Rd
CRA0065014	Ehrman Barn / Ruhl Barn	7039 Middletown Rd
CRA0065114	Burkholder House / Heise House	7147 Middletown Rd
CRA0065214	Weber House / Snyder House	7214 Middletown Rd
CRA0065314	Adams House / Snyder House	7280 Middletown Rd
CRA0065414	Baker House / Snyder House	1300 Middletown Rd
CRA0065515	Pinehart House / Scott House	1520 Nazor Rd
CRA0065614	Enger House / Robinson House	1459 SR 598
CRA0065714	Enger Barn / Robinson Barn	1492 SR 598
CRA0065814	Barnhart House / Robinson House	1526 SR 598
CRA0065914	Kinstle House / Hershner House	1676 SR 598
CRA0066014	Middletown Cemetery / Whitman Cemetery	1789 SR 598
CRA0066114	Hiltner House / Ashcroft House	1820 SR 598
CRA0066214	Moser House / Gladhill House	1898 SR 598
CRA0066314	Klirknight House / Hershner House	1910 SR 598
CRA0066414	Pointer House / Kile House	1965 SR 598
CRA0066514	Methodist Episcopal Church	Middletown Rd & SR 598
CRA0066613	Farm / P Pfeiffer Betts Traxler	1486 SR 602
CRA0066714	Kottyan House / Morrison House	1501 SR 602
CRA0066814	Payne House / Brokaw House	1565 SR 602
CRA0066913	Smith House	1735 SR 602
CRA0067014	Smutz House / Eddler House	5486 Westfall Rd
CRA0067114	Blankenship House / Smith House	5503 Windfall Rd
CRA0067214	Nelson House / Flick House	5698 Windfall Rd
CRA0067314	Nelson Schoolhouse / Jefferson Twp Subdist No 3	Windfall Rd
CRA0067414	Weber House / Smith House	5836 Windfall Rd
CRA0067514	Zucker House / Cunningham House	5972 Windfall Rd
CRA0067614	Leonard House / Sprow House	Windfall Rd
CRA0067714	Windfall Cemetery / Tracht Cemetery	Windfall & Biddle
CRA0067814	Call House / Ressinger House	6430 Windfall Rd
CRA0067914	Appleman House / Helfrich House	6497 Windfall Rd
CRA0068015	Barnes-Talbot Cemetery	Middletown Rd
CRA0068115	Windbigler House / Keaster House	7570 Middletown Rd
CRA0068215	Cox House / Fate House	7646 Middletown Rd
CRA0068315	Cox House / Talbot House	7683 Middletown Rd
CRA0068415	Cox Barn / McKean Barn	7683 Middletown Rd
CRA0068515	Patterson House / Witer House	7714 Middletown Rd

OHI_NUM	NAME(S)	ADDRESS
CRA0068615	Weaver House / Eichhorn House	8141 Middletown Rd
CRA0068715	Zeger House / Knorr House	1477 Nazor Rd
CRA0068815	Carr House	1873 Nazor Rd
CRA0068915	Stumps House / Stumpf House	1504 SR 61
CRA0069115	Deems House / Allison House	1521 SR 61
CRA0069215	Wachs House / Harrop House	1737 SR 61
CRA0069315	Puglisi House / Eichhorn House	1854 SR 181
CRA0069614	Spangler House / Miller House	1753 SR 598
CRA0069717		6063 Brandt Rd
CRA0070215	Neak Barn / Eichhorn/Burgert	8031 Middletown Rd
CRA0070314	Miller Bldg / Whiteman Bldg	Fairview Rd
CRA0070515	T-Plan Farmhouse	State Route 61
CRA0070609	Keller School / No 1 Schoolhouse	5210 SR 98
HUR0035608	C Raisch House	4600 SR 61
HUR0044508	Mathias Carothers House	4880 Weis Rd
HUR0044608	William Fox House	7___ Coder Rd
HUR0044808	Conrad Nagle House	4314 Base Line Rd
HUR0045108	Carson House / Blair House	6772 Base Line Rd
RIC0006301	Thomas House Public Library / Cuykendall House	23 W Broadway
RIC0006401	Webber House	175 W Broadway
RIC0006501	Dr PE Havers Office / Dr Benshooters Home	13 W Broadway
RIC0006601	Kosers Royal Blue Mkt & Webber	57 W Broadway
RIC0006701	Ervin House / Brinkerhoff House	247 W Broadway
RIC0006801	Dick House / Hornbeck Property	223 Springmill Rd
RIC0006901	Dr Liem Office / Drennan House	18 Plymouth St
RIC0007001	Donnenwirth House / Dr Austin & Kling Offices	51 Plymouth St
RIC0007101	Raymond House / Smith House	233 W Broadway
RIC0007201	Cobes House / Taylor-Robinson House	101 Plymouth St
RIC0007301	B & O Depot	Bell St
RIC0008201	John Dick House	127 W Broadway
RIC0008401		Bell St
RIC0008501		121 W Broadway
RIC0008601	Sourwine Hotel / National House	Main & Rt 603
RIC0008701	Sourwine House	49 RailRoad
RIC0008801	Schodorf House	Plymouth-Springmill Rd
RIC0009001	Masonic Bldg Webers Cafe	10-16 Main
RIC0009105	Dowds House	26 S Gamble
RIC0009201	McDougal House	Updyke Rd at Plymouth
RIC0009301	Bobs Cafe Pool Hall Rays Shop / Spear Block	SE Side Sq on Rt 61
RIC0009401	McQuates Furniture / Grahanis	26 Plymouth St
RIC0009502	Pugh House	London W Rd RailRoad #3
RIC0009605	Marvin House	57 N Gamble St
RIC0009701	Caretakers Storehouse / Greenlawn Guest House	Greenlawn Cemetery
RIC0009801	Studer House	Updyke Rd at Rt61
RIC0009901	McIntire Farm	70 Plymouth St
RIC0010105	Reed House	4852 Smiley Rd
RIC0010301	Faulkner House	Champion Lash & London

OHI_NUM	NAME(S)	ADDRESS
RIC0010405	Schroeder House	Kuhn Rd N of State
RIC0010801	Fenner House	Fenner & Baseline Rd
RIC0011001	Knaus House	SR 598 Sec 2
RIC0011201	Russell House	S Side Parsel Rd at Fenner Rd
RIC0011301	Beck Farm	Parsel Rd
RIC0011401	Hunter Farm	Fenner Rd at AC&Y RR
RIC0011901	Sponseller House	Henry Rd Sec 13
RIC0012309	Pal Miller House	556 Galion Airport Rd
RIC0026009	Cowan Log House	Crestline-Blooming Rd near Airport
RIC0026109	Delvin Rader Log House	Hornining Rd near Middletown
RIC0039005	Henry Sheets House	23 Marvin St
RIC0043505	First United Methodist Church	18 S Gamble
RIC0043805	Arnold House	90 W Main St
RIC0043905	Steele Home	94 W Main
RIC0044705	First United Presbyterian Church	24 N Gamble
RIC0067509	Arter Farmstead / Endly House; George Geddes House	176 Galion Airport Rd
RIC0067710	Contrascarz House / C Wakefield House	4174 US 30
RIC0068309	Green House	5263 SR 181
RIC0068409	Hines House	5345 SR 181
RIC0068509	Zimmerman House / M Reister House	5486 SR 181
RIC0069110		3904 W 4th St
RIC0069210		3914 W 4th St
RIC0069410	Billheimer House	4685 SR 181
RIC0069610	Craider House	4588 SR 309
RIC0077110	Smith House	4173 US 30
RIC0077310	Roe/Steiner/Kolb	4564 SR 309
RIC0077510	Johnson Farm / Marks Farm	3858 Snodgrass Rd
RIC0077810	Boggs House	3894 W 4th St
RIC0077910	Weaver House / Christman House	Eckstein Rd S of SR 181
RIC0078009	Ulmer Farmstead / Voegle Farm	507 Galion Airport Rd
RIC0078109	Arter House	176 Galion Airport Rd
RIC0078609	Rader Log House / Sipes Farm	Middletown Rd
RIC0078709	Biglin House	Horning Rd near SR 81
RIC0078809	Ashbough Farm	649 Horning Rd
RIC0078909	Rader House / Neff Farm	181 Horning Rd
RIC0081209	Rader House / A Ashbough House	5178 SR 181
RIC0082410	Perman Barn / Epstein Barn	Eckstein Rd
RIC0082510	Walker House / Klenkel House	719 Earick Rd
RIC0082610	Kleilein House / Trimble House	695 Earick Rd
RIC0084409	L-Plan Farmhouse	Beam Rd 800 ft E of Thrush Rd
RIC0084509	Dalmation Farmhouse	Beam Rd 1100 ft W of Horning Rd
RIC0084609	Front-gable Farmhouse	Beam Rd 600 ft W of Horning Rd
RIC0084709	Two-porch Mansion	Beam Rd 1300 ft E of Horning Rd
RIC0084809	Side Chimneys Farmhouse	Beam Rd 4400 ft E of Horning Rd
RIC0085006	Pittman Property / Wise Farm	3535 Stiving Rd

Table 2. National Register of Historic Places Inventory of Listed Cultural Resources within the Survey Area.

