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A CAVE ASSESSMENT AND SUMMER MIST NET SURVEY AT 11 ADDITIONAL SITES FOR THE ENDANGERED INDIANA BAT ALONG THE PROPOSED PORTSMOUTH BYPASS PROJECT IN SCIOTO COUNTY, OHIO

22 December 2003

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1.0 Regulatory Setting

The federal Endangered Species Act (ESA) [16 U.S.C. 1531 *et seq.*] became law in 1973 and provides for the listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under ESA, the U.S. Fish and Wildlife Service (USFWS) strives to protect and monitor the numbers and populations of listed species. Many states enacted similar laws.

Section 7(a)(2) of the Act states that each federal agency shall insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of designated critical habitat. Federal actions include (1) expenditure of federal funds for roads, buildings, or other construction projects, and (2) approval of a permit or license, and the activities resulting from such permit or license. This is true regardless of whether involvement is apparent, such as issuance of a federal permit, or less direct, such as federal oversight of a state-operated program.

Section 9 of the Act prohibits take of listed species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." The definition of harm includes adverse habitat modification. Actions of federal agencies that do not result in jeopardy or adverse modification, but that could result in a take, must be addressed under Section 7.

Prior to development of the Portsmouth bypass project, the Ohio Department of Transportation (ODOT) must comply with a variety of requirements for environmental protection, including compliance with ESA. Environmental Solutions & Innovations, Inc. (ESI) was contracted to complete a summer mist netting survey for the endangered Indiana bat (*Myotis sodalis*) within the bypass footprint in Scioto County, Ohio. Initially 10 sites were selected and netted (ESI-Schwierjohann and Brack, 2003), and after additional coordination between ODOT, CH2MHill, and the USFWS, Ohio Field Office, it was decided that an additional 11 sites should be netted. In addition, during filed netting studies, a "cave" was located and investigated for it potential use by bats.

ESI completed field efforts under Federal Endangered species permit TE 023664-10 and State of Ohio Division of Wildlife permit 216.



2.0 **Project Setting**

2.1 Location

The project site is in the Appalachian Plateau Physiographic Province of southcentral Ohio (Figure 1). More specifically, the site is within the Shawnee-Mississippian Plateau. The area is characterized by high relief (400'-800' ASL). The Plateau is highly dissected with course- and fine-grained rock sequences and is considered the most rugged area in Ohio. Remnants of ancient lacustrine clay-filled Teays drainage system are extensive in lowlands but absent in uplands. The geology of the Plateau has developed from Devonian and Mississippian age shales, siltstones, and locally thick sandstones; a Pleistocene age sandy outwash of the Scioto River; Teays age Minford clay, and silt loam and channery colluvium (ODNR, 2003).

The bypass is intended to connect Ohio State Route 23 to Ohio State Route 52. The general footprint of the bypass runs west to east from Lucasville to Minford and then south to Wheelersburg. The footprint covers an area approximately 14.5 miles (23.3 km) long by 1.5 miles (2.4 km) wide. Primary drainage within the footprint comes from the Little Scioto River; Candy Run, Long Run, and Sweet Run creeks are also important watersheds for the area.

2.2 Regional Species Occurrence

The federally endangered Indiana bat is known from the region that includes the Portsmouth bypass project area. Winter hibernacula occur in nearby Adams and Brown counties in Ohio, and Carter County, Kentucky. Evidence of a maternity colony was recorded east of Scioto County in Lawrence County, Ohio. Both Scioto and Pike counties have records of summer, nonreproductive Indiana bats (Figure 2).



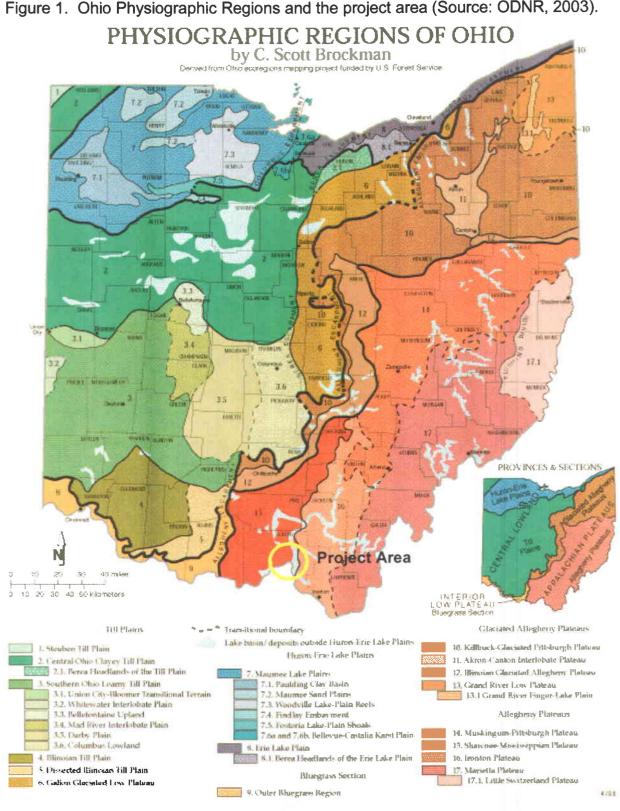
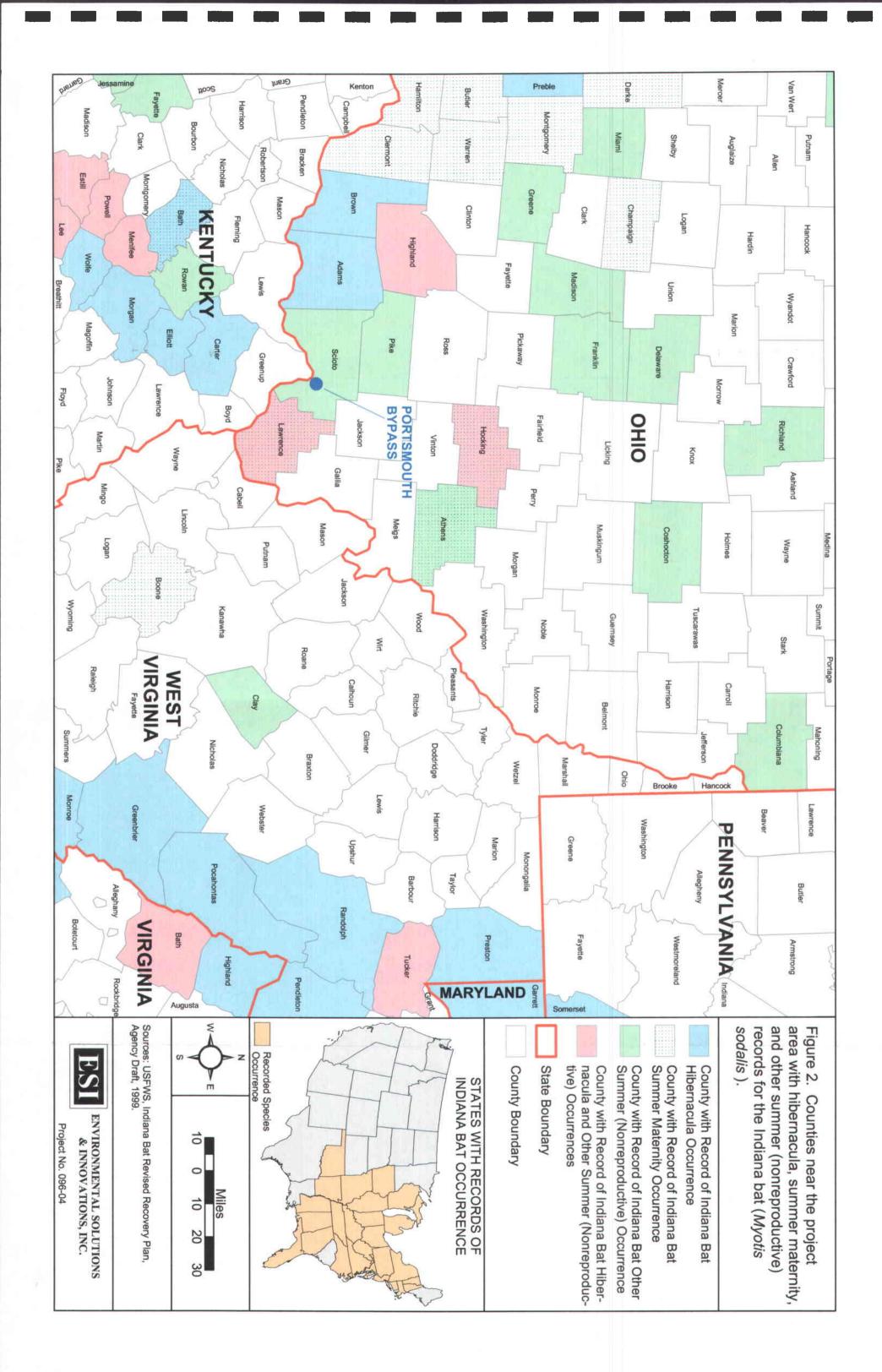


Figure 1. Ohio Physiographic Regions and the project area (Source: ODNR, 2003).

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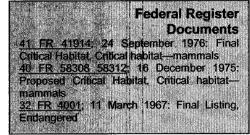




3.0 Ecological Setting

The USFWS listed the Indiana bat as endangered on 11 March 1967. The current total population of Indiana bats is estimated at 350,000 individuals (USFWS, 1999).

This is less than half the estimated population of 1960. Long-term, detailed documentation of population changes are lacking in most areas, although Indiana is an exception (Brack et al., 2003; Brack et al., 1984; Brack and Dunlap, 2003; Johnson et al., 2002). Summer habitat losses (USFWS, 1999) and winter disturbance (Johnson et al., 1998) are believed to have contributed to the decline.



Indiana bats are "tree bats" in the summer and "cave bats" in winter. A detail life history is provided in the U.S. Fish and Wildlife Service Recovery Plan (1999), Brack (1983), and LaVal and LaVal (1980). Figure 3 provides a chronology of seasonal activities discussed in the following paragraphs.

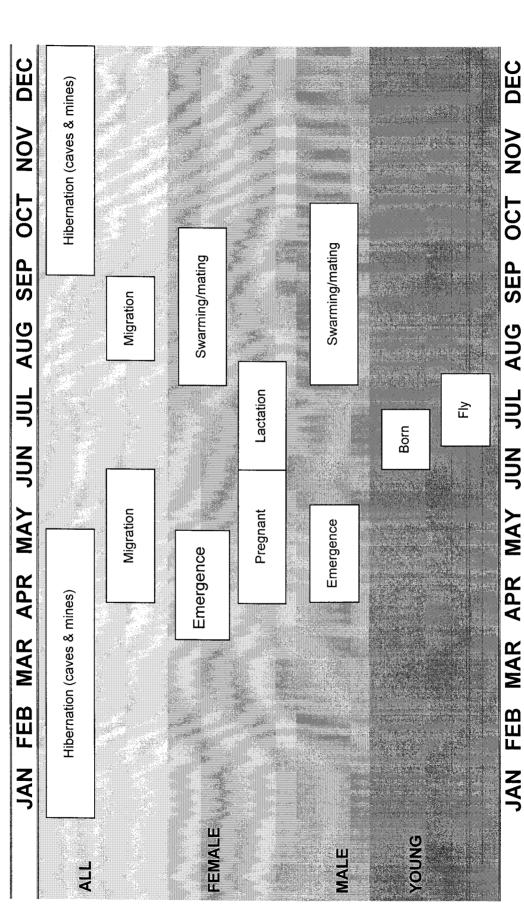
The winter range of the Indiana bat is restricted to regions of well-developed limestone caverns. which serve as hibernacula. Most hibernacula are in caves, but abandoned mines are sometimes used. There are large populations of Indiana bats in only a few caves: most hibernacula contain only a few bats. Large populations of bats hibernate in caves in Indiana, Kentucky, and Missouri (over 82% of the Smaller populations are known from known population). Alabama, Arkansas, Connecticut, Georgia, Illinois, Iowa, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia. Although the winter range is large, the species is restricted to approximately 135 known hibernacula.



