



**Green Brook Flood Damage Reduction Project  
Bound Brook, New Jersey**

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## **INDIANA BAT SURVEY REPORT**

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**OCTOBER 2007**

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## 1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE), New York District (District), is engaged in a Flood Damage Reduction Project for the Green Brook Sub Basin, which is located within the Raritan River Basin in north-central New Jersey in the counties of Middlesex, Somerset, and Union. The Green Brook Flood Damage Reduction Project includes approximately 14 miles (mi) of levees and floodwalls along Green Brook and its tributaries, and flood proofing in the lower portion of the project area. Due to its size, the Green Brook Flood Damage Reduction Project is broken into construction elements, which are further divided into segments. This report focuses on the R2 Segment of the Bound Brook Project Element, and is scheduled to begin construction in 2008. This segment will involve construction of 3,030 linear feet (lf) of levee, a pump station, 730 lf of floodwall, and two roller-gate closure structures.

The Bound Brook Project Element, R2 Segment (hereafter referred to as the “Survey Area”), is located on a 10-acre (ac) property in eastern Somerset County, approximately 8 kilometers (km) southeast of Bridgewater Township and along the southern border of the borough of Bound Brook (Appendix A, Figure 1). The Project site elevation is generally less than 10 meters (m). Dense residential areas abut the Project site to the north (Bound Brook Borough) and southeast (South Bound Brook Borough). A patchy distribution of open space, including fields, parking lots, and small water bodies are located to the west and southwest of the Survey Area.

The U.S. Fish and Wildlife Service (USFWS) identified the Survey Area as potential habitat for the Indiana bat (*Myotis sodalis*), a Federal and State endangered species. Therefore, the District contracted Northern Ecological Associates, Inc. (NEA), in association with North East Ecological Services, LLC (NEES), to perform an Indiana bat survey within the Survey Area. On August 8<sup>th</sup> and 9<sup>th</sup>, 2007, staff from NEA and NEES conducted surveys for Indiana bats within the R2 Segment of the Bound Brook Project Element for the Green Brook Project. This report provides a summary of the bat survey as follows: Section 2, survey objectives; Section 3, Indiana bat natural history; Section 4, general site and habitat characteristics; Section 5, survey methodology; Section 6, results; Section 7, discussion; and, Section 8, literature cited. A United States Geological Survey (USGS) quadrangle map and an aerial map of survey locations are

included in Appendix A. A copy of the final work plan for the survey effort and USFWS approval of the work plan are provided in Appendix B. Photographs of the survey event are included in Appendix C, field data forms are included in Appendix D, and the results of bat DNA testing are available in Appendix E.

## **2.0 SURVEY OBJECTIVE**

The Survey Area (Bound Brook Element – R2 Segment) within the Green Brook Flood Control Project is located along Middle Brook, in the city of Bound Brook, Somerset County, New Jersey (Appendix A, Figure 1). The Survey Area includes approximately 4.1 hectares (ha) (10 ac) of floodplain and upland forest, and has been identified by USFWS as potential habitat for the Indiana bat, a Federal and State endangered species. According to the USFWS, the Survey Area is proximate to known and potential hibernacula and may be utilized as a foraging and roosting site before and after hibernation. In order to comply with permit conditions regarding rare species, a survey was required prior to development/construction on the site to determine the presence or absence of the Indiana bat. Information on the occurrence of the Indiana bat within the Survey Area is needed to protect and/or mitigate for potential Project impacts to the species.

### **3.0 INDIANA BAT NATURAL HISTORY**

The USFWS listed the Indiana bat as Federally endangered in 1967 because of dramatic population declines and destruction of key maternity roosts and hibernacula (Trombulak et al., 2001, Clawson 2002). Despite almost 40 years of protection, Indiana bat populations continue to decline in their core range, although the cause of the decline is unknown (Clawson 2002). Indiana bats spend the winter hibernating in caves and abandoned mines throughout the eastern United States. Upon emergence from these hibernacula in the spring, Indiana bats migrate to their summer range, where adult females form reproductive colonies to raise their young. These maternity colonies remain relatively intact from June through August and are generally located under exfoliating bark or in tree cavities (Kurta & Rice 2002). Roost trees are generally located in riparian, floodplain and bottomland forest habitat. Indiana bat roosts appear to have key characteristics that are generally independent of the tree species (Scherer 1999). Specifically, roost trees are large (greater than 36 centimeter (cm) diameter at breast height (dbh)), tall, near water, and in direct sunlight most of the day (Kurta et al., 1993, Menzel et al., 2001, Kurta & Rice 2002). During the summer months, females use multiple roosts and appear to switch between them on a regular basis (Hicks 2003); adult males are believed to live alone or in small groups under exfoliating bark (Ford et al., 2002). Foraging by the Indiana bat is generally concentrated in riparian habitat, although there is growing evidence that their habitat selection is more diverse.