NRHP REFERENCE #	RESOURCE NAME	ADDRESS
3000325	Springfield Township School	3560 Park Ave W, Ontario
74001427	Crestline City Hall	121 W Bucyrus St, Crestline
76001385	Heckler Farmhouse	N of Crestline off SR 61 on Oldfield Rd, near Crestline
78002030	Hoffman, John, House	211 Thoman St, Crestline
78002031	Methodist Episcopal Church	Thoman & Union Sts, Crestline
78002179	Most Pure Heart Of Mary Church	West St & Raymond Ave, Shelby
79002809	J & M Trading Post - Annex	Leesville Rd, Leesville
79002810	Leesville Town Hall	SR 598 & CR 229, Leesville
79002811	J & M Trading Post	6867 Leesville Rd
79002812	Crawford, Col. William, Capture Site	.5 mi E of SR 598 & CR 229, Leesville
82003638	Shelby Center Historic District*	E & W Main Sts, Shelby
86000035	Sacred Heart of Jesus Churches	SR 61, Bethlehem
86003493	Marvin Memorial Library	34 N Gamble St, Shelby
87002146	Ferrell, Silas, House	25 E Main St, Shiloh
96000116	Plymouth Greenlawn Cemetery Chapel	Greenlawn Cemetery, Plymouth
99000094	Tubbs--Sourwine House/Searle House	49 Railroad St, Plymouth
*Contributing elements of Shelby Center Historic District listed in Table 3.		

Table 3. Shelby Center Historic District (NRHP# 82003638) Contributing Elements.

OHI #	NAME	ADDRESS
RIC0010005	Phelan Bldg & Fashion Shop/ DLC & HMD Bldg	68 W Main
RIC0010205	Duffs Shoes Wise Jewelers	50-52 W Main St
RIC0010505	Coney Island Restaurant/ HJ Birer Bldg	39 W Main St
RIC0010605	Daily Globe	37 W Main
RIC0010705	True Value Hardware/ S & S Block	72-74 W Main St
RIC0010905	Dicks Furniture & Appliance T Mickey Store	62 W Main
RIC0011105	WA Shaw Bldg	57-59 W Main
RIC0011505	Citizens Bank of Shelby	29 W Main
RIC0011605	Mutual Plate Glass Insurance	23 W Main St
RIC0011705	Knights of Pythias/ Garrett Bldg	10-12 W Main
RIC0011805	Shelby Municipal Bldg	23 W Main St
RIC0012005	Fire Station	14 W Main St
RIC0012105	1st National Bank State Liquor	56-58 W Main St
RIC0012205	Hancock Insurance/ Webers	51-53 W Main St
RIC0041705	The Old Hotel/ Hotel Shelby	68 E Main St
RIC0041805	Pizza Palace	62 E Main
RIC0041905	Keils Department Store	52 E Main St
RIC0042005	Keils Department Store	50 E Main St
RIC0042105	Shelby Eagles Aerie 763 Bldg	42 1/2 E Main
RIC0042205	Fisher Appliance Store/ Kelloggs Clothing	44 E Main St
RIC0042305	Shelby Furniture/ Main St Furniture	40 E Main
RIC0042405	DeVito Studio	38 E Main St
RIC0042505	City Loan & Savings & Style Shp	34 E Main St

Table 3. Shelby Center Historic District (NRHP# 82003638) Contributing Elements.

OHI #	NAME	ADDRESS
RIC0042605	Memorial Park	E Main & High School Ave
RIC0042705	Light Insurance	22 W Main
RIC0042805	Coffee Shop/ Stevensons Drug Store	26 W Main
RIC0042905	Hoovers Home Color Center/ Ellerys	28 W Main
RIC0043005	Big Plus Health Food	30 W Main
RIC0043105	Hoffmans Shoes	34 W Main
RIC0043205	The Fox Den	48 W Main
RIC0043305	First National Bank/ Dempseys Wholesale Grocer Prov	60 W Main St
RIC0043405	Seltzer Electric Co	10 S Gamble
RIC0043605	Peoples Clothing	76 W Main St
RIC0043705	PG'S Tavern	86 W Main
RIC0044005	Masonic Temple/ Lesseuers	21 E Main
RIC0044105	Ooty Bldg	6 Mohican
RIC0044205	Browning Bldg	13 W Main
RIC0044305	Shelby Telephone Co	10 Water St
RIC0044405	Shelby Sporting Goods	49 W Main
RIC0044505	K Building	55 W Main St
RIC0044605	Dutch Inn	15 N Gamble
RIC0044805	US Post Office Shelby	26 N Gamble
RIC0044905	DV Brickley Block/ Brickley Hotel & Restaurant	63 W Main St
RIC0045005	Wisler Carpet Shop	69 W Main
RIC0045105	Winbigler Bldg	71 W Main
RIC0045205	Segami Photography Studio	73 W Main St

Table 4. Determinations of Eligibility for National Register of Historic Places within the Survey Area.

REFERENCE #	OHI #	COUNTY	NAME	ADDRESS	PLACENAME
4000062	-	Richland	Rock Road Bridge	Former Erie Railroad over Rock Rd.	Ontario
65004828	-	Crawford	Calvary Reformed Church	Thoman & John Sts	Crestline
65004829	-	Crawford	1st United Methodist Church	Thoman at Union	Crestline
65004830	-	Crawford	Hoffman House/Shunk Museum	211 Thoman St	Crestline
65004867	-	Crawford	Fraternal Order of Eagles	217 E. Bucyrus St.	Crestline
65005023	RIC0044805	Richland	U.S. Post Office	26 North Gamble	Shelby
-	CRA001013	Crawford	Elias Lavely House/Summit Farm	2133 Parcher Rd	Whetstone Twp.
-	CRA063314	Crawford	Kocher House	1624 Brandt Rd	Jefferson (Township of)
-	CRA064314	Crawford	Gibson House	1475 Knorr Rd	Jefferson (Township of)
-	CRA069015	Crawford	Spoke House	1506 SR 61	Jackson (Township of)
-	-	Richland	[Residential House]	70 North Gamble Street	Shelby

Table 5. OGS Recorded Cemeteries 1803-2003 within the Survey Area.

County	OGS Reference #	Name
Richland	10265	Crestline Greenlawn-East Crestline
	10268	Saint Joseph/Josephs
	10269	Sacred Heart-Shelby Settlement-Bethlehem
	10260	Mount Pleasant
	10262	Pioneer Rest
	10263	Trauger
	10259	Greenlawn-Plymouth
	10264	Tyson Farm-Tyson
	10182	Mount Hope-Shiloh-McBride-Lutheran
	10181	Salem Lutheran-Old Salem-Old Salem Lutheran
	15497	Planktown
	10180	Adams-Bodley-Dick-(Hazel Brush)
	10194	Landis
	10195	London-Dunkard-Saint Peters Church-(Saint Peters)
	10193	Hoffman/Huffman
	10198	Roush-Roush Family
	10287	Ontario-Ontario Community
	10278/10286	New Castle
	10279	Bnai-Brith
	10291	Riblet
	10281	Kleilein/Kleinlein
	10266	Kuhn Farm
	10290	Unnamed #1
	10274	Myers/Meyers
	5803	Fenner
	10261	Opdyke
Crawford	2456	Talbot/Talbott-Barnes
	2487	Fairview
	2488	Galion Mausoleum
	2493	Mount Calvary
	2461	Middletown-Miller
	2462	Smith
	2463	Tracht
	2464	Windfall-Little Windfall
	2458	Gledhill
	2515	Campbell
	2518	Infirmary-Crawford County Home
	2522	Old Olentangy Village
	2520	Olentangy-Kile-Dinkel-German Evangelical Lutheran
	2517	Salem Evangelical-Cook-Kiess-Winfield-(Salem)
	2466	Blowers
	2470	Galloway
	2501	Luke
	2526	Stewart
	2468	Conley-Charlton