Brack (3D/I, 1996) documented a population of nearly 9,300 Indiana bats hibernating in a mine in Preble County, Ohio. The most recent survey (ESI-Brown and Brack 2002) indicated that the number of bats hibernating in the mine has remained stable since first discovered. Spring (ESI-Little et al., 2001) use of coal mines by the Indiana bat in Virginia, and autumn use in Ohio (ESI-Brack and Little, 2001) have recently been documented. Such use may be associated with autumn swarming, winter hibernation, and spring staging, or it may represent use during seasonal



Figure 3. Seasonal chronology of Indiana bat activities.



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migration or simply occasional visitation unrelated to specific seasonal events (i.e., vagrants). In Ohio, sampling of the mine the following spring failed to produce any Indiana bats, thereby failing to support the hypothesis that the mine is a hibernaculum. In Indiana and Virginia, individual Indiana bats have been found wintering in caves that were not subsequently used by any Indiana bats for hibernation, indicating that individual Indiana bats, like many species of bats, are occasionally found in caves and mines that are not suitable for or support populations of hibernating bats (Brack et al., 2003; ESI Brack, 2000).

Indiana bats hibernate from mid-November to mid-April. Hibernating Indiana bats usually form dense clusters on cave ceilings in portions of the cave where winter temperatures are suitable. Initially this temperature was believed to be 4 - 8°C during mid-winter, but was supported with scant data. Recent analysis of long-term data in hibernacula with increasing numbers of bats indicates the optimal range appears to be closer to 6 - 8°C (Brack and Dunlap 2003). Clusters are not sexually segregated.

Hibernation by bats is an adaptation that allows for survival through the winter months when food and water are not available. Mammalian hibernation consists of periods of hibernation interrupted by periodic, spontaneous arousals. Bats frequently move during arousal, and thus are able to change the microenvironment to which they will be exposed during the next period of hibernation. The duration of the period of hibernation between arousals varies by species (Brack, 1979; Brack and Twente, 1985; Twente et al., 1985), and is affected by temperature.

Female Indiana bats leave hibernacula earlier in spring (beginning in mid-April) than do males (peak of departure in early May). This part of spring activity is referred to as staging. Some males remain near hibernacula throughout summer while others migrate to distant areas (Whitaker and Brack, 2002). When female Indiana bats emerge from hibernation, they migrate up to several hundred miles to maternity colonies. Females form nursery colonies under exfoliating bark of dead trees, or living trees such as shagbark hickory (Carya ovata) in upland or riparian forests. A single maternity colony typically consists of 25 to 100 adult females. Maternity colonies have been found in many species of trees, indicating that it is tree form, not species that is important for roosts. Some species of trees in which roosts have been documented include slippery elm (Ulmus rubra), American elm (U. americana), cottonwood (Populus deltoides), northern red oak (Quercus rubra), post oak (Q. stellata), white oak (Q. alba), shingle oak (Q. imbricaria), sassafras (Sassafras albidum), sugar maple (Acer saccharum), silver maple (A. saccharinum), green ash (Fraxinus pennsylvanica), and bitternut hickory (Carya cordiformis).

Since Indiana bat roosts typically are located in dead or dying trees, they are often ephemeral. Roost trees may be habitable for one to several years, depending on the species and condition of the tree (Callahan et al., 1997). In addition, a single colony of bats moves among roosts within a season. Therefore, numerous suitable roosts



may be needed to support a single nursery colony (Foster and Kurta, 1999; Kurta et al., 1993). It is not known how many alternate roosts are required to support a colony within a particular area, but large tracts of mature forest containing large trees increases the probability that suitable roost trees are present. Indiana bats exhibit strong site fidelity to summer roosting and foraging areas, returning to the same area year-after-year.

Reproductive phenology is likely dependent upon seasonal temperatures and the thermal character of the roost (Humphrey et al., 1977). Like many other bats, Indiana bats are thermal conformists (Henshaw, 1965), with prenatal, neonatal, and juvenile development heavily temperature dependent (Racey, 1982). Cooler summer temperatures associated with latitude or altitude likely affect reproductive success and therefore the summer distribution of the species (Brack et al., 2002).

Females are pregnant when they arrive at maternity roosts. Fecundity of the species is low with females producing only one young per year. Parturition typically occurs between late June and early July. Lactating females have been caught from 11 June to 29 July in Indiana, from 26 June to 22 July in Iowa, and between 11 June and 6 July in Missouri (Brack, 1983; Clark et al., 1987; Humphrey et al., 1977; LaVal and LaVal, 1980). Juveniles become volant between early July and early August.

Indiana bats may travel several miles to forage. Instances where individuals from maternity colonies traveled 2.5 miles in Illinois (Gardner et al., 1991), and summer males traveling 3.1 miles in Missouri (LaVal and LaVal, 1980) have been documented. Brack (1983) observed foraging light-tagged bats within 2 miles of caves used during the autumn swarming period.

Indiana bats forage in upland and floodplain forest (Brack, 1983; Humphrey et al., 1977; LaVal et al., 1977; LaVal and LaVal, 1980; Gardner et al., 1991). Foraging activity is concentrated around the foliage of tree crowns, and although the bats may forage in other areas, it is quantitatively and qualitatively less important (Brack, 1983). Indiana bats often use stream corridors and other linear woodland openings as flight corridors from roosts to foraging areas.

Brack and LaVal (1985) referred to the Indiana bat as a selective opportunist that often eats similar types of prey when readily available. However, components of the diet do vary by habitat, geographic location, season, and sex or age of the bat (Kurta and Whitaker, 1998; Brack and LaVal, 1985; Brack, 1983; Belwood, 1979). In Missouri, Brack and LaVal (1985) noted that terrestrial-based insects, e.g., moths (Order Lepidoptera) and beetles (Coleoptera), were most often eaten, logically as a result of treetop foraging. The proportion of aquatic insects eaten [e.g., flies (Diptera), caddisflies (Trichoptera), and stoneflies (Plecoptera)] was small and influenced by the lunar cycle.



Indiana bats begin to arrive at hibernacula in late August (Figure 3) and engage in a behavior referred to as swarming (Cope and Humphrey, 1977). Early during autumn swarming, bats visit hibernacula at night but may day-roost in woodlands. As the season progresses, more bats roost in hibernacula caves. Males become active first in mid-August. Females begin arriving in late August. By September, numbers of swarming females peak, although the male may be more common since males frequent the swarming site more than females. By late September, many females are hibernating; males remain active until mid-October or later, apparently in an effort to breed late-arriving females. Swarming chronology likely is influenced by temperature and precipitation.

Swarming is an important part of the Indiana bat's life cycle and is when most copulation occurs (Hall, 1962). However, Richter et al. (1993) postulated that males lacking sufficient fat to survive winter hibernation may remain active, seeking opportunities to mate well into the winter in a final effort to reproduce before they die. Females store sperm through winter hibernation, and fertilization is delayed until spring (Wimsatt, 1944). It is not known whether juvenile females mate their first autumn. Limited mating may occur in spring (Hall, 1962).



4.0 Methods

4.1 Site Selection

Survey sites were selected to provide broad coverage of the project area, focusing on areas that provided larger trees and riparian corridors suitable for travel and forage. Sites were selected using topographic maps, aerial photographs, and reconnaissance survey information on potential Indiana bat habitat collected by CH2MHill biologists. Sites were also interspersed with 10 sites previously netted (ESI-Schwierjohann and Brack, 2003).

4.2 Mist Netting

Efforts to survey for endangered bats are difficult to standardize because of the large amount of variability that exists in a field situation. However, a number of practices used for summer surveys for Indiana bats have provided structure for implementation of netting guidelines provided by the U.S. Fish and Wildlife Service (1999) in the most recent (Agency Draft) revision of the Indiana Bat Recovery Plan. Those guidelines (Table 1) were employed at the 11 net sites surveyed.

Eleven mist net sites were selected and operated for two nights each from 26 July to 6 August 2003. Each site consisted of two net sets run for two nights, for a total of four net nights per site. Net placement was based upon canopy cover, presence of a flight corridor, water, and conditions near the site. Nets were set to maximize coverage of flight paths used by Indiana bats along suitable corridors. Site selection was based upon an expectation of greatest bat activity and an effort to provide survey coverage of the permit area. Nets are often placed over streams, which are used as travel corridors and sometimes for foraging. In upland areas, road ruts or other areas of standing water frequently produce high capture rates. The location and specific orientation of each net was determined in the field.

Mist net sites were also selected based upon habitat characterizations described for the Indiana bat in current literature and experience of ESI personnel capturing this species. Habitat with the following characteristics were selected to the degree they were available:

- Large trees (>16 inches dbh) for maternity roosts
- An open canopy, apparently important for warming roost sites
- An open, uncluttered understory, used for travel and forage

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To insure compliance with weather conditions outlined in the Table 1, temperature, percent cloud cover, wind, and rainfall were monitored and recorded hourly while mist nettina.

Table 1. Netting guidelines.

1. Netting Season: 15 May to 15 August, when Indiana bats occupy summer habitat. Construction and an and a second second 1 2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available - monofilament or black nylon - with the mesh size approximately 11/2 inch (11/4 - 13/4) (38 mm). 3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A "typical" net set consists of three (or more) nets "stacked" on top of one another; width may vary up to 60 feet (20 m). 4. Net Site Spacing: Streams – one net site per 0.5 mile (1 km) Land Tracts - two net sites per 250 acres (1 square km) 5. Minimum Level of Effort Per Net Site: Two net locations (sets) per net site, with locations (sets) at least 100 feet (30 m) apart Two (calendar) nights of netting At least three net-nights (1 net-night = 1 net set deployed for 1 night); typically, two net sets are deployed at one site for two nights, resulting in four net-nights Sample Period: begin at dusk and net for 5 hours (approximately 0200h) Nets are monitored at approximately 20-minute intervals No disturbances near the nets between checks 6. Weather Conditions: net only if the following weather conditions are met: • No precipitation Temperature > 10°C (50°F) No strong winds 7. Moonlight: avoid net sets with direct exposure to a moon 1/2 -full or greater typically by utilizing forest canopy cover

4.3 **Bat Capture**

The netting setup allows bats to be caught live and released unharmed near the point of capture. Bats were identified to species using a combination of morphological characteristics (e.g., ear and tragus, calcar, pelage, size/weight, length of right forearm, and overall appearance of the animal). The species, sex, reproductive condition, age, weight, length of right forearm, and time and location/net site of 2003 Indiana Bat Survey - 11 sites 11 Portsmouth Bypass Project

Source: U.S. Fish and Wildlife Service, 1999

capture were recorded for all bats captured. Age (adult or juvenile) of bats is determined by examining ephiphyseal-diaphyseal fusion (calcification) of long bones in the wing. Weight was measured to 0.1 grams using a Pesola spring scale. Length of the right forearm of each bat was measured to the nearest 1.0 mm using either dial calipers or metric ruler. The reproductive condition of captured bats was classified as non-descended male, descended male, non-reproductive female, pregnant female (based on gentle abdominal palpation), lactating female, or post-lactating female.

Bats were not banded. Bat processing and data collection was typically completed within 30 minutes of the time the bat was removed from the net. Data, recorded in the filed are provided in Appendix A.

4.4 Habitat Characterization of Net Sites

Habitat assessment at net sites focused on features indicative of suitability for Indiana bats. A habitat description of each net location was completed (Appendix A). The emphasis of this description was habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, distance to water, stream or pond characteristics (if a net was placed over them), and flight corridors. Habitat form was emphasized because the Indiana bat roosts in many species of trees. Tree species composition was included because it provides insight to edaphic conditions of each site.