The Hibernia Mine in Morris County, New Jersey is the only site known to contain Indiana bats in New Jersey. This site was protected in 1994 with a metal gate to prevent disturbance to the roughly 30,000 bats of various species that use the mine throughout the winter. At the last survey, approximately 115 Indiana bats were using the Hibernia Mine (USFWS 2007). The site is located approximately 15.5 mi north of the Green Brook Project site.

Hibernacula and summer habitat of the Indiana bat has been actively documented and monitored in New York for the last 10 years. Currently, New York is known to provide habitat for almost 33,000 Indiana bats during the winter hibernation period, in seven mines spread across six counties. The two largest hibernacula are the Williams Hotel Mine and the Walter Williams Preserve Mine. These mines collectively contain more than 21,000 Indiana bats and both are

located in Ulster County, New York. Radiotelemetry data collected over the last several years suggests that many of these bats migrate out of the mines and travel towards the Champlain Valley near eastern New York.

#### 4.0 SITE CHARACTERISTICS AND HABITAT

The approximately 4.1 ha (10 ac) Survey Area includes a mix of hardwood forest, wetlands, and open meadows within the Raritan River floodplain. The Survey Area is bordered by railroad tracks and residential housing to the north, railroad tracks and the Raritan River to the south, Middle Brook to the west, and residential housing to the east (Appendix A, Figure 2). A baseball field is located in the north-central portion of the Survey Area, and a small, intermittent, unnamed creek is present in the eastern portion of the site. An access trail is situated in an east-west direction, parallel to the railroad tracks that form the northern and southern borders.

Undeveloped portions of the Survey Area are primarily wooded, with a patchy distribution of small clearings that are overgrown with herbaceous ground cover (clearings are approximately 0.1 ha). The Survey Area is best described as a small, bottomland, floodplain hardwood forest, with tree species and canopy structure typical of bottomland hardwood systems, that experiences periodic flooding and contains poorly drained soil. Dominant overstory trees within the Survey Area include silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), balsam poplar (*Populus balsamifera*), and pin oak (*Quercus palustris*), with fewer numbers of black cherry (*Prunus serotina*), American elm (*Ulmus americana*), boxelder (*Acer negundo*), eastern sycamore (*Platanus occidentalis*), and shagbark hickory (*Carya ovata*). The understory is relatively dense and although seedlings from the aforementioned trees are present, the understory is dominated by invasive and/or undesirable species that include poison ivy (*Rhus radicans*), reed canarygrass (*Phalaris arundinaceae*), Japanese knotweed (*Polygonum cuspidatum*), and rose (*Rosa multiflora*). Ground cover in forested areas includes grasses (*Poa* spp.), pokeweed, (*Phytolacca Americana*), goldenrods (*Solidago* spp.), vines, and various fern species. Reed canarygrass and dense grasses dominate ground cover in open areas.

No open water is present directly within the Project boundary area, but two waterways are located along the Project border, and several small water bodies are located within 1.0 km of the Project boundary (Appendix A, Figure 2). Middle Brook flows northwest to southeast along the western boundary of the survey area. At the time of the NEA/NEES site visit on June 29<sup>th</sup> to develop the work survey plan, stream flow was slow, stream depth was approximately 0.3 m, and the stream channel width was approximately 12-15 m. Based on a USACE evaluation of



hydrologic conditions in the Survey Area, flow in Middle Brook in late summer is limited to a narrow, shallow run. The stream banks are lined with dominant deciduous trees, including eastern sycamore, green ash, eastern cottonwood (*Populus deltoides*) and silver maple. The understory community along the stream banks is comprised primarily of dense herbaceous ground cover of pokeweed and Japanese knotweed as well as sapling trees and woody shrubs (e.g., boxelder, honeysuckle (*Lonicera* spp.)). The overstory trees lining the stream banks are mature and have relatively few low branches such that a high canopy exists above the water channel. There are two known locations along Middle Brook where branches create a low canopy that is conducive to capturing bats. The Raritan River is located approximately 130 m south of the Project boundary and flows southwest to northeast (Appendix A, Figure 2). Based on an assessment of aerial photography for the area, the river is approximately 60 m wide at the section of river located south of the Survey Area. In addition, several small (approximately 100 m wide) water bodies are located to the southwest and within 1.0 km of the Survey Area.