APPENDIX B

MAPS AND PHOTOGRAPHS OF HISTORIC PROPERTIES

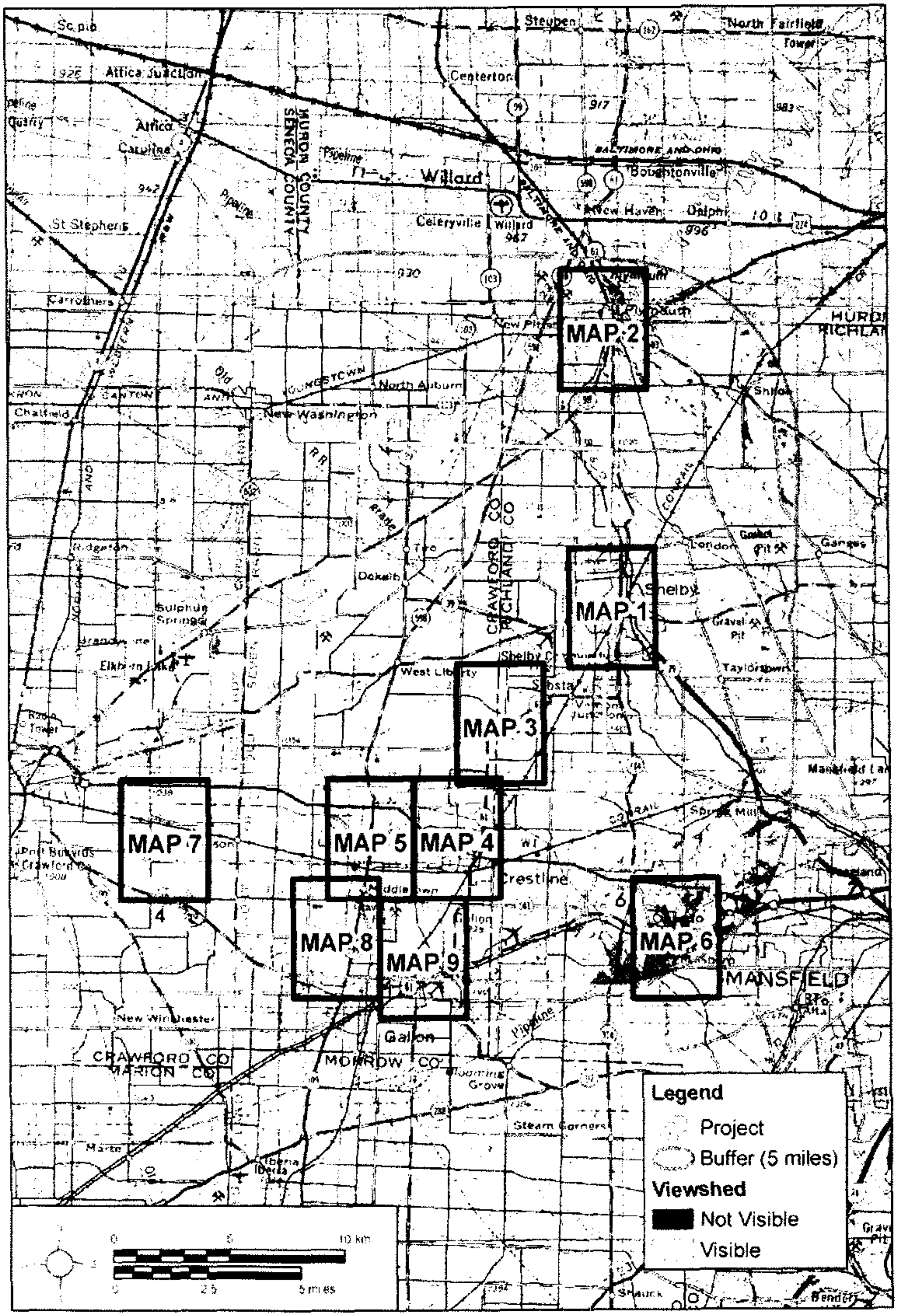

Figure 1. Project Area and visual APE showing individual map tiles 1-9.

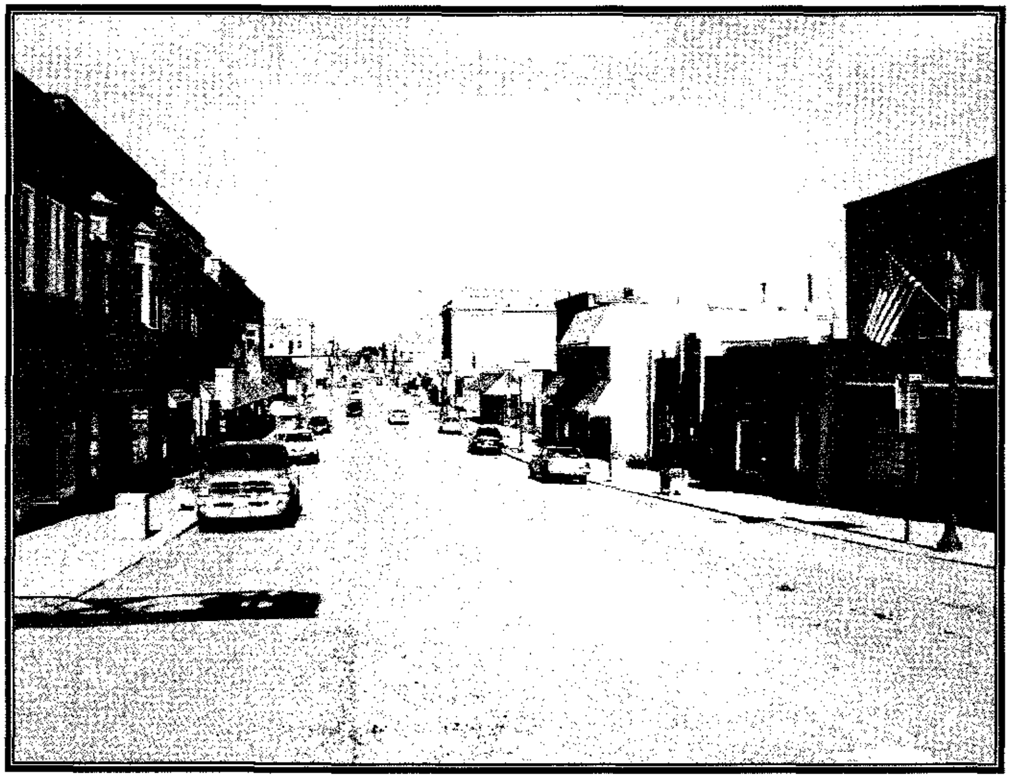

Figure 2. Street scene, Shelby Center Historic District (82003638), Shelby, Ohio, looking west from railroad grade toward town center along Main Street.

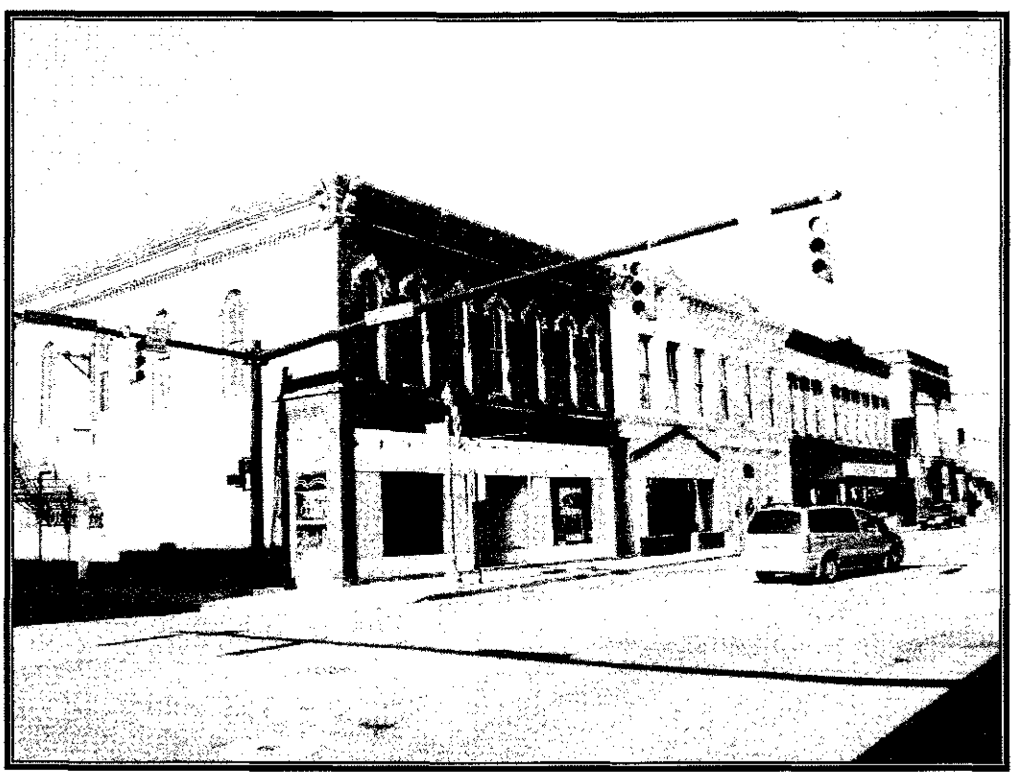

Figure 3. Street scene, Shelby Center Historic District (82003638), Shelby, Ohio, looking at southwest corner of North Gamble Street and West Main Street.