Habitat characterization identifies components of canopy and subcanopy layers. Trees that reach into the canopy are canopy trees, regardless of their diameter/size. As defined in the Indiana Bat Habitat Suitability Index Model (3D/Environmental 1995), dominant trees are the large trees in the canopy (>16" dbh) that have the greatest likelihood of being used by maternity colonies of Indiana bats. Many smaller trees are often also found in the canopy, and in some situations, the canopy can be entirely composed of small-diameter trees. ESI's habitat characterization identifies dominant and subdominant elements of the canopy.

The subcanopy vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 2 feet (0.6 m) and the canopy layers, usually beginning at about 25 feet (7.6 m).

Vegetation in the understory may come from:

- Lower branches of overstory trees
- Young overstory trees
- Small trees and shrubs that are confined to the understory

The amount of vegetation in the understory is termed clutter. Many species of bats, including the Indiana bat, tend to avoid areas of high clutter.



Other site-specific parameters pertinent to assessing the quality of the habitat were also recorded such as distance to water, stream habitat (if present), standing water in an upland site, and travel corridors – or lack thereof.

Each net site was documented with a sketch.

4.5 Investigations at a Cave in the Project Area

During summer netting surveys, people living in the project area directed us to a cave that was in the project vicinity. This "bat cave" as it was known by local people, was located at 38°45"51.4" north latitude and 82°52"40.3" west longitude in a bluff of a railroad cut (Figure 4). Because the entrance to the cave was on the bluff face, it could not be readily trapped or netted so vertical caving equipment was used to enter the cave. On 27 September 2003, the cave was surveyed to determine if bats were currently or could potentially use the cave, e.g., the presence of bats, droppings, air movement, obstructions that might hinder use by bats, or indications that bats had not used the cave such as undisturbed spider webs.

4.6 Statistical Analysis of Capture Data

The species diversity in the project area was examined with the species diversity index (SDI) = $I/\sum P_i^2$, where P_i is the proportion of bats belonging to species i, (MacArthur, 1972). This index has an advantage over other commonly used indices in that it provides an estimate of the number of equally represented species in the catch. Chi-square analysis was used to compare the catch of males and females.



5.0 Results

5.1 Weather and Temperature

In general, precipitation, humidity, and cloud cover were higher than normal for the Portsmouth area during the survey period (Weather Underground, 2003), as they were for most of the 2003 netting season.

Start/End Dates (2003)	High Temp. °F	Low Temp. °F
26 July	80	67
6 Aug	76	63

Nevertheless, weather parameters were within netting guidelines. Days were sometimes overcast, humid, and rainy. Rain sometimes occurred in late afternoon, prior to netting. Evening skies sometimes were overcast and fog occurred upon occasion. Nighttime lows ranged from 62 to 73°F, and high temperatures ranged from 68 to 84°F during the project period. The spread of temperatures between high and low ranged from 2 to 13 degrees. Appendix A contains completed Weather Data Sheets.

5.2 Mist Netting and Site Selection

Eleven net sites were surveyed for a total of 44 net nights. Survey sites were selected to provide broad coverage of the project area, focusing on areas that provided larger trees and riparian corridors suitable for travel and forage. Sites were selected using topographic maps, aerial photographs, and on-site reconnaissance survey, and were interspersed with 10 sites previously netted (ESI-Schwierjohann and Brack, 2003). Sites were numbered beginning at 11 (Figure 4).

5.3 Bat Captures

No endangered bats were captured.

A total of 30 bats of four species were captured at 11 net sites (Table 2). Most reproductive adult females had completed lactation, and capture of juveniles indicated that young of the year were volant. The big brown bat (*Eptesicus fuscus*) was the most frequently captured species, followed by the red bat (*Lasiurus borealis*), eastern pipistrelle (*Pipistrellus subflavus*), and little brown bat (*Myotis lucifugus*). Species diversity was relatively low with a Diversity Index value of 3.5. Nine reproductive females (all species combined) were captured versus six adult males, which is not significantly different than random ($\bar{x} = 0.6000$; P = 0.4386).

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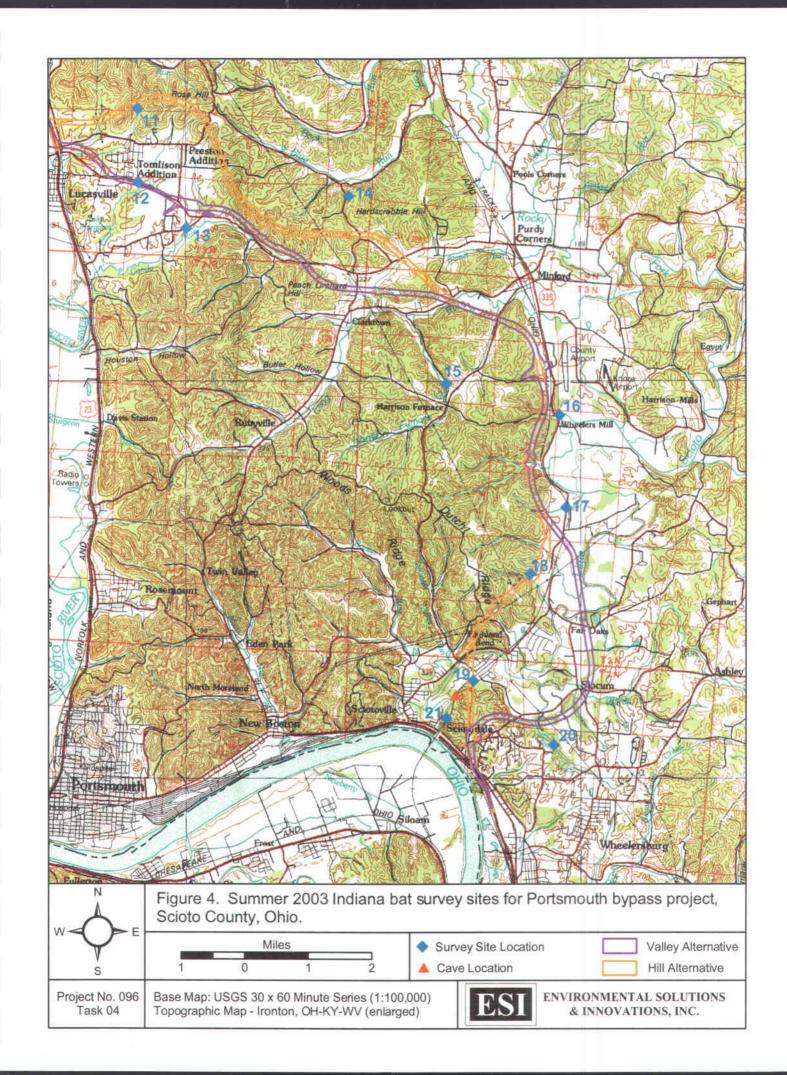


Table 2. Bat captures from 26 July to 6 August 2003 for the Portsmouth bypass project, Scioto County, Ohio (sites 11 – 21).

			Female	;			
Species	Male	L^1	PL ²	NR ³	Juv. ⁴	 Escape⁵	Total
Eptesicus fuscus	5		6	2	2	1	16
Pipistrellus subflavus		1	a pér c		2		3
Myotis lucifugus	1		1	1			3
Lasiurus borealis			1	2	4	1	8
Total	6	1	8	5	8	2	30

¹L=lactating; ²PL=Post lactating; ³NR=non-reproductive; ⁴Juv = Juvenile; ⁵Escape=escaped from net before processing was completed

Two bats escaped before sex and morphometric data were collected, although they were identified to species.

5.4 Habitat Assessment

Approximately half of the project area is forested. The remaining area is heavily affected by suburban development and agricultural operations. Net sites were over travel corridors formed by stream or other linear openings such as roadways. Net sites were typically near developed areas and/or agricultural operations. Overall, net sites were classified as having open to moderately closed canopies, moderately closed understories, and a relatively low abundance of large trees. Based on these net site characteristics, the habitat is viewed as being poor to moderate with low roost site potential. Appendix A contains completed Net Site Habitat Description Data Sheets.

5.5 Cave Habitat

The cave consisted of two side-by-side openings. Facing into the cave, the opening on the left was about 4 feet in diameter and unobstructed by vegetation. This passage narrowed quickly and ended within approximately 30 feet. No air was moving into or out of the passage. No bats were found in the passage. Several (<10), relatively fresh, feces were found scattered within the entrance. These were probably from one or a couple bats that had recently night-roosted within the entrance.

The second (right) entrance was similar in size. No bats or feces were found, and no air movement was detected. The total length was two to three times that of the left side, and included two vertical drops of 6 to 10 feet each. Most of the passage was extremely narrow, barely allowing passage of surveyors. The passage was explored until the end could be seen.



6.0 Discussion and Conclusions

Netting efforts provided no evidence that endangered Indiana bats use the project area during summer months. The species complement, diversity, and number of bats captured in the project area was less than in earlier studies (ESI-Schwierjohann and Brack, 2003), but was nevertheless relatively typical for the geographic location and type of habitat. The disparity between the relative bat capture success of the two study periods may be explained by the fact that the "choicest" habitat was surveyed during the first set of netting. All species caught were also caught during earlier sampling. Perhaps the most surprising absence is the northern bat (*M. septentrionalis*), which was relatively common in the earlier sample and is typically a common bat in many woodland habitats. The little brown bat (*M. lucifugus*) does form maternity colonies in trees and sometimes uses habitat similar to that of the Indiana bat, although this species often roosts in man-made structures and sometimes shows a propensity to foraging near or otherwise using streams and other bodies of water. One species, the silver-haired bat (*Lasionycteris noctivagans*) is a migrant that would not be present during the time sampling was completed.

No bats were found in the cave, although evidence of meager night roosting use was found. The cave does not posses the physical characteristics typical of hibernacula used by populations of bats. The length and volume are generally unsuited for producing an environment suitable for hibernation. One or a couple big brown or eastern pipistrelle bats may occasionally use the cave during hibernation. Studies suggest that both species are very variable in the winter habitats they use, and in Indiana, Brack et al. (2003) found eastern pipistrelles in a greater diversity of cave types than any other species.

Bryan and Kiser (1996) caught 11 bats of three species over three nights of netting north of the Portsmouth bypass project site in Pike County. All three species (big brown bat, eastern red bat, and eastern pipistrelle) were also caught during the current project and all are commonly found in a variety of habitats, including open/edge and developed areas. They do not form maternity colonies in large trees, as does the Indiana bat (*M. sodalis*).

In contrast to the earlier study in the project area, more reproductive females were captured than males, although the difference was not significant. Nevertheless, poorer habitats sometimes produce fewer reproductive females with a higher energy and nutritional demand. A low female capture rate may indicate a poor quality of habitat.



Habitat for the Indiana bat within the project area at sites netted was of relatively low value. Ecological impacts from natural and man-made disturbances were evident throughout the project area. An ice storm during the previous season destroyed much of the forest canopy in many areas. The storm also felled many snags that could have served as potential roost sites. Due to storm damage and the early successional stage of most forested areas, understory clutter was typically high and unfavorable for bat activity.

Streams in the project area were heavily impacted by land use in surrounding areas. All showed signs of erosion and some streams had been dredged. Cattle often had access to streams, leading to high sediment loads. ATV trails along and through streams also increased sediment loads and erosion. Many streams had only narrow bands (sometimes a single row) of small- to medium-sized trees buffering them from agricultural fields and or maintained areas (e.g., roads, lawns, parking areas). Some had no buffer. Cursory examination of flora and fauna of the stream ecosystem revealed apparent low diversity and density.