Potential foraging and travel corridor habitat for the Indiana bat includes the corridor along Middle Brook and an interspersed of small forest clearings with meadow and wetland edge habitat. Approximately nine tree snags with exfoliating bark were noted within the Survey Area (Appendix A, Figure 2) as shown in Appendix C, Photograph 8 (only six are shown on the figure due to figure scale). Snags consisted of relatively small pin oaks (approximately 30 cm dbh), with few branches and low percent bark remaining (approximately 15%), that were not projecting above the surrounding canopy. Although the snags did not project above the canopy, they are located in small light gaps, and likely receive high solar insolation during the late morning through mid-day. Loose exfoliating bark was present on each snag, presenting potential roost habitat for Indiana bats (Appendix C, Photograph 7). Although the snags observed during the assessment are smaller than typical roost trees used by Indiana bats, the size does fall within the range of documented roosts (USFWS 2007).

## **5.0 SURVEY METHODOLOGY**

NEA/NEES bat specialists and a USACE biologist conducted a site visit on June 29, 2007 to become familiar with the Survey Area, characterize site conditions and habitats, determine potential net survey locations, and to gather all information necessary to develop an Indiana bat survey work plan (USACE 2007). Following the methodology presented in the July 2007 work plan (USACE 2007), NEA/NEES bat specialists conducted bat surveys on August 8<sup>th</sup> and 9<sup>th</sup>, 2007 as described below. Photographs from the field survey event are included in Appendix C, field data forms are provided in Appendix D, and a copy of the final USACE work plan is provided in Appendix B.

To document the status of Indiana bats, The Indiana Bat Recovery Team, as part of the Draft Recovery Plan (Clawson et al., 1999; USFWS, 2007) established guidelines (the Guidelines) for conducting biological surveys that are focused on the capture of Indiana bats. The Guidelines define the appropriate timing of the survey (May 15 – August 15) and the appropriate netting equipment (40/1 or 50/2 mist nets), net configurations (7 m high nets or ‘triple stack’ that is up to 20 m wide depending on corridor width), and net spacing (one net site per km of stream habitat and two net sites per square km of forested habitat). The Guidelines also specify appropriate sampling conditions for temperature, precipitation, and moon phase. Lastly, the Guidelines state, “travel corridors such as stream or logging trails typically are the most effective places to net”. In addition to the Recovery Plan Guidelines, the USFWS requires that a qualified professional contractor conduct the work. Such contractors would require both state and Federal permits to capture and handle Indiana bats and have documented proficiency in appropriate research techniques.

### **5.1 SURVEY PROTOCOL**

The Indiana bat mist netting survey for the Project site was conducted by NEA/NEES bat specialists on August 8<sup>th</sup> and 9<sup>th</sup>, 2007 in accordance with the aforementioned Guidelines and USACE work plan (Appendix B) as follows:

- Each net (4 nets) at each net location (2 net locations) was sampled for two consecutive nights (August 8<sup>th</sup> and 9<sup>th</sup>, 2007) for a total of eight net nights.

- Surveys were conducted during calm to light wind conditions and clear to overcast cloud conditions (including intermittent light drizzle during the first hour of sampling on 09 August).
- Ambient temperature throughout the sampling period ranged from 25.3° centigrade (C) to 30.3°C.

## **5.2 NETTING LOCATIONS AND EQUIPMENT**

Nine (9) meter long mist nets (thin filament nets (50 denier) with 38 millimeter (mm) mesh size), were used to capture bats in flight. Net sets included two to three stacked nets (i.e., nets placed on top of each other). Horizontal stacking of nets provides both horizontal and vertical coverage of the traveling corridor and the largest sampling effort for a site.