Figure 4. Street scene, Shelby Center Historic District (82003638), Shelby, Ohio, looking at northeast corner of North Gamble Street and West Main Street.

Figure 5. Commercial buildings, Shelby Center Historic District (82003638), Shelby, Ohio; view looking northwest at buildings along East Main Street.

MAP 1

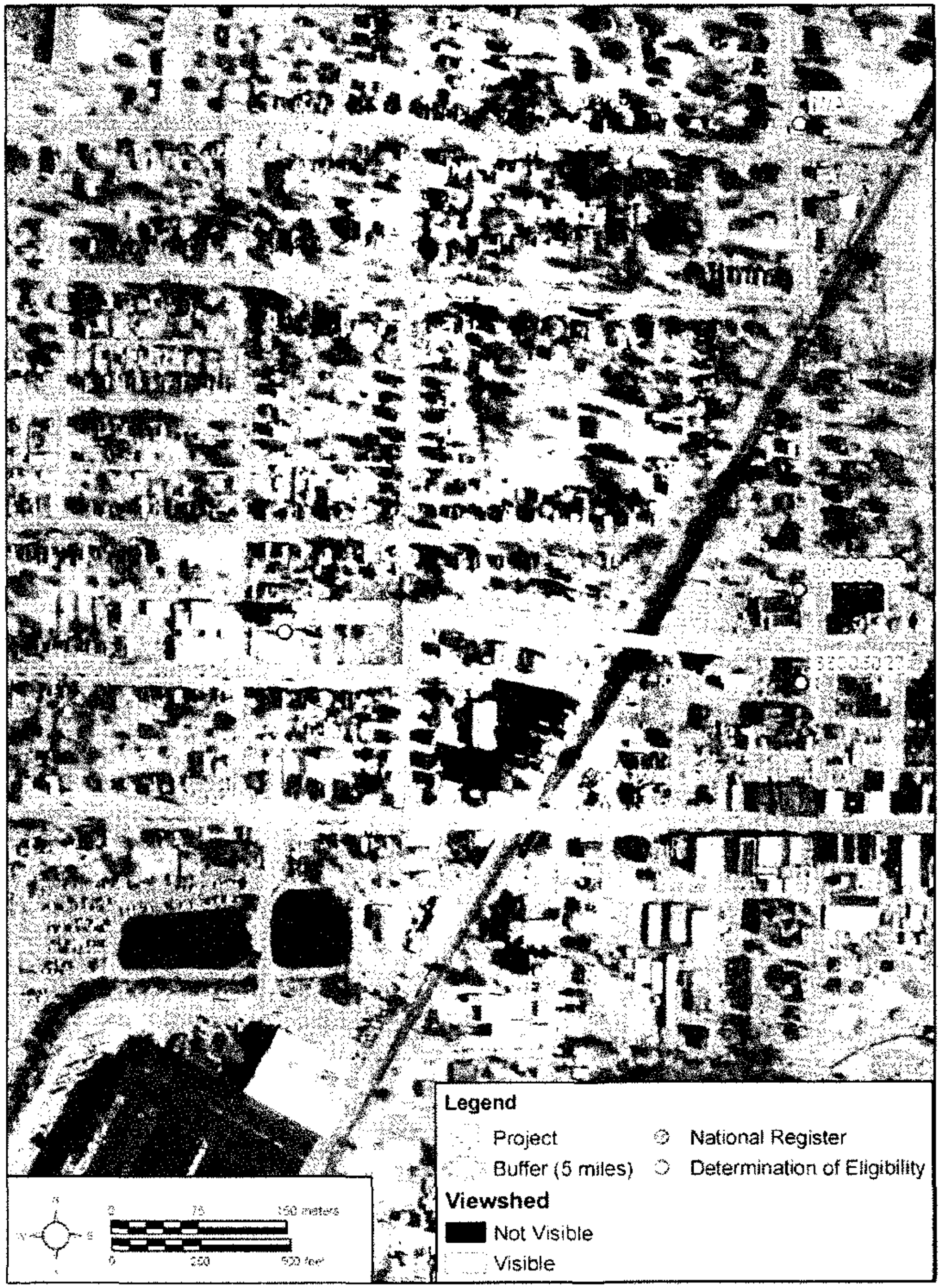

Figure 6. Aerial map of Shelby, Ohio, with locations of the U.S. Post Office (65005023), Marvin Memorial Library (86003493), and the Most Pure Heart of Mary Church (78002179) pinpointed.

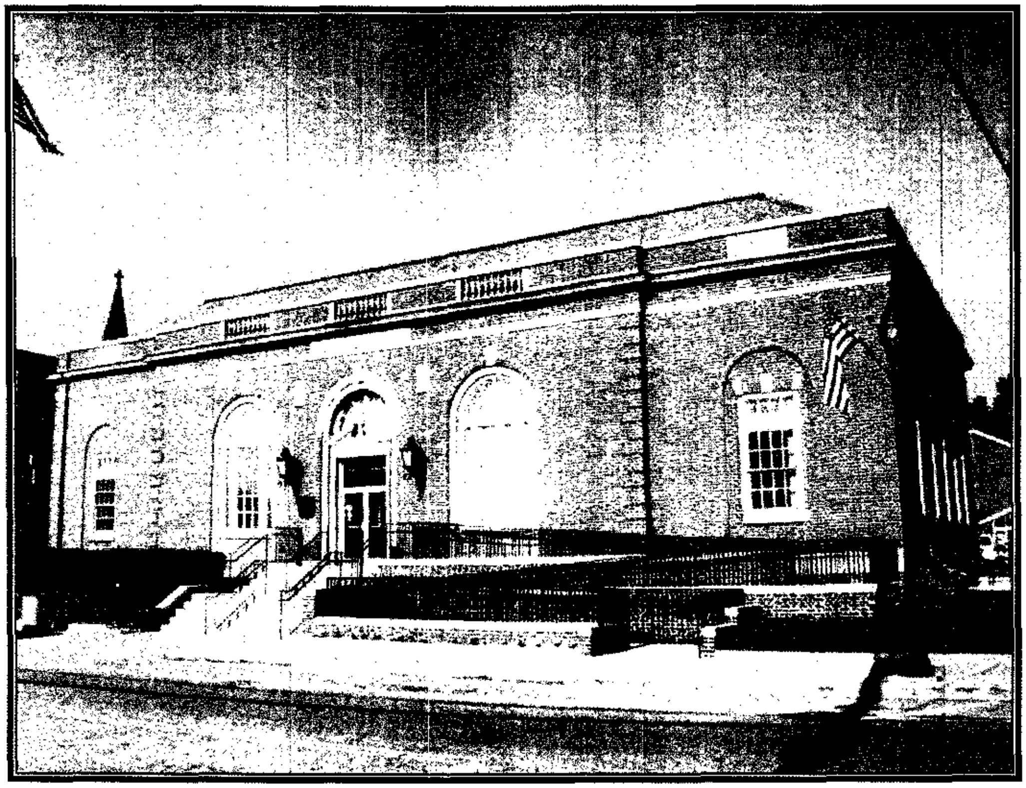

Figure 7. U.S. Post Office, Shelby Center Historic District (82003638), corner of Whitney and N. Gamble Street, Shelby, Ohio; view looking west.