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7.0 Literature Cited

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Appendix A

Completed project data sheets

Image: State: OH County: Scioto Forest GPS: Latitude: N 3 8 5 3 4 4 4 1 Site Name/#: State: OH	ABITAT DE e: ODOT CH LaMeua t: XXXXXXXX Longitude: <u>M</u>	ESCRIPT 12MHill 12G/ N	2013) 학교 <u>학교 : 소</u> 합	
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Roost Tree Potential for the Area is: High				
Subdominant Overstory Species (<38cm/15"):		`		. •
1. Acer saccharum 2.	0-01			
Relative Abundance of Dominant vs. Subdomin	ant: <u>83 76</u>	US: 15 14		
Description of Overstory Habitat Form:	1. 1			
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Dominant Understory Species: 1. Acer sach	harim			
2. Oxydendru	m arboreum		· · · · · · · · · · · · · · · · · · ·	
3. Description of Habitat Form:				• •
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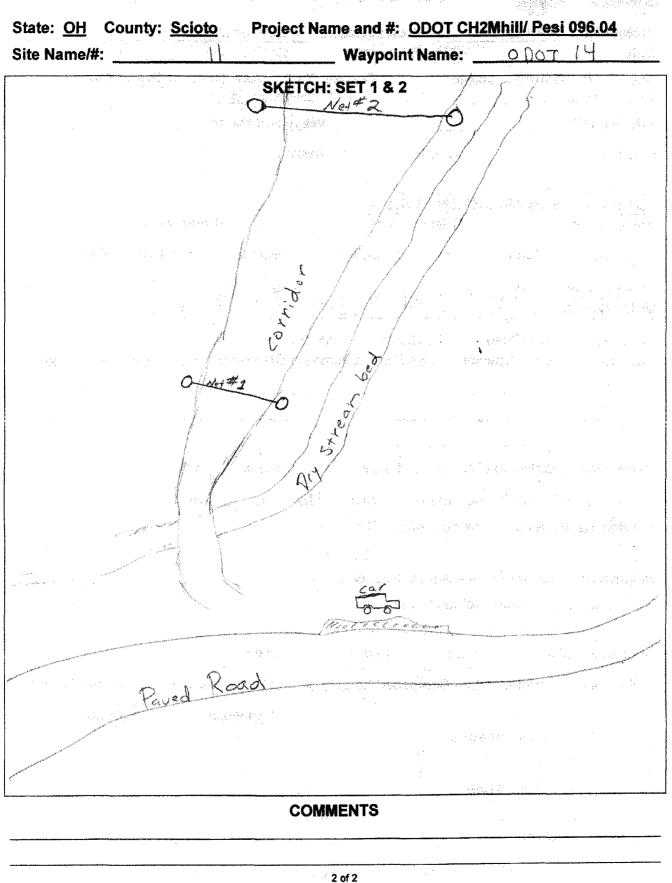
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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

NET SITE HABITAT DESCRIPTION (Continued)



an a	Brossty of Environ	mental Solutions & Innovations	Ine
	781 Neeb Road. Cincinnal	i, OH 45233 (Phone: 513-451-	1777)
Project No.: Pesi 096,04 Project Name: Date: <u>O2</u> August 2003 Biologist:	ODOT CH2MHIII La Mountai	N, Jeffcott	
State: OH County: Scioto Forest: GPS: Latitude: NB S S J ' 4 40 " Longit	ude: <u>WPನ_56</u>		
Site Name/#: V	/aypoint Name:	000T 17	
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MECERANICOM AND A CONTRACT OF A CONTRACT			
Estimated Canopy Closure: Closed Mo Dominant Overstory Species (>38cm/15"): Estima			
1. Acer Saceharum			
2. Plantanus Occudentalis			
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Roost Tree Potential consists of: KLarge Trees	Snags Both		
Roost Tree Potential for the Area is: 🛛 High 💢	Moderate Low		
Subdominant Overstory Species (<38cm/15"):			
1. Paques onericana 2.	3.		
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Is Subcanopy Vegetation Lay Comprised Largely	of: Lower Branch	es of Canopy Trees	>
	□ Saplings	☐ Shrubs	
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	Property of 781 Neeb Road. (: Environmental Solutions & Innovations, Cincinnati, OH 45233 (Phone: 513-451-17
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/EGETATION:		
1. Platanus occidentalis 2. Betulainigra 3. Carva ovata		
Roost Tree Potential consists of: X La		Both
Roost Tree Potential for the Area is:		and the second
Subdominant Overstory Species (<38cr		
1. Acer Saccharum 2.		3
Relative Abundance of Dominant vs. Su	ibdominant: <u>857</u>	US 15 78
Description of Overstory Habitat Form:		
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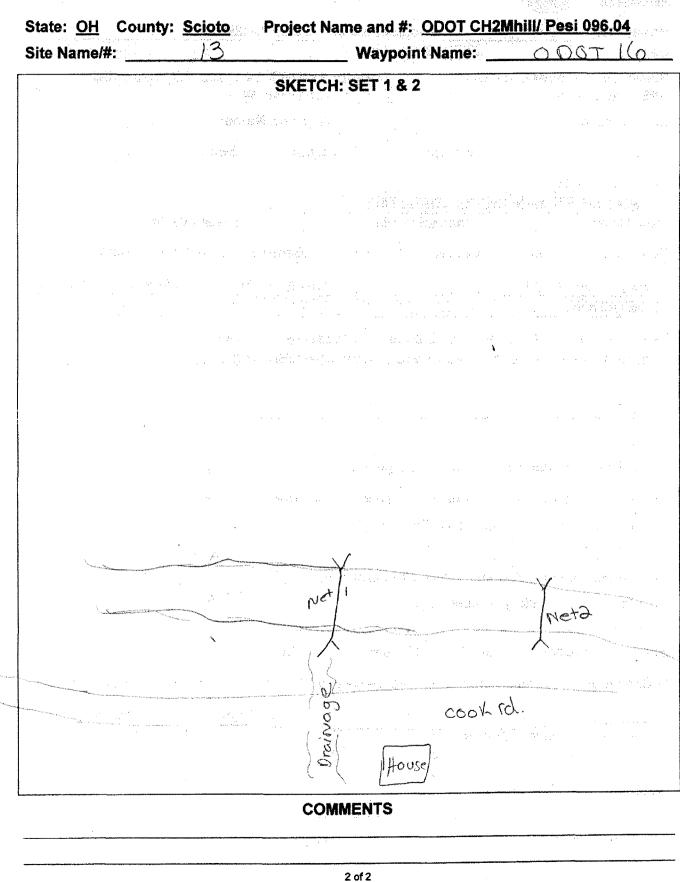
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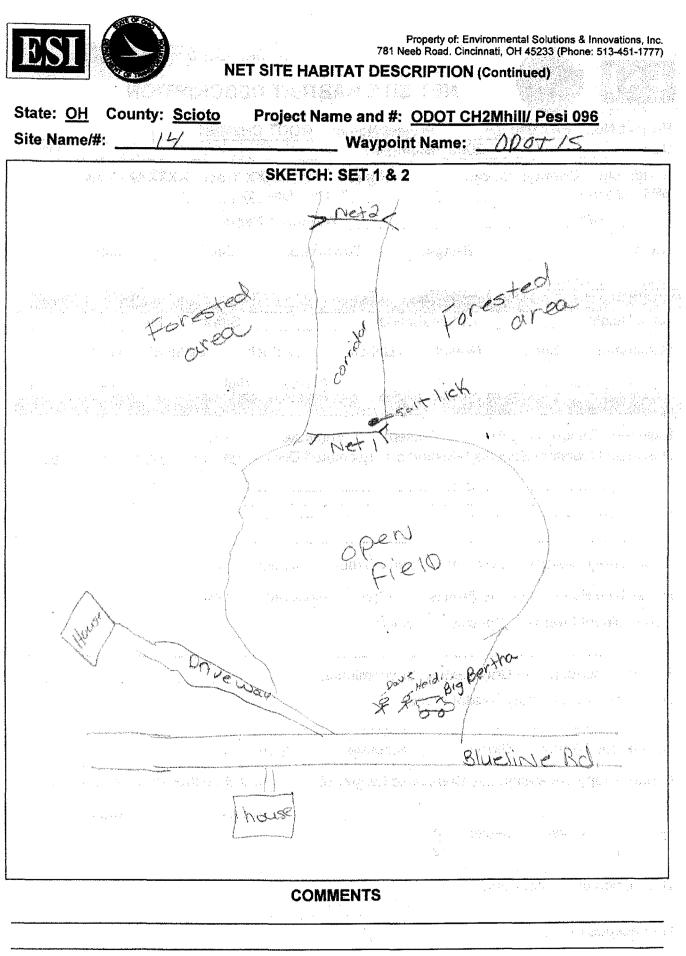
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Substratum: Sand Gravel Cobble Bedrock Silt/mud other	
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Estimated Canopy Closure: Closed Moderate Open , Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: 16dbh Sm 12dbh	
1. Her sarchaurum	
2. Her rubrum	
Roost Tree Potential consists of: Large Trees Snags Both	
Roost Tree Potential for the Area is: High (Moderate) Low	
Subdominant Overstory Species (<38cm/15"):	
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Relative Abundance of Dominant vs. Subdominant: <u>50/50</u> Description of Overstory Habitat Form:	· · · · · · · · · · · · · · · · · · ·
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Dominant Understory Species: 1. A. Sacoha	
Dominant Understory Species: 1. A. Sacchrum 2. A. rubrum 3.	
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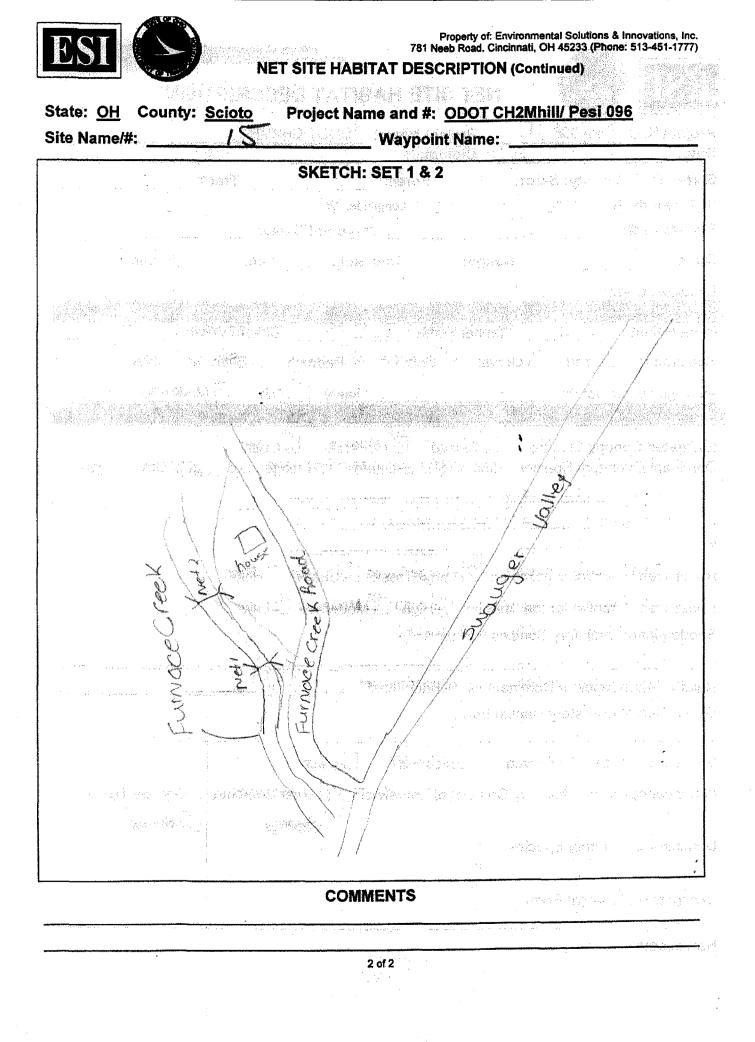
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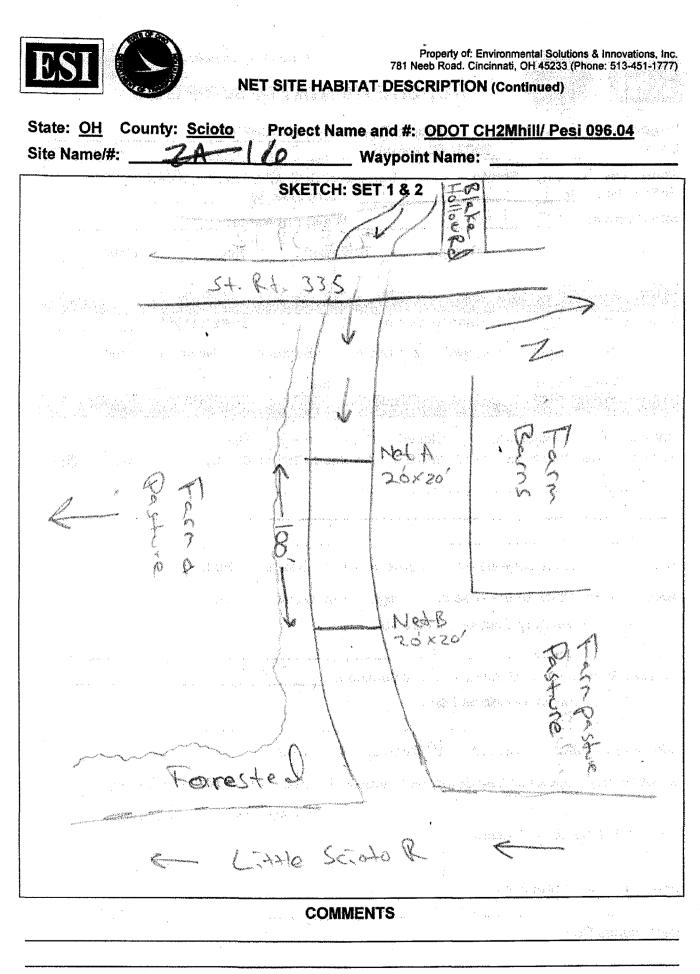
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	Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)
	ABITAT DESCRIPTION
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Date: 3 July 2003 Biologist:	J-Schwierjohann/J.Duffey
State: OH County: Scioto Forest GPS: Latitude: <u>N 3 8 ° 4 9 , 4 1.2</u> "	: XXXXXXXX Tract: XXXXXXXXXX Longitude: <u>W 8 2 ° 5 0 ' 5 7.6</u> "
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Substratum: Sand Sravel Cobble	Bedrock Silt/mud other
Average Water Depth:	Clarity: 🖾 High 🗌 Moderate 🗌 Low
VEGETATION TO MAKE SET THE SALARD	
Estimated Canopy Closure: Closed X N Dominant Overstory Species (>38cm/15"): Estin	
1. Platanus accidentalis	
2. Jugluns right	
3. Heer negunido	
Roost Tree Potential consists of: 🛛 Large Tree	s 🔲 Snags 🗌 Both
Roost Tree Potential for the Area is: High	☐ Moderate Ø Low
Subdominant Overstory Species (<38cm/15"):	
1. Heer negundo 2. Juglar	sinigra 3. Acer sucharing
Relative Abundance of Dominant vs. Subdomina	
Description of Overstory Habitat Form:	
Thin riparian, Few large frees, Ca.	1004 7570 closed over corridor
Subcanopy Clutter: Closed Moderate	> X Open Open outside cossider
Is Subcanopy Vegetation Lay Comprised Largel	y of: 🛛 Lower Branches of Canopy Trees?
Dominant Understory Species: 1. Lindera 2. Januari	□ Saplings □ Shrubs
3. Description of Habitat Form:	iniparian in agricultural land
	Urtica ditoica, Impatiens paillida
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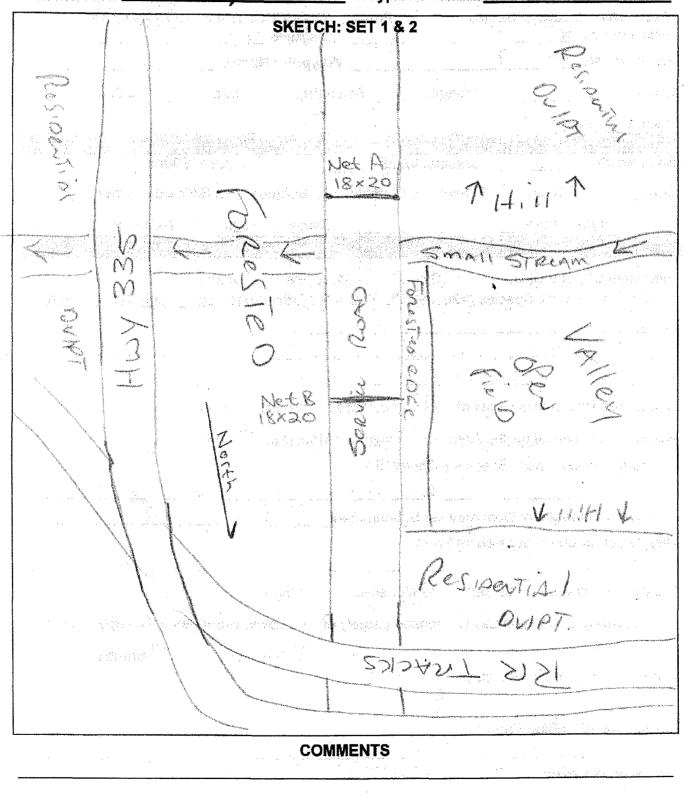


	Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)
	HABITAT DESCRIPTION
Project No.: Pesi 096.04 Project Na	ame: ODOT CH2MHill
	J. Schwiegohann / J. Duffey
State: OH County: Scioto For GPS: Latitude: <u>N 3 8 ° 4 8 ' 2 5 .</u>	<u>1" Longitude: W 8 2 ° 5 0 ' 4 8 5 "</u>
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Roost Tree Potential for the Area is:	"我们你们,这个人,你们不知道,你们不知道,你们不知道,你们不知道,你们不知道,你们还能能够能
Subdominant Overstory Species (<38cm/15")	
ta se se se se se se transfer en la se	uns nigra 3 Gliditsia trincastes
Relative Abundance of Dominant vs. Subdon	ninant:1:3
Description of Overstory Habitat Form:	priidor. Wis development/pasture
Subcanopy Clutter: Closed Modera	ate 🛛 Open
	gely of: Lower Branches of Canopy Trees?
	Saplings Shrubs
Dominant Understory Species: 1. Acer 1 2. Linde	ubra ra benzoin
Description of Habitat Form: Dry road corridor between r	estidential + pasture near RR
Herbaceous Cover Moder Abover	mortiens pallida, Khus redicens
Hemerace	Ilus fulua, Parthenocissus quinquefolia

.



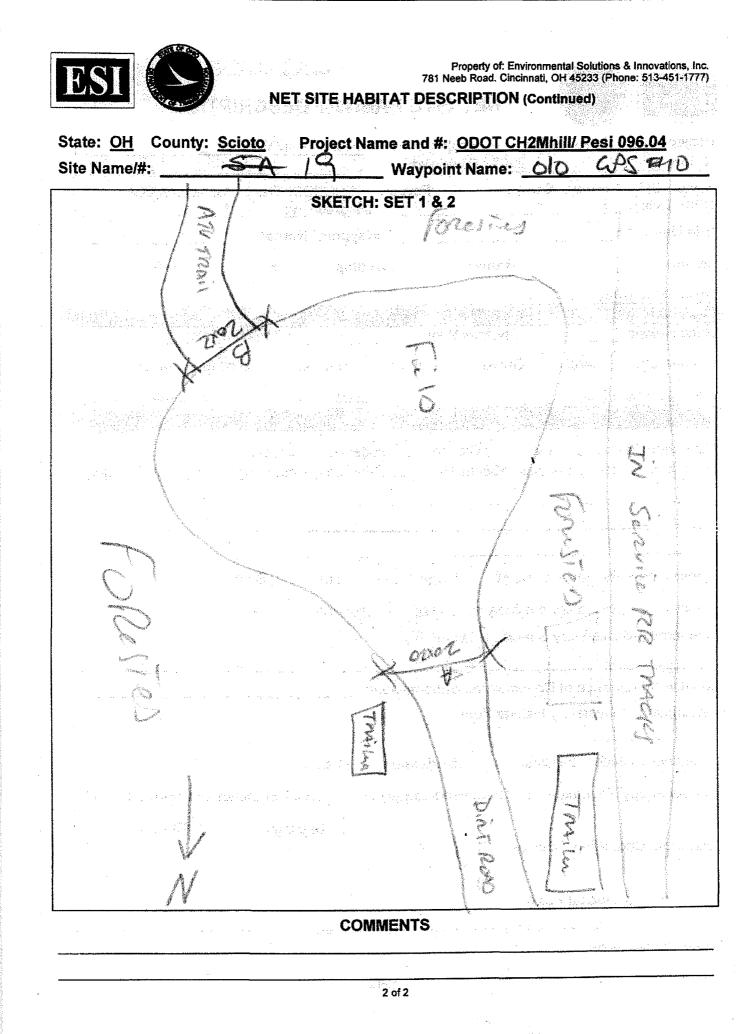
NET SITE HABITAT DESCRIPTION (Continued)



Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)
NET SITE HABITAT DESCRIPTION
Project No.: Pesi 096 04 Project Name: ODOT CH2MHill
Date: <u>3 Aug 2003</u> Biologist: <u>J. Schwierjohann/J. Duffey</u>
State: OH County: Scioto Forest: XXXXXXXX Tract: XXXXXXXXX GPS: Latitude: <u>N 3 8 17</u> , <u>3 19</u> , Longitude: <u>W 8 2 5 1 25 0</u> ,
Site Name/#: Waypoint Name: Waypoint Name:
Quad.: Range: Township: Sec.: ¼ Sec.:
Distance to water: 150
ESTIMATED STREAM OF A RACTERISTICS POWER IN THE STREAM Width: Stream Width:
Substratum: Sand Gravel Cobble Bedrock Silt/mud other
a she an
Average Water Depth: Clarity: High Moderate Low
Estimated Canopy Closure: Closed Moderate Open, Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg:
1. Quereus alba
2. Quercus monterna (Preives)
3. Preximus americana
Roost Tree Potential consists of: Large Trees Snags Both
Roost Tree Potential for the Area is: 🖾 High 🕅 Moderate 🗌 Low
Subdominant Overstory Species (<38cm/15"):
1. Forrubra 2. Judims nigra 3. Quercusalba
Relative Abundance of Dominant vs. Subdominant:
Description of Overstory Habitat Form: Moderne 2 Successional Closed corridor adjudo pasture
Subcanopy Clutter: Closed Moderate Open
Is Subcanopy Vegetation Lay Comprised Largely of: 🗌 Lower Branches of Canopy Trees?
Saplings Shrubs
Dominant Understory Species: 1. Nuclea Subortica
2. Sesserer albitom
Description of Habitat Form: Uphan hardwood edge, Uniformaged,
Herbaceous Cover: Smilex Spp., Rubus spp., Lonicera japonica
1 of 2 Fescue

ES Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777) **NET SITE HABITAT DESCRIPTION (Continued)** State: OH County: Scioto Project Name and #: ODOT CH2Mhill/ Pesi 096.04 Site Name/#: 18 Waypoint Name: <u>COR</u> and the second second GN 5 SKETCH: SET 1 & 2 X4 ST. 100 Se 42 11:11 Netsice 201220 ncec Net sike an G. Y 1.1 - 1.1 Shallow đ - ofe sted COMMENTS CCASE. Contraction of the second 2 of 2