Based on site conditions in the Survey Area and the protocols recommended by the USFWS for summer sampling for the Indiana bat, a total of two net sites were surveyed for the Bound Brook Element, R2 Segment (USFWS 2007) as shown in Appendix A, Figure 2. Each net site consisted of two net locations, spaced a minimum of 200 m apart. Site 1 was located on Middle Brook (stream corridor site), and consisted of two triple-stack 9 m mist nets set across the stream under the riparian canopy (Appendix A, Figure 2). One net (Net 1a), the southernmost net on Middle Brook, was located approximately 350 m north of the intersection of Middle Brook and a bridge associated with the train track located along the southern boundary of the Survey Area (Appendix C, Photographs 1, 2 and 9). The second net (Net 1b), the northernmost net on Middle Brook, was located approximately 575 m south of the intersection of Middle Brook and a bridge associated with the train track located along the northern boundary (Appendix C, Photographs 3 and 4). Site 2 was located along a small woodland trail running along the southern Survey Area border (forested corridor site), and consisted of two double-stack 9 m nets placed within a cluster of pin oak snags located in the south central portion of the Survey Area (Appendix A, Figure 2). One net (Net 2a) was located along the woodland trail adjacent and to the south of the snag cluster (Appendix C, Photograph 5). The second net (Net 2b) was placed along the edge of a small clearing located to the north of the snag cluster (Appendix C, Photograph 6).

Nets were set up and opened by sunset and checked every 10 minutes for a minimum 5-hour period each night. All captured bats were identified to species, evaluated at a central processing

location for biological information such as sex, age, and weight, and released in a timely manner (Appendix C, Photographs 10, 11, and 12). Data was recorded in field log books and on data forms. Copies of field data forms are available in Appendix D. Each bat received a triangular wing puncture that allowed biologists to separate recaptures from other bats. As per the special conditions of the New Jersey State Collecting permit, available in Appendix B, any captured bat that was presumed to be an Indiana bat was banded and hair and tissue samples were collected for analysis and confirmation of species. Indiana bats were also fitted with a radio tag and tracked until a roosting location was confirmed.

## 6.0 SURVEY RESULTS

A total of 29 individual bats comprising three species (Appendix C, Photographs 13, 14, and 15) were captured throughout the survey (Table 1). The dominant species in the Survey Area was the big brown bat (*Eptesicus fuscus*). Nineteen (19) big brown bats were captured, representing 65% of the bats captured (Appendix C, Photograph 14). The two other captured species were the little brown myotis (*Myotis lucifugus*) with eight captures (28%) (Appendix C, Photograph 15), and the eastern red bat (*Lasiurus borealis*) with two captures (7%) (Appendix C, Photograph 13). One bat (female big brown) was recaptured the same night and was therefore not included in the capture total. One bat, caught at Net 1b (adult male), was identified as a potential Indiana bat because of its coloration and weakly-keeled calcar. The bat was processed as an Indiana bat, a radio transmitter was attached (Appendix C, Photograph 16), and tissue and hair samples were submitted to Western Michigan State University (Vonhof 2007) for species confirmation. The DNA analyses determined that the bat was a little brown myotis. Copies of the field notes and data forms are available in Appendix D and the laboratory DNA confirmation is provided in Appendix E.

**Table 1: Summary of Mist-net Captures at the Bound Brook Survey Area.**

	Net 1a	Net 1b	Net 2a	Net 2b	Total
Little brown myotis	2	6	0	0	8
Big brown bat	5	14	0	0	19
Eastern red bat	0	2	0	0	2
<b>Total</b>	<b>7</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>29</b>