Figure 8. 1st United Presbyterian Church, Shelby Center Historic District (82003638), N. Gamble Street, Shelby, Ohio; view looking west.

Figure 9. Commercial building, Shelby Center Historic District (82003638), 73 West Main Street, Shelby, Ohio; view looking north.

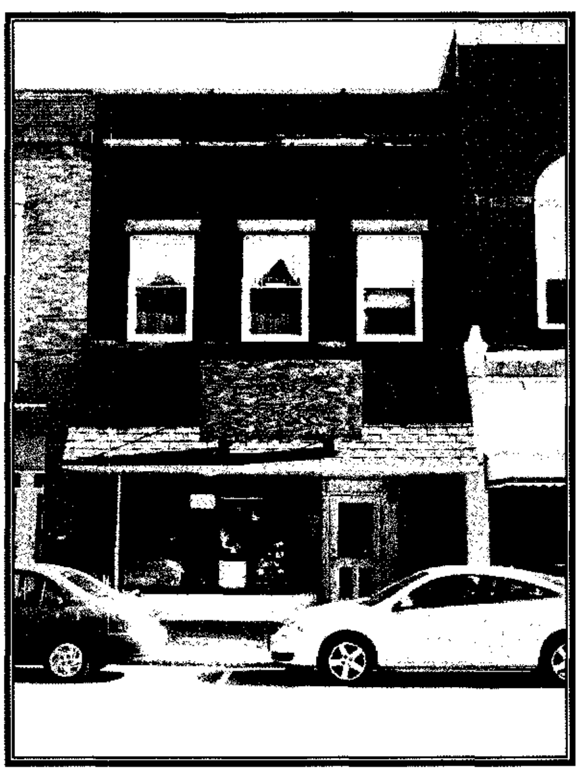

Figure 10. Commercial building, Shelby Center Historic District (82003638), 73 West Main Street, Shelby, Ohio; view looking north.

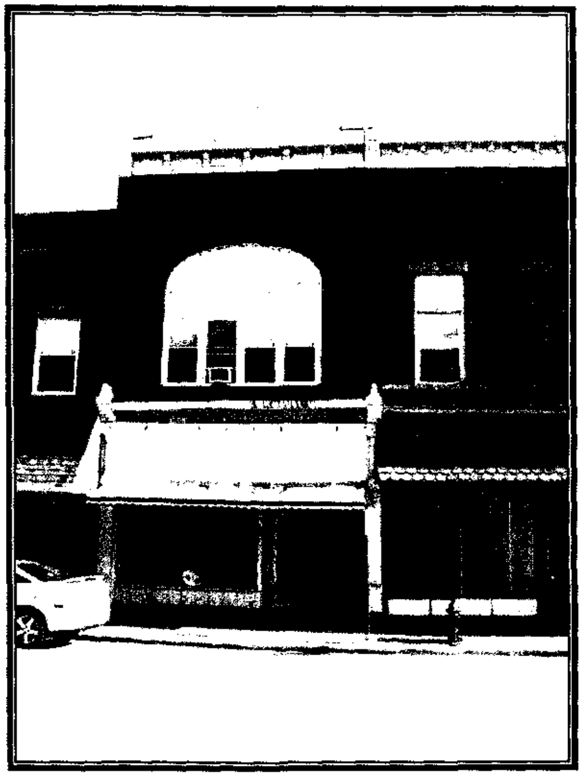

Figure 11. Commercial building, Shelby Center Historic District (82003638), 71 West Main Street, Shelby, Ohio; view looking north.

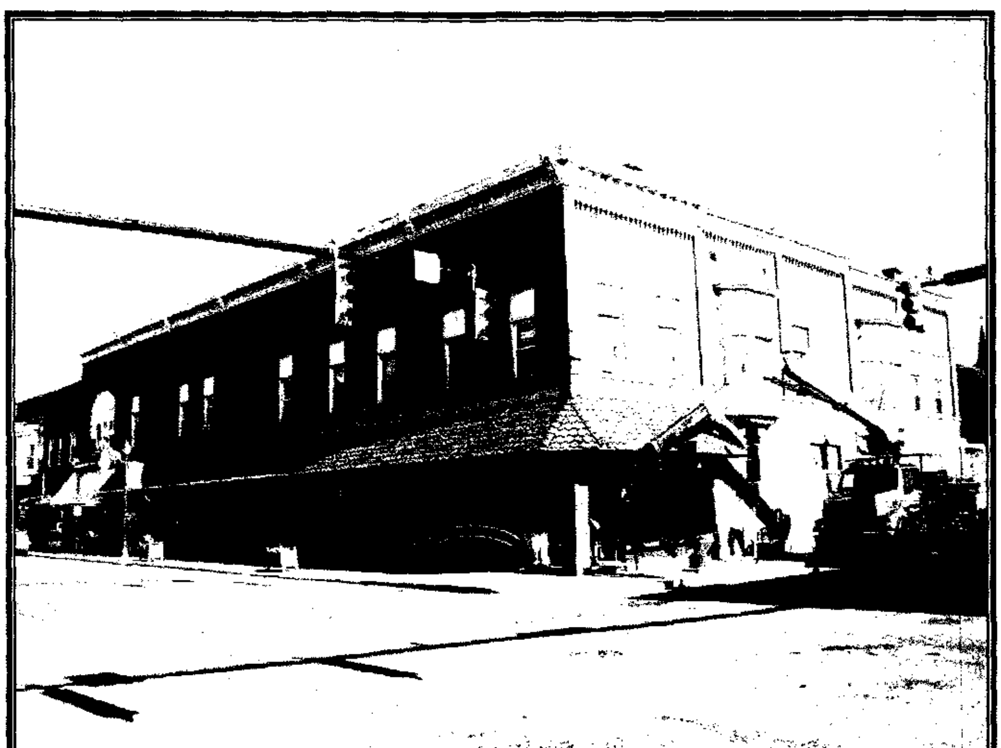

Figure 12. Commercial building, Shelby Center Historic District (82003638), northwest corner West Main Street and North Gamble Street, Shelby, Ohio; view looking northwest.

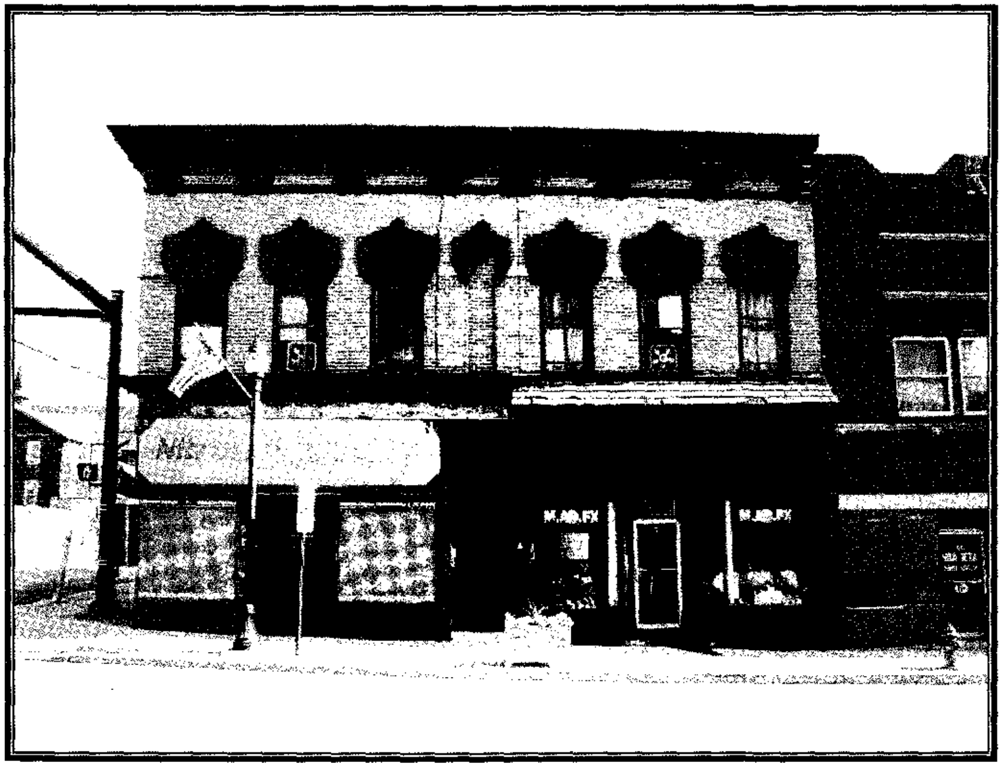

Figure 13. Commercial building, Shelby Center Historic District (82003638), 57-59 West Main Street, Shelby, Ohio; view looking north.