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	na na sana ang kanalan na Pananana. Na Sanananananananananananananananananana		nvironmental Solutions & In cinnati, OH 45233 (Phone:	
ESI ()	NET SITE	HABITAT DESC	RIPTION	
Project No.: Pesi 096	3.04 Project Na	me: ODOT CH2MH	M	
Date: 6 Aug	Series and the	a service of the serv		while yo
State: OH County:- GPS: Latitude: <u>N 2</u>	Scioto Fore	st: XXXXXXXX Trac		
Site Name/#:A	19	Waypoint Name:	and the second	
Quad.:	Range: 1	 Township: Sec		a de la companya de l
Distance to water:	a second and a s	rownsnip Sec		• • · · · · · · · · · · · · · · · · · ·
ESTIMATED STREAM Bank Height:	2010/07/2010 TANK STREET, WARRANT AND AND AND ADDRESS OF A DREET, STREET, STREE	Stre	am Width:	
Substratum: Sand	Gravel Cobb	le 🗌 Bedrock 🗌	Silt/mud other	·
Average Water Depth:		Clarity: 🗌 High		Low
VEGETATION CALL				
1. <u>2. <u>M</u> Face down 3. Roost Tree Potential of Roost Tree Potential for Subdominant Overstor 1. <u>Laguadance of</u> Relative Abundance of Description of Overstor</u>	onsists of: Large Tr or the Area is: High y Species (<38cm/15"):	rees Snags B Moderate KLo 4. Acer saccha	w um 5. Fraxinu	s americana <u>eudoacc</u> acia
Uniformaged -	ouns trees, mad	enably closed	conidors	
Subcanopy Clutter:	Closed Doderat	te 🗌 Open		
Is Subcanopy Vegetation	on Lay Comprised Larg	jely of: 🗌 Lower Bra	nches of Canopy	Trees?
Dominant Understory S	Species: 1. Sinta 2. Shus s	Saplings Aceudoaccacia Spp. Scientalis	Shrubs	
Description of Habitat F	Form: L. Recently he	awily logged	open area w	<u>iith co</u> rridou
Herbaceous Cover: 🤇	oning rayueed, c id, Joe-pye weed	on ron planting lead	sing to fore	rof over
Pesce	그 그는 것 같은 것 같	1 U C		



and the second				
EST (S)	JET SITE H/	Property of: Em 781 Neeb Road. Cinci	rironmental Solutions & Inn nnati, OH 45233 (Phone: 5 RIPTION	ovations, inc. 13-451-1777
Project No.: Pesi 096.4 Date: <u>oce August</u> 2003	Biologist:	The La Mun	tain, D. J.	=Ffcot
State: OH County: Scioto	Forest		Tract:	
GPS: Latitude: <u>N 3 8 • 4 5</u> ,				
Site Name/#: Shela f	#20	Waypoint Name:	<u>avoi 17</u>	
	nge: Tov	vnship: Sec.	.: ¼ Sec.:	• <u>•••••</u> •••••••••
Distance to water:				
Bank Height: Cha		<u> 1 < Ft_</u> Strea	im Width:/5	ft
Substratum: Sand Grav	vel 🕅 Cobble	Bedrock	Silt/mud other	
Average Water Depth:	Linch	_ Clarity: 🕅 High		
MEDIETAITION				
Dominant Overstory Species (>3 1. Plantaneso caidentalis 2. Acer sacchacum		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	.g. <u>a upr</u> on <u>a</u>	
3.	· · ·			
Roost Tree Potential consists of		s 🗌 Snags 🖉 Bo	oth	
Roost Tree Potential for the Area	a is: 🛛 High 🖉		v	
Subdominant Overstory Species				
1. Fagus americana	2		3	
Relative Abundance of Dominan	it vs. Subdomina	nt: 75% vs 2.	5 %	
Description of Overstory Habitat	Form:			
Subcanopy Clutter: Closed	Moderate	Open	9,000,000,000,000,000,000,000,000,000,0	-
Is Subcanopy Vegetation Lay Co	omprised Largely	of: Cower Brar	nches of Canopy T	rees?
	•	Saplings	Shrubs	
Dominant Understory Species:				
	2. Fagus ame 3.			·.
Description of Habitat Forme				
Description of Habitat Form:	· · · · · · ·	an a	- 	
en er	L Clear Weed	Stinging nettle, P.	Warnein co.	
Description of Habitat Form: Herbaceous Cover: Jewelweed Winged Mor	t, clear weed, okey flower 10	Stinging nettle, P.	olygonium spy	

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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777) **NET SITE HABITAT DESCRIPTION (Continued)** 國家語 计管理计学可任 Project Name and #: ODOT CH2Mhill/ Pesi 096 County: Scioto State: OH #2 Spelano _ Waypoint Name: _____00___ Site Name/#: \bigcirc SKETCH: SET 1 & 2 지 않는 것 같아? NO NC Stream 12. FECH RA . P $\Delta_{i,j}$ Cassin A. 4月1日1日1日1日 x:注意:《大林音音》第 1981年2月1日日 1 Sh CX. -0 ø 5 ----manisher A. 2.4 <u>____</u> (E) (Shi relevent oper sold of mediatestic search of the disguest statist, in the pass often in the relevant inter- $\sum_{i=1}^{n} \frac{|h_i|}{|h_i|} \leq \sum_{i=1}^{n} \frac{|h_i|}{|h_i|} \leq \sum_{i$ and the second second COMMENTS 2 of 2

TSHES			781 Neeb Roa	d. Cincinnati, OH 45	Solutions & Innovations, 2333 (Phone: 513-451+1	
			ABITAT DE	30RIP 110	JN	1. 11.
Project No.: <u>Pesi</u> Date: <i>4Av4</i>		Project Nam Biologist:		2MHill	· ``\@~~	
State: OH Coun	tv: Scioto	Fores	t: XXXXXXXX	Tract: XXXX	XXXXXX	
GPS: Latitude: <u>N</u>	<u> 8.48</u>	: 32.3	"Longitude: <u>W</u>	<u>82.2</u>	2:49.7	" -
Site Name/#:	TTF COL	#21	Waypoint Nai		GPS =10	<u>></u>
Quad.:			wnship:	Sec.:	_ ¼ Sec.:	
Distance to water:						
Bank Height:		nel Width:		Stream Width	1:	
Substratum: 🛛 Sa	nd 🗌 Grave		Bedrock	Silt/mud	other	
Average Water Der	oth:		_ Clarity: 🗌 H	igh 🗌 Mo	oderate 🗌 La	w
VEGELIXITICS VILL						
Estimated Canopy Dominant Overstor	(a) A. (1997) A. (1997)	(A) A set of a set		Open, ge: Lg: <u>30d</u>	bh Sm <u>/S dbh</u>	
1. Ulmis Am	nenican	····				
2 JULINS	NIGA				میں جامع ہوتا ہے۔ م	
	and the second					
3. Quenus	pusin					
3. Quencus Roost Tree Potentia		Large Tree	es 🗌 Snags	Both		
	al consists of:			~~		
Roost Tree Potentia Roost Tree Potentia Subdominant Overs	al consists of: al for the Area story Species (is:	Moderate	Low		
Roost Tree Potentia Roost Tree Potentia Subdominant Overs	al consists of: al for the Area story Species (is: High <38cm/15"): 2. <u> V/m~1</u>	Moderate A	Low <u>x 3. <i>Ro</i>c</u>	sinà Psera	<u>у</u> Аст
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A caa Taa</u> Relative Abundance	al consists of: al for the Area story Species (<u>Aron</u> e of Dominant	is: High <38cm/15"): 2. <u>U/mrj</u> vs. Subdomin	Moderate A	Low <u>x 3. <i>Ro</i>c</u>	sina Pseva	×
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A can Tan</u> Relative Abundance Description of Over	al consists of: al for the Area story Species (<u>60000</u> e of Dominant story Habitat F	is: High <38cm/15"): 2. <u>//av1</u> vs. Subdomina	Moderate A Ammiun ant: 174	Ilow <u>× 3. <i>Ro</i>(</u>	sinia Aseva	
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A CA Relative Abundance</u> Description of Over	al consists of: al for the Area story Species (<u>Annon</u> e of Dominant story Habitat F	is: High <38cm/15"): 2. <u>Ulmui</u> vs. Subdomini form: <u>Cluttenes</u>	Moderate Amanican Amanican ant: 1:4	Ilow <u>× 3. <i>Ro</i>(</u>	sina Asera	
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A CA</u> Relative Abundance Description of Over <u>UNENEN</u> Sc Subcanopy Clutter:	al consists of: al for the Area story Species (<u>b</u> of Dominant story Habitat F	is: High <38cm/15"): 2. <u>Umu1</u> vs. Subdomini form: <u>CluTienes</u>	☐ Moderate / Am <i>mican</i> ant:/ + 4 , <u>∧s ∧e ∧ I</u> ☐ Open	Ilow <u>2 3 Rod</u> <u>6 APS</u>		
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A CA Relative Abundance</u> Description of Over	al consists of: al for the Area story Species (<u>b</u> of Dominant story Habitat F	is: High <38cm/15"): 2. <u>Umu1</u> vs. Subdomini form: <u>CluTienes</u>	Moderate	Low <u>3. Rod</u>	Canopy Trees?	
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A</u> <u>Ca</u> Relative Abundance Description of Over <u>UNINE So</u> Subcanopy Clutter: Is Subcanopy Vege	al consists of: al for the Area story Species (<u>AAAAAA</u> e of Dominant story Habitat F <u>MEMAAA</u> Closed station Lay Con	is: High <38cm/15"): 2. <u>Unul</u> vs. Subdomini form: <u>Cluftenes</u> Moderate nprised Large	Moderate	Low <u>3 Rod</u> <u>AAAS</u> Branches of Igs		
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A CA</u> Relative Abundance Description of Over <u>UNENEN</u> Sc Subcanopy Clutter:	al consists of: al for the Area story Species (<u>AAAAAA</u> e of Dominant story Habitat F <u>MEMAAA</u> Closed station Lay Con	is: High <38cm/15"): 2. <u>Unul</u> vs. Subdomini form: <u>Cluftenes</u> Moderate nprised Large	Moderate	Low <u>3 Rod</u> <u>AAAS</u> Branches of Igs	Canopy Trees?	
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Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A</u> <u>Ca</u> Relative Abundance Description of Over <u>UNINE So</u> Subcanopy Clutter: Is Subcanopy Vege	al consists of: al for the Area story Species (<u>AAAAA</u> e of Dominant story Habitat F <u>MEAAAA</u> Closed station Lay Con	is: High <38cm/15"): 2. <u>Unul</u> vs. Subdomini form: <u>Cluftenes</u> Moderate nprised Large	Moderate	Low <u>3 Rod</u> <u>AAAS</u> Branches of Igs	Canopy Trees?	
Roost Tree Potentia Roost Tree Potentia Subdominant Overs 1. <u>A</u> <u>Ca</u> Relative Abundance Description of Over <u>UNUNE So</u> Subcanopy Clutter: Is Subcanopy Vege Dominant Understo	al consists of: al for the Area story Species (<u>A</u> e of Dominant story Habitat F <u>Closed</u> tation Lay Con ory Species: tat Form:	is: High <38cm/15"): 2. <u>Unul</u> vs. Subdomini form: <u>Cluftenes</u> Moderate nprised Large	Moderate	Low <u>3 Rod</u> <u>AAAS</u> Branches of Igs	Canopy Trees?	
Roost Tree Potentia Roost Tree Potentia Subdominant Overs A CA Too Relative Abundance Description of Over Market Subcanopy Clutter: In Subcanopy Vege Dominant Understo Description of Habi	al consists of: al for the Area story Species (<u>A</u> e of Dominant story Habitat F <u>Closed</u> tation Lay Con ory Species: tat Form:	is: High <38cm/15"): 2. <u>Unul</u> vs. Subdomini form: <u>Cluttenes</u> EXModerate nprised Largel 1. <u>Cursen</u> 2. <u>Acc</u> 3. Ulm)	Moderate	Low <u>3 Rod</u> <u>AAAS</u> Branches of Igs	Canopy Trees?	

Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777) E **NET SITE HABITAT DESCRIPTION (Continued)** State: OH County: Scioto Project Name and #: ODOT CH2Mhill/ Pesi 096.04 Site Name/#: 44-20 GPS Waypoint Name: 005 #10 SKETCH: SET 1 & 2 OR Fresters Homesite 37× 8/ 3 Ś Forester n 1 8050 COMMENTS

2 of 2

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	Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)	ge / of /	Camera # NA	11. . 000714	Time Down	03.00 02:00			Location	2 Meters	Z d	μM						
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	3AT CAPTURE DATA	ODOT CH2MHill	Lanna ,	Forest: XXXXXXXXX Tract: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Height				Reprod F=(NR/PG/L /PL:M=↑/J	DL Id		YL						
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	BA	Project Name:	Biologists:	st: XXX					Age & Ad R or Jv	Ad Ad		Ad			240 -			Alexandri Alexan
		E L	Ö	Forest	Nawr Nivio	New Nylo			Time (2400)	╉╍┉╂	0130	0330						
			2003			Nylon /			· · · · · · · · · · · · · · · · · · ·						-			· •
		Pesi 096.04	July	State: OH County: Scioto GPS: Latitude: N 2 0 5	Net type Mono //Old Nutory New Nuton	Mono / Old Nylon / New Nylon Mono / Old Nylon / New Nylon	Site Description/Comments:		Species	s fix ws	(escaped	2						
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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)	Pageof	Camera # NA	14 . OPOT 14	Time Down	02:00			Location in net									 4. 	
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BAT CAPTURE DATA	ODOT CH2MHill	amountain	Forest: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Height	M			Reprod F=(NR/PG/L /PL: M=↑/↓			C)							•
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Δ	Project 1	Biologists:	rest: XXXXXXXX	uo	50			Age Ad or Jv				C			•			
	ď	•	For 1/ 1/	A New Nvlon	New Nyl New Nyl		to serve and	Time (2400)										
	Pesi 096.04	11 4 2003	State: OH County: Scioto GPS: Latitude: <u>N 3 8 5 3 1</u>	Net type Mono / Old Nvlon	Old Nylon Old Nylon	Site Description/Comments:		Species		· ·)				
	Project No.: Pesi 096.04	Date: 27 July	State: OH Co GPS: Latitude:_	Trap # Net #) Descriptio		1						an in diaman				•
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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)



WEATHER DATA SHEET

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Date: 💪		si 096,% 	_ Project Name: _ Biologist:	H. LoMou	· · · ·	1. Juffcor
State: O	H Cou		Forest:		Tract:	
		<u>38.53</u>	<u>, 441 "</u>	.ongitude: <u>W</u> 8	The second se	272.
Site Nam	e/#:	11	Ŵ	aypoint Name:	_ODOTI	4
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ime	Temp	Wind Speed (estimated	Wind Direction:	% Cloud		
2400 h)	(°C/F)	see chart)	From to	Cover (estimated)	Comments	
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7:45	7JF	0		20%)0		
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1:45	710F	O		0.0%		
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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

WEATHER DATA SHEET

		nty: Scioto	Forest:		Tract:
SPS: Lati Site Nam	tude: <u>N</u>	<u>58.53</u>			2.58.272.
		e H eren en angelen. Ny series angelen angel	Wa	ypoint Name:	ODOT19
Commer	<u>1ts:</u>				
	se (Our				
'ime 2400 h)	Temp (°C/F)	Wind Speed (estimated – see chart)	Direction:	% Cloud Cover (estimated)	Comments
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4:30	72°F			60%	
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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)	of	*		4-4-	Time Down	00	00			Location	het	R N				u .		
: Environmental Solutic Cincinnati, OH 45233 (1	Page	Camera #	(† 12	1 '	Tim	CD: 00	60											
Property of 781 Neeb Road. C		fat	Site Name/#:	R .	Time Up	00:10	31:00			Belly: Net #	н М. М. Ц							
АТА		N, Jeffco	XXXXXXXX	2.250							(g) (mm)	5				- - -		
BAT CAPTURE DATA	Project Name: ODOT CH2MHill	Biologists: LaMeruntain	Forest: XXXXXXXXX Tract: XXXXXXXXX	Longitude: <u>W </u>	Height	000	100			1		<u> </u>						
BAT CAI	t Name:	lists: Lar	CXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	ongitude: W	Length	18			· ·	Sex M or								
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01:00	68°F			20%	
03:00	68°F			20%	



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Date:	<u>29</u> J	2003	Project Name: Biologist:	LaMALIA	Hain, Jeffcott
State: Ol	l Cou	nty: Scloto	Forest: _	-4/110/114	Tract:
GPS: Latil	ude: <u>N</u>	<u>36.23</u>	* <u>3 @ 3</u> " Lo	ngitude: W 8	_ Tract: <u>え・ら </u>
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Date: 03 August 2003	Biologist: HUMBORDAIN	D. Teffcot
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	<u> 0 4 8</u> " Longitude: <u>W 8 2 * 5 み</u>	
Site Name/#: 15	Waypoint Name: 000	
Comments:		

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Time (2400 h)	Temp (°C/F)	Wind Speed (estimated – see chart)	Wind Direction: From to	% Cloud Cover (estimated)	Comments
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		<u>38.50</u>	<u>, 048</u> " Lo	ngitude: <u>W</u>	J.2J.	5 3 4"
Site Name	ə/#:	15	Wa	point Name:	ODOT 1	8
Commer	nts:	, , ,	n Alfred Martin			
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MM(eld), 1277	Stewley Ister					
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6	50.5	XXXXX Site Name/#:	Time Up	2 HOR	2045	Hollow Red	Belly: F, M, E	and the second second						/			
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	2003	5 9 -		1 Nylon /	d Nylon /												
Project No.: Pesi 096.04	11/	State: OH County: Scioto GPS: Latitude: $\underline{N} = \underline{3} \otimes \underline{4} \oplus \underline{4}$	Net type	Mono / Old Nylon / New Nylon	Mono / Old Nylon / New Nylon Mono / Old Nylon / New Nylon	Site Description/Comments:	Species										
	M	OH Co atitude: N	Net #	Ŧ	2	scription											
Project	Date:	State: GPS: L	Trap#		\parallel	Site De	# bi										

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Property of: Environmental Solutions & Innovations, Inc. 781 Neep Road. Cinchinati, OH 45233 (Phone: 513-451-1777)	Jo	Camera # -/	9_1	014 20/200	Time Down	0130			Location in net								a di kanan dagi si bertakan di Kina pada da sete		
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T CAPTURE DATA	ODOT CH2MHII	Schwier Johen	DOCOCOCK Tract XXXXXXXXXX	itude: <u>W 8 5 0 5 / - 6</u>	Height	20 2 2		10-1	Reprod F=(NR/PG/L /PL; M=1/J								/		
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	Project No.: Pesi 096.04	P.S	State: OH County: Scioto	GPS: Latitude: <u>N _ S ・ </u>	Net type Mond / Old Nivion / New Nivion	Mono / Old Nylon / New Nylon	Nono / Old Nylon / New Nylon	Site Description/Comments:	Species				245 0 14 0 10 0 10 0 10 0 10 0 10 0 10 0				and the second		
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ESI	Project N	Date:	State: O	GPS: Latit	Trap#	7		Site Desc	Capt #			and the second secon							

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WEATHER DATA SHEET

Project No.:		Project Name	: ODOT CH2MH	III		
Date: 31	JULY	2003 Biologist:	J.Schureri	ohann li	2. O'tter	1
State: OH		그는 말 아니는 것 같은 것이 같을 수 있는 것이다.	XXXXXXXX		., z 🕹 🔨 📢	ana di A
GPS: Latitude	: <u>N38</u> *	49.41.2"	Longitude: W 8	2. · 5 c	· · 57.4	D , P
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TO Loca	1					

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True Contraction

Time (2400 h)	Temp (°C/F)	Wind Speed (estimated – see chart)	Wind Direction: From to	% Cloud Cover (estimated)	Comments
2100		1-3	ω- > ε	100%	"Heart moving through
2130		1-3.	いうと	100%	
2200		1-3	$\omega \rightarrow \varepsilon$	80%	Clearing in W
2930		1-3	$\omega \rightarrow E$	60%	11 - Ale Ale
2300		1-3	$\omega \rightarrow \epsilon$	50%	$\mathbf{w} \in \mathbf{w}$
2330		1-3	とうた	25%	Clouds In E
0000		1.3	WAE	50%	CLUSINNE
0030		1-3	WAE	80%	
0010		1-5	ن > E	100%	
0130				80	
0200				80	



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MatrixTemp (2400 h)Wind Speed (estimated - see chart)Wind Direction: From to% Cloud Cover (estimated) 9.700 76° $1-3$ $W \rightarrow E$ 75° $1-3$ 9.700 76° $1-3$ $W \rightarrow E$ 75° $1 \rightarrow \infty$ 9.130 76° $1-3$ $W \rightarrow E$ 75° $1 \rightarrow \infty$ 9.300 75° $1-3$ $W \rightarrow E$ 50% 9.300 74° $1-3$ $W \rightarrow E$ 50% 9.300 74° $1-3$ $W \rightarrow E$ 50%	
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2330 749 1-3 636 25%	
0000 74° 1-3 , W→E 25%	
0030 720 1-3 Water 50% Malerder For	
0100 72° 1-3 WHE 50%	
6130 72° 1-3 50%	ta na su

Property of: Environmental Solutions & Innovations, Inc. eeb Road. Cinclinatt, OH 45233 (Phone: 513-451-1777)															an a		
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Property of Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cinclinatti, OH 45233 (Phone: 513-451-177)	1	Camera # _/	C	" Waypoint Name: <u>cole/GPS #10</u>	Time Down	0000	0		Location	net	Certer	center			1999 A. 1999		
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ÄP		N H	88	S	Length	X	x										
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		29	ပီ	ude: N	Net #	X,	4/	Liptio!			ste si	5030150					
	Project No.: Pesi 096.04	Date: <u>29 July</u>	States OH County: Scioto	GPS: Latitude: N 3 8 4 8	Trap #	1	1	Site Description/Comments:			I Er	۲, ۱			 		
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781 Neet	300	Site 1	Wayp	Time Up のいの	0		Beily: F M F	L L								
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	~~~~	XXXXXXXXX Tract XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		· · · · · · · · · · · · · · · · · · ·			RFA (mm)	39.4	48							
PA	ODOT CH2MHII	X	2				<b>X</b> (9	0	00.5							
<b>R</b>	ODOT CH2MHIII	act		Height	8											
2	DO DO J	XX	8 				Reprod F=(NR/PG/L	ł	78							
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BAT	Project Name: Blologists:	Š	rongin												27. 17.	
	Project I Biologis	Forest X		Ę	vlon Vlon		Age Ad		Ť							
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P	Project No.: Pesi 096.04 Date: ろつ びいy 2003	State: OH County: Scioto		Trap #		Site Description/Comments:	# Capt		<del>с</del> б							
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## WEATHER DATA SHEET

State: OI GPS: Latif	<u>, ∧ ⊂</u> H Cou tude:_ <u>N</u>	<u>3 8 • <u>4 8</u></u>	Forest: X) <u>25.9</u> " Loi	<u>D. Schuller</u> XXXXXXX ngitude: <u>W</u> <u>S</u>	<u>shann / J. Outrey</u> Tract: XXXXXXX <u>A., 5. 0., 4, 8, 5.</u> ,
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Accors	ال بحذيا	- Laiza	went then a	and the	
Time (2400 h)		Wind Speed (estimated – see chart)	Direction:	% Cloud Cover (estimated)	Comments
2100		6	NA	85%	High this clouds
2130		Ø	N/A	85%	n = n
2200		1-3	- CU ^L →E	85%	u u
2230		1-3	$\omega \rightarrow E$	40%	clearing in NE
2300		l-Zerris	い <del>、</del> C	20%	clearing in NE
2330		1-3	₩	15%	PatchycloudeinesE.
0000	har Aurorit	1-3	ω÷ε	15%	(1,1) = (1,1) = (1,1)
0030		1-3	wae .	10%	
5.100		1-2	w ->E	10%	
5130		1-3	ುತ್ತ	6%	ACTIVE STREET
0200			DSE	10%	
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### WEATHER DATA SHEET