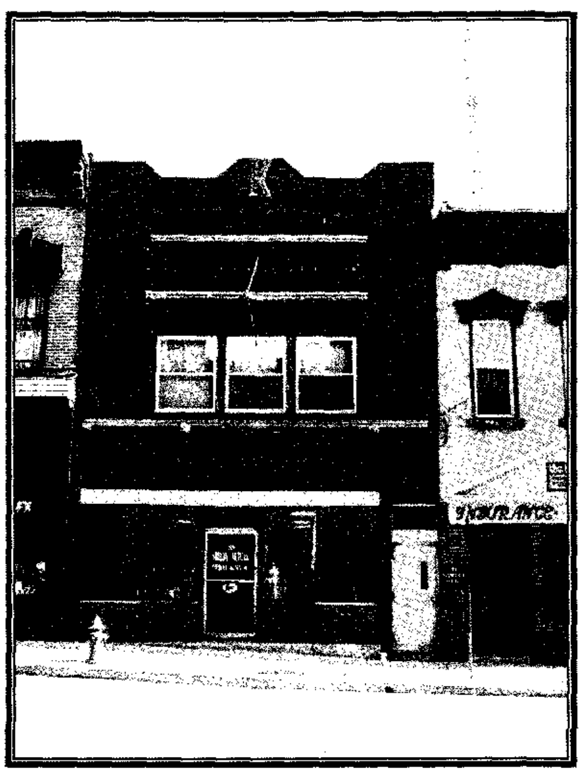

Figure 14. Commercial building, Shelby Center Historic District (82003638), 55 West Main Street, Shelby, Ohio; view looking north.

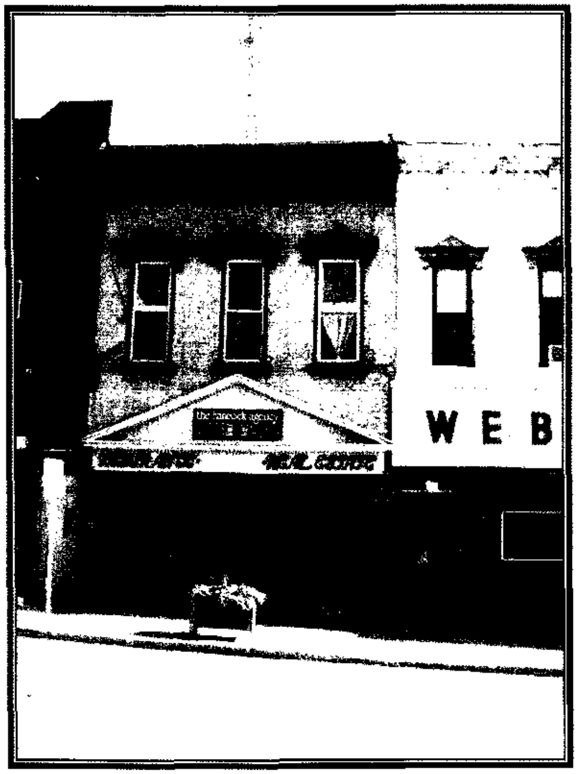

Figure 15. Commercial building, Shelby Center Historic District (82003638), 53 West Main Street, Shelby, Ohio; view looking north.

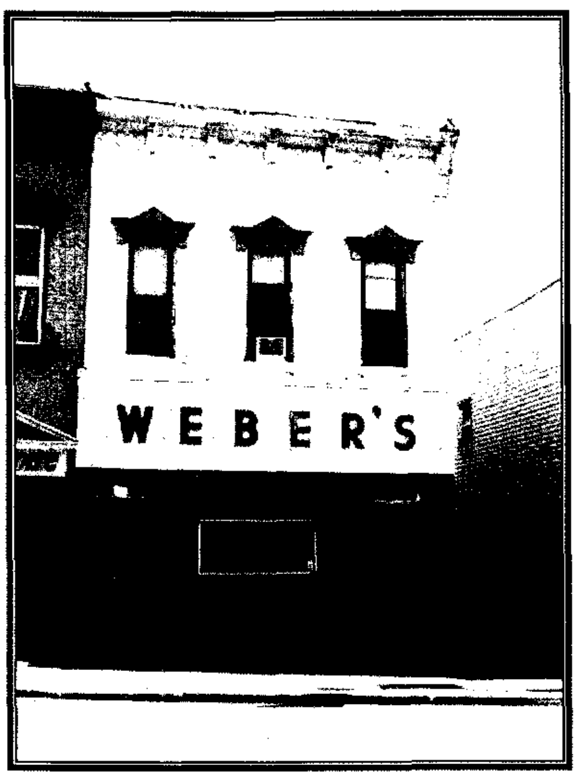

Figure 16. Commercial building, Shelby Center Historic District (82003638), 51 West Main Street, Shelby, Ohio; view looking north.

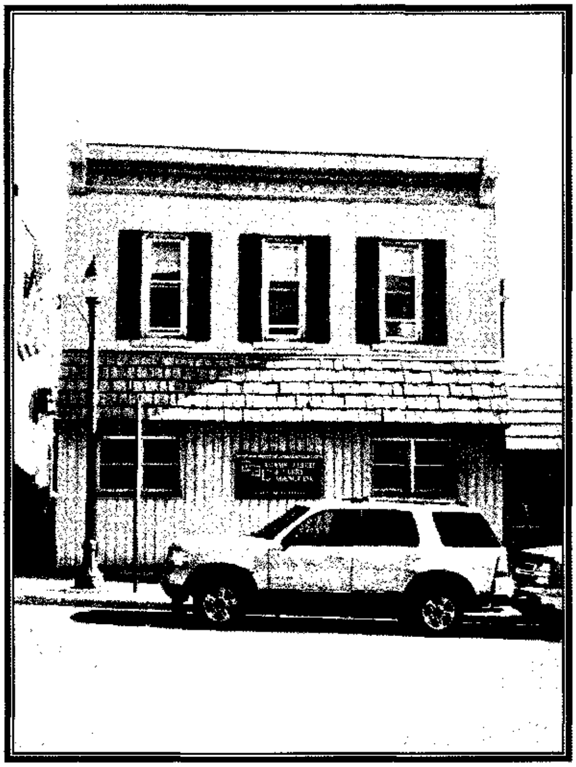

Figure 17. Commercial building, Shelby Center Historic District (82003638), 49 West Main Street, Shelby, Ohio; view looking north.

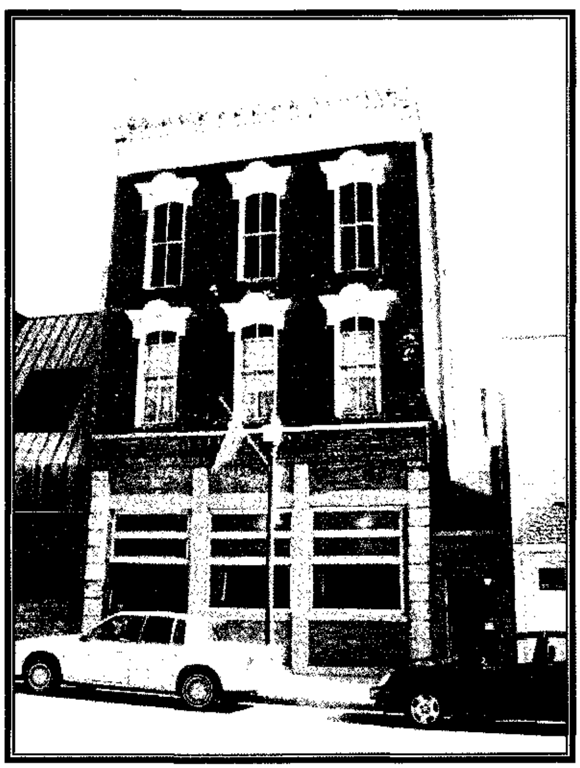

Figure 18. Commercial building, Shelby Center Historic District (82003638), 37 West Main Street, Shelby, Ohio; view looking north.

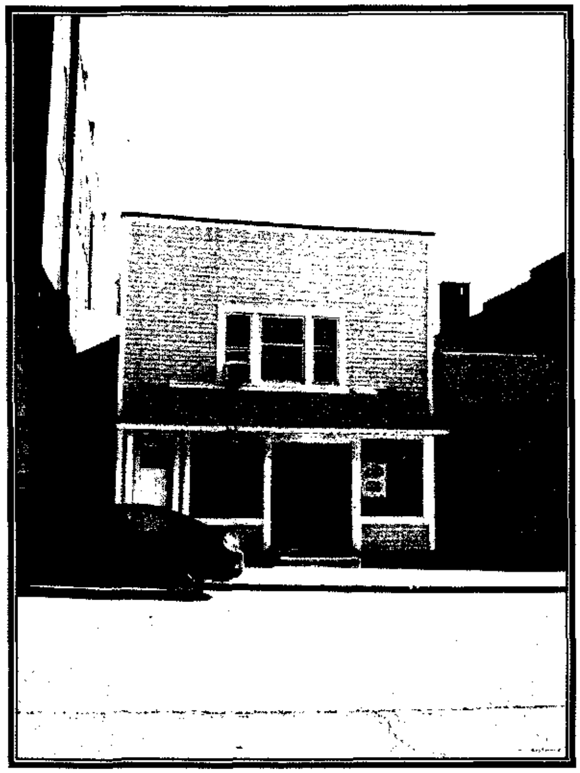

Figure 19. Commercial building, Shelby Center Historic District (82003638), 35 ½ West Main Street, Shelby, Ohio; view looking north.

Figure 20. Commercial building, Shelby Center Historic District (82003638), 31-33 West Main Street, Shelby, Ohio; view looking north.

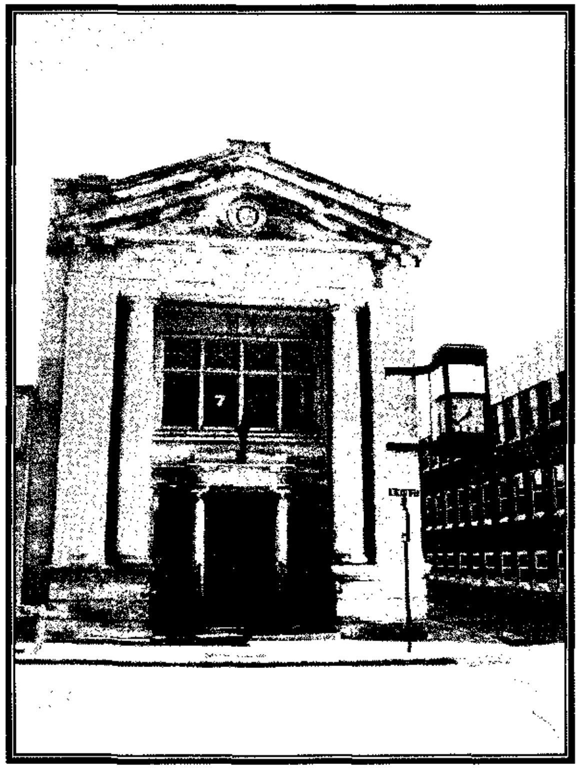

Figure 21. Commercial building, Shelby Center Historic District (82003638), 29 West Main Street, Shelby, Ohio; view looking north.

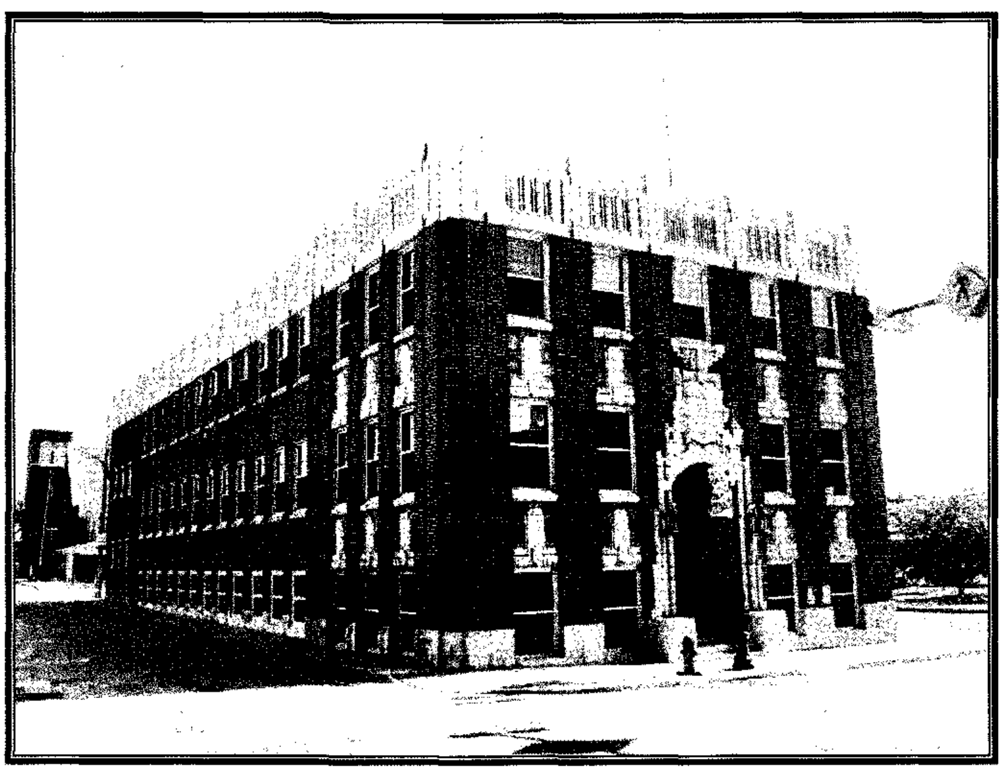

Figure 22. Commercial building, Shelby Center Historic District (82003638), 23 West Main Street, Shelby, Ohio; view looking northeast.

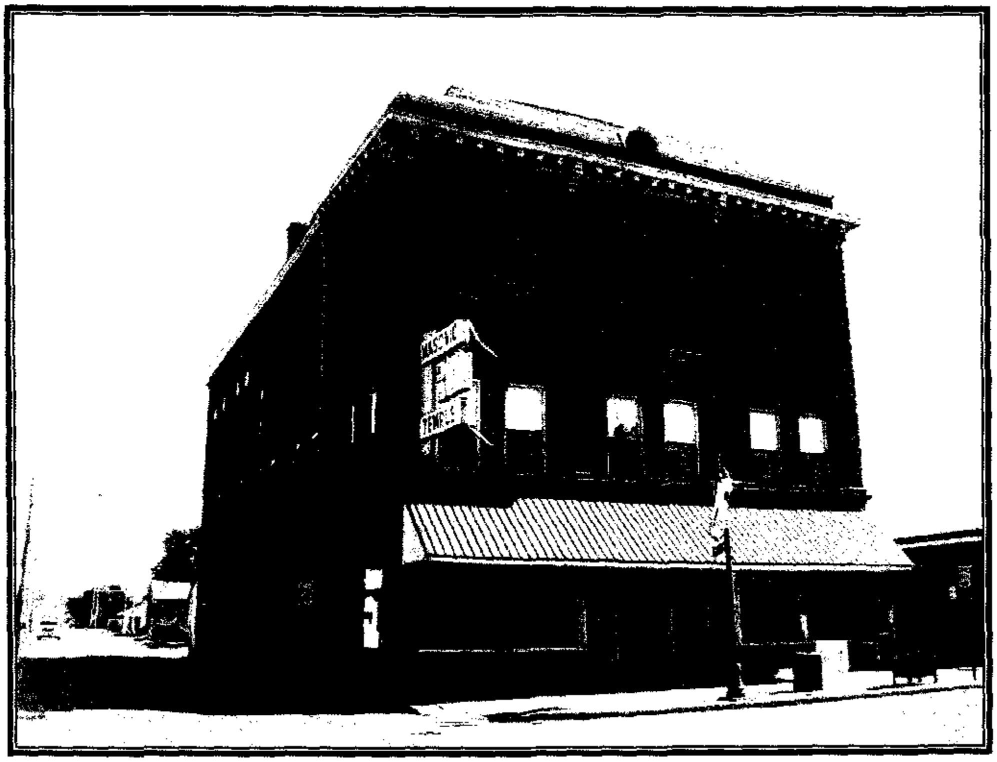

Figure 23. Commercial building, Masonic Hall, Shelby Center Historic District (82003638), 21 East Main Street, Shelby, Ohio; view looking northeast.