Project No.:         Pesi 096         Project Name:         ODOT CH2MHill           Date:         30 July 2003         Biologist         July 2004         Biologist	Noth O.T. N
State: OH County: Scioto Forest: XXXXXXXX Tract: XX	<ul> <li>A set of the set of</li></ul>
GPS: Latitude: <u>N 3 8 4 8 2 5 9</u> " Longitude: <u>W 8 2 6 5 0</u>	A CONTRACTOR AND A CONTRACTOR OF A CONTRACTOR O
Site Name/#: Waypoint Name:	5PS # 10

### Comments:

Time (2400 h)	Temp (°C/F)	Wind Speed (estimated – see chart)	Wind Direction: From to	% Cloud Gover (estimated)	Comments
2100		No. S	N/A	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Y NA
2130		Ø	N/A	0%	N/A
2200		ø	M/A	0.60	N/A
2230		ð	Au	Øž	this cladrinul
2300		ø	N/A	1596	u. v., mau
2330		ó é	N/A	15%	at
0000		ď	K//A	15%	$-10^{-2}$
0039		Ó	N/A	15%	11 T
0100		Ø	NA	25%	Cover Moning WAS
0130		Ø		60%	Clauding quickly
0200		Ø	NIA	75%	1
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Property of: Environmental Solutions & Innovations, Inc. 781-Neeb Road: Cincinnati, OH 45233 (Phone: 513-451-1777)		4		の田	umo				Sio	5	a an shaddaa										
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Cincinnati Cincinnati	Page	<b>.</b>		lame:				-  Š	Q Po						- Physics and a		1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 19		/		
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8	Project Nai	Biologists	X	" Longi				016	2	Age Ad I or Jv	5	$\mathbf{Y}$			$\frac{1}{2}$		and a second				
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		2003		N		Mono / Old Nylon	VION /	2	ij		¢	$\bigcirc$					a de relative de la construcción de				
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	si 096	100	inty: .	3	Net type	Mono	Mono / Old Nvlon / New Nvlon	Comn		Species	a and a second a seco	a a constante de la constante d					and the state of the second		a bara da taka sana sa		
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	Project No.: Pesi 096.04		State: OH County: Scioto	GPS: Latitude: <u>N</u> <u>∃</u> <u>8</u> <u>•</u> <u>⊣</u>	$ \rightarrow $	1		Site Description/Comments:			a (a a tha bear an tha	a.					ey entre se				
	e al maine	<b>Date:</b>	State	GPS:	Trap#		1	Site		Capt #							and the second second		میں میں اور می اور میں اور میں		

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Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road: Cincinnati, OH 45233 (Phone: 519-451-1777)		/ jo	Camera # 4	と大	208/6P3#10	Time Down		<u>9</u> /		Location in hat				an ang tang bang pangangang pangang ang tang tang tang tang tang tang			1		
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781 Neeb			D.ff.	Site N	.C. Waypoint Name:	Time Up	0200	?))/		Belly: F M E					/	American and a subserver			
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	T CAPTURE DATA	ODOT CH2MHII	Schwierjohan	Forest: XXXXXXXXX Tract: XXXXXXXXX	15.02	Height	0 1 1 1	2/		Reprod F=(NR/PG/L /PL: M=1/J		a second a s		and a straight of the second se Second second		「「「「」」」、「「」」、「」」、「」、「」、「」、「」、「」、「」、「」、「」			
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	B	Project Na	Biologists	st XX	" Long					Age Ad or Jv					e años. E artes				
			ā	Fore			New Nylo	New Nylo		Time (2400)		3							
		04	2003	cioto 	GPS: Latitude: <u>N く ど と と と と い</u> Longi	9	Mono / Old Nylon / New Nylon Mono / Old Nylon / New New Nylon	Mono / Old Nylon / New Nylon	ents:		Q	3				and the second states of the second			
C		Project No.: Pesi 096.04	3 Aug	State: OH County: Scioto	X N Z		Mono /	Mono /	Site Description/Comments:	Species	a second a s	として				and the surveyory of a second			
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Project No.:	Pesi 096		Project N	ame: (	ODOT CH	12MHill			
Date: 2	Aug	2003	Biologist:	5	i Sahu	ierto	hann	15.0	Suffey
State: OH	County:	Scioto	Foi						
GPS: Latitude		The second s	t de la construction de la section de la	a state of the sta	a hard the part of the state of	an a		No. 25 Constraints of the	a an
Site Name/#:		<b>^</b> .			point Na				A. 5 - 4
Comments:	Thurs	Lecha				(教長)		1975 2	

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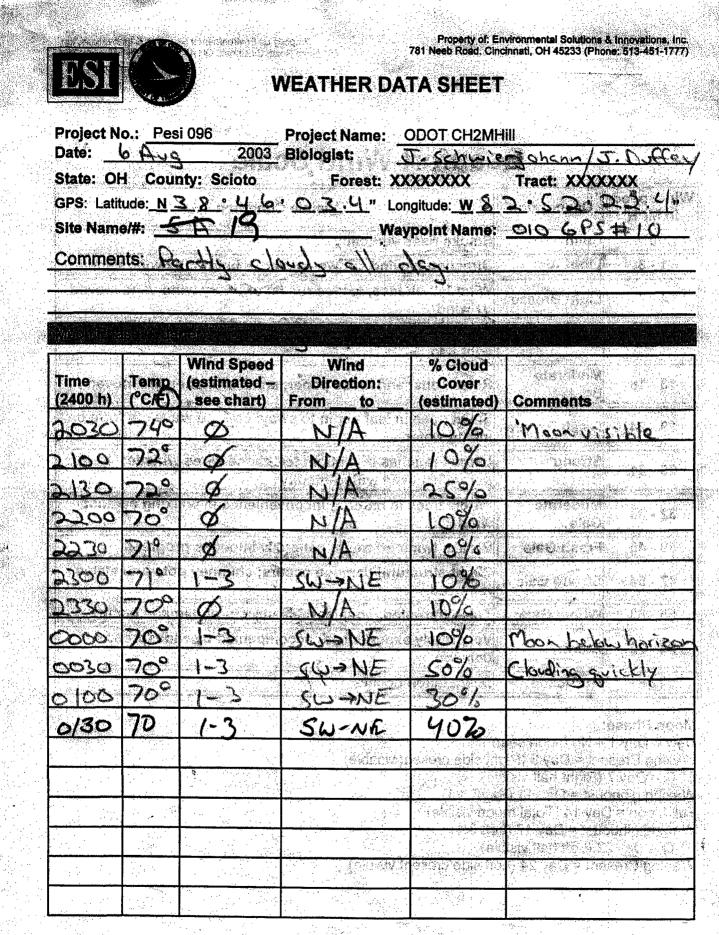
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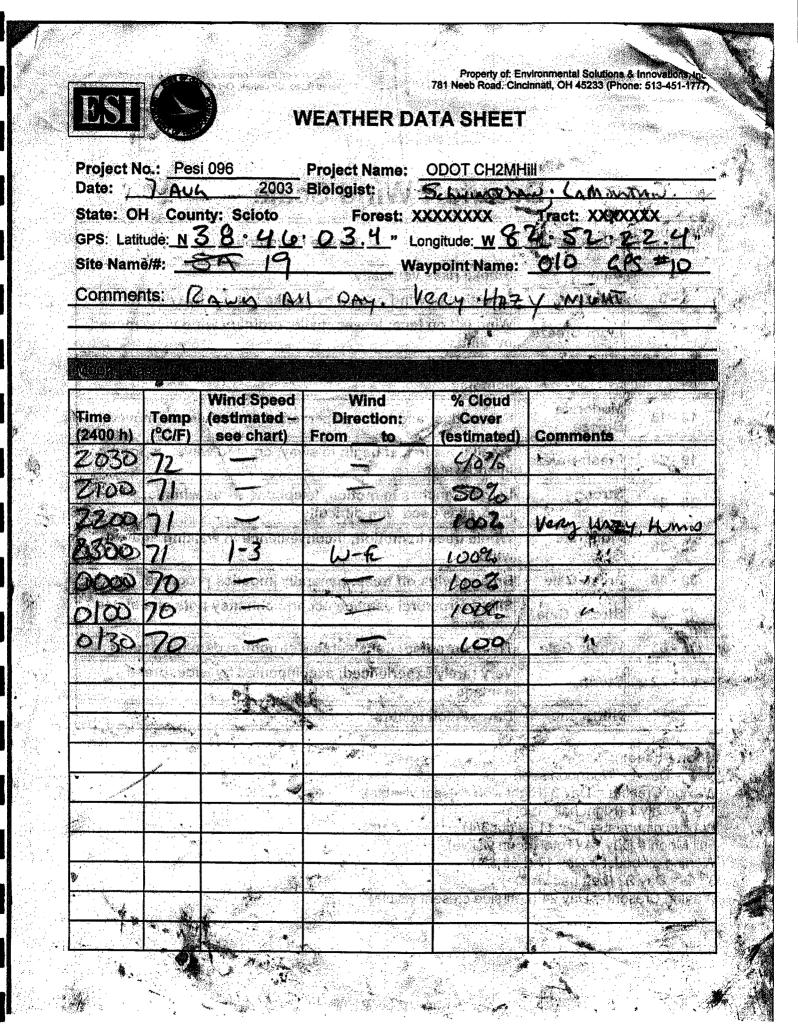
Time (2400 h)	Temp (°C/E)	Wind Speed (estimated – see chart)	Wind Direction; . From to	Cloud Cover (estimated)	Comments
2100	760	1-3	NW→SE	100%	
2330	76°	1-3	NUISSE	100%	Moon Racely visible
2200	73°	1=3	こちょうの	■ 1.1.1.2.2.2.2倍的機能構成的体態に応	Clouds this in NW
2230	73°	l-3	NUASE	85%	
2300	न्रुपुरु	1-3	NUSSE	109%	Distant lightning
2330	<u>75°</u>	1-3	ててそのの	109%	Licht Rain
0000	<u>25°</u>	Ø	<u>N/A</u>	100%	Pain stopped
0030	<u>^\$°</u>	M DUNE UT	A	100%	
0100	74°	Ø	<u>N/A</u>	100%	Distant lichthing
0130	24°	Ø	N/A	100%	
0200	740	1-3	W->E	100%	
				Sectors and the	e de la constante de la constan Final de la constante de la cons
				l cardon	
			10x (0/17)		

Project N Date: State: O	<u>3 Au</u> H Cou	si 096 <u>-</u> 2003 nty: Scloto	Biologist:	ODOT CH2MH	lill Soliconn/J. D.Mfey Tract: XXXXXXX
GPS: Lati Site Nam		i i i i i i i i i i i i i i i i i i i			2.51.25.0" 008/GPS#10
Comme	nts: <u>s</u>	<u>Scattered</u>	<u>Thunders</u>	<u>Horns A</u>	11 gers
a alta an ann ann ann					
Time (2400 h)	Temp (°C/F)	Wind Speed (estimated – see chart)	Wind Direction: From to	% Cloud Cover (estimated)	Comments
2100	740	143	$\omega \rightarrow \varepsilon$	75%	Fronts moving ->
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Date: Shur	<b>M</b>	ă	Biologists:		Schuizena	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1(term	Trues		Camera #
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### WEATHER DATA SHEET

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<b>Date:</b> _ <u>O</u> _	Date: 05 Mayst 2003		Biologist	<b>its:</b> <i>H</i>	La Mountain	inter inter	W P	Teffco	+	Camera # <u>MA</u>	MA
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WEATHER DATA SHEET

Property of: Environmental Solutions & Innovations, Inc. 781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

Project No.: Pesi 096 Project Name: ODOT CH2MHill Date: 4 2003 Biologist: huier 50 State: OH County: Scioto Forest: XXXXXXXX Tract: XXXXXXX .... GPS: Latitude: N 38:45:32.3" Longitude: W 82:5 Site Name/#: Waypoint Name: 📿 15 21 Comments: Zhun Evening showere predicted erstorm all day

Calm at beginning of bat survey. Rain ending and approx 2000 hrs. Day Imposed (convice)

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# WEATHER DATA SHEET

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