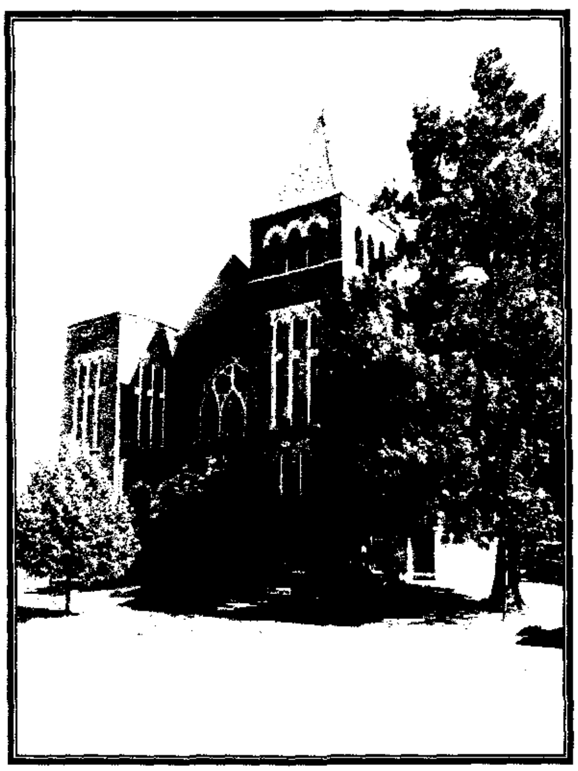

Figure 24. First Christian Church, Shelby Center Historic District (82003638), corner of East Main Street and 2nd Street, Shelby, Ohio; view looking northwest.

Figure 25. Commercial building, Shelby Center Historic District (82003638), southwest corner of East Main Street and Mansfield Road, Shelby, Ohio; view looking southwest.

Figure 26. Commercial building, Shelby Center Historic District (82003638), East Main Street, Shelby, Ohio; view looking south.

Figure 27. Commercial building, Shelby Center Historic District (82003638), 52-54 East Main Street, Shelby, Ohio; view looking south.

Figure 28. Commercial building, Shelby Center Historic District (82003638), 52 ½-50 East Main Street, Shelby, Ohio; view looking south.

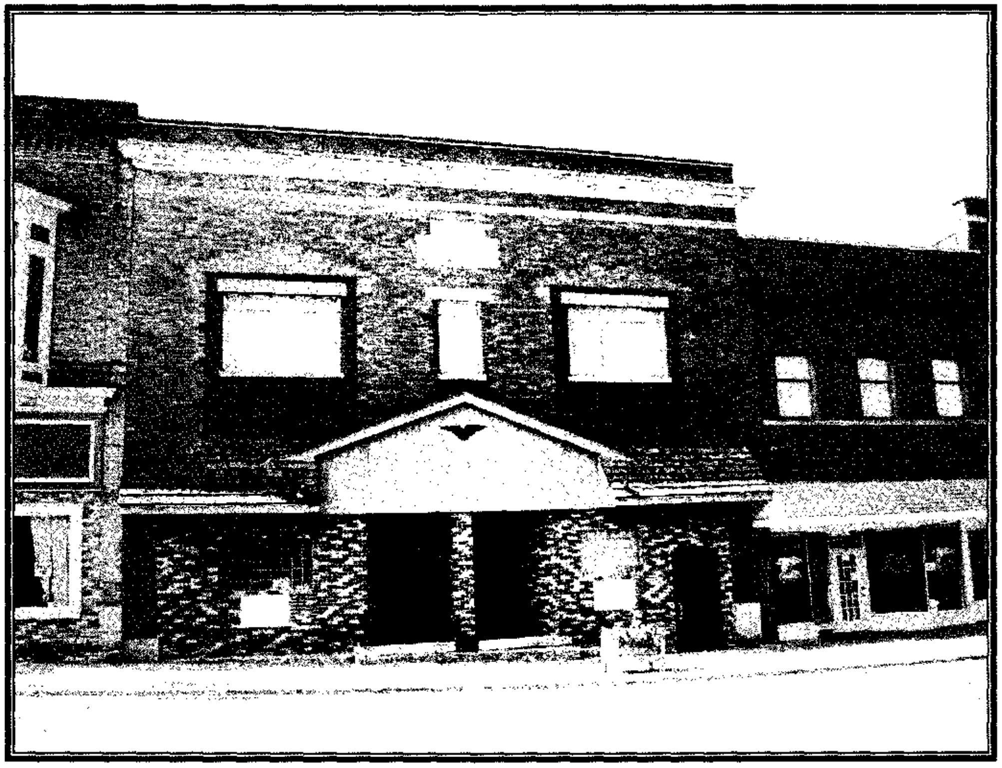

Figure 29. Commercial building, Shelby Center Historic District (82003638), 46 East Main Street, Shelby, Ohio; view looking south.

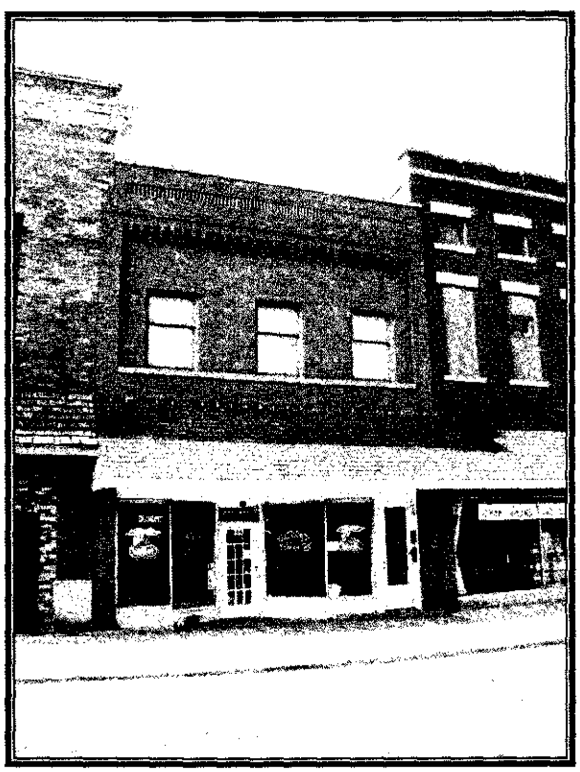

Figure 30. Commercial building, Shelby Center Historic District (82003638), 44 East Main Street, Shelby, Ohio; view looking south.

Figure 31. Commercial building, Shelby Center Historic District (82003638), 40-44 East Main Street, Shelby, Ohio; view looking south.

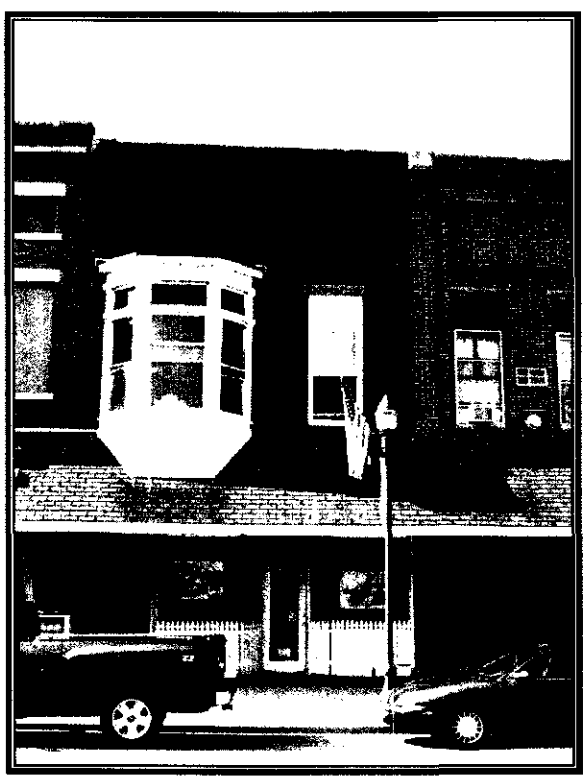

Figure 32. Commercial building, Shelby Center Historic District (82003638), 38 East Main Street, Shelby, Ohio; view looking south.

Figure 33. Commercial building, Shelby Center Historic District (82003638), 34-36 East Main Street, Shelby, Ohio; view looking southeast.

Figure 34. Memorial park & bandstand, Shelby Center Historic District (82003638), East Main Street, Shelby, Ohio; view looking south.