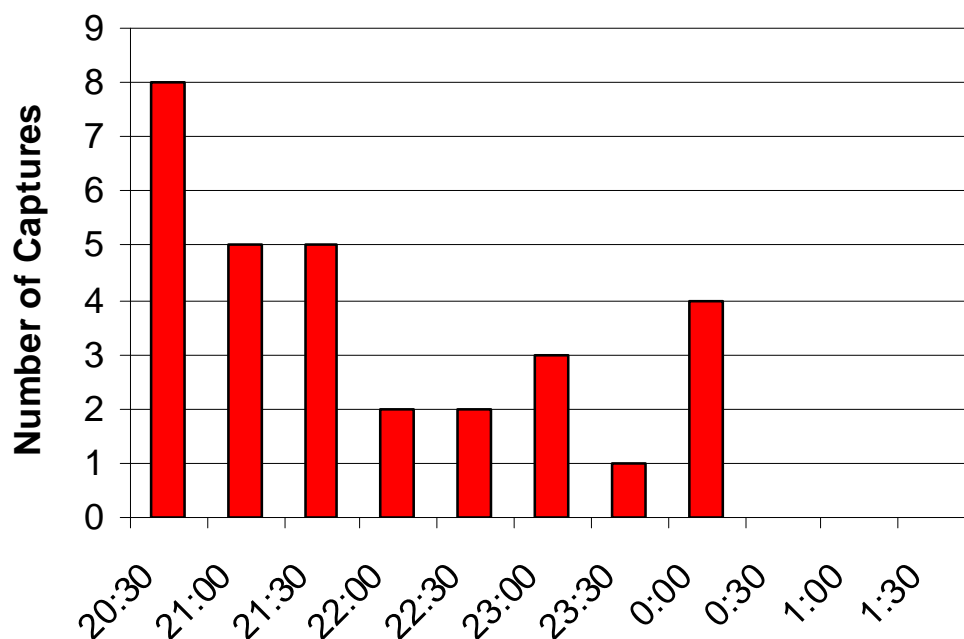
Spatial analysis of the data shows that all of the bats were captured at the stream corridor site (Site 1). Within that site, 77% of the bats were captured at Net 1b at a median time of 21:29 and an average net height of 4.2 m. The remaining 23% of the bats were captured at Net 1a at a median time of 21:07 and an average net height of 2.5 m.

Demographic analysis of the data shows that all of the adult females were reproductively active. Specifically, all the adult females were in a post-lactational condition (Table 2). No juvenile little brown myotis were captured during the survey. Also, no male juveniles were captured during the survey.

**Table 2: Demographics of Captured Bats at the Bound Brook Survey Area.**

	<u>Juveniles</u>		<u>Adult Male</u>		<u>Adult Female</u>	
	Male	Female	Repro.	NR	Repro.	NR
Little brown myotis	0	0	0	2	6	0
Big brown bat	0	6	3	2	8	0
Eastern red bat	0	1	0	0	1	0
<b>Total</b>	<b>0</b>	<b>7</b>	<b>3</b>	<b>4</b>	<b>15</b>	<b>0</b>

Temporal analysis of the data (including recaptures) show that the majority of bats were caught within the first 90 minutes of the survey (Figure 3), with lower levels of activity occurring throughout the remainder of the sampling period. Furthermore, 73% of the captured bats were caught on the first night of sampling.

**Figure 3: Temporal Distribution of Bat Captures at the Bound Brook Survey Area**

A Holohil BD-2N radio transmitter was attached to the dorsum of the potential Indiana bat captured on August 8<sup>th</sup>, 2007 in Net 1b (Appendix C, Photograph 16). Once the frequency was calibrated (best frequency = 150.0968 Hertz (Hz)), the bat was released and tracked using a 3-

element Yagi antennae. The bat was subsequently tracked to a house located at 290 West Main Street in Bound Brook, approximately 1,000 m from the point of capture (Appendix A, Figure 2). Upon investigation the following two mornings (August 9<sup>th</sup> and 10<sup>th</sup>), it was determined that the bat was roosting under the wooden eave of the house (Appendix C, Photographs 17, 18, and 19). The bat used two separate roosts on the house; both were located in close proximity under the wooden eave, about 6 m off the ground, on the east facing side of the house.

A northern flying squirrel was the only incidental capture (Appendix C, Photograph 20). The squirrel was removed from the net and immediately released at the capture site.

## **7.0 DISCUSSION**

This survey was conducted to determine whether Indiana bats could be found using the Bound Brook area during the summer activity period. The Green Brook Flood Damage Reduction Project, and specifically the Bound Brook Project Element R2, contains habitat that is potentially suitable for the Indiana bat. However, the survey found no evidence of Indiana bats within the Survey Area, despite a relatively high capture rate of several species of bats in the Survey Area (3.75 bats/net-night (b/nn)). This is similar to capture rates from New York (3.60 b/nn: Jaycox, 2003) and higher than surveys from eastern Maine (1.41 b/nn: Zimmerman and Glanz, 2000), Tennessee (1.81 b/nn: Libby, 2001), and Pennsylvania (2.03 b/nn: Hart et al., 1993).

The primary sampling site (stream corridor: Site 1) had bat activity throughout much of the night, with peak activity occurring within the first hour after sunset. The second site (forested corridor adjacent to open areas) did not produce any bats, nor were any bats observed flying in proximity to the net sites. These data suggest that the Bound Brook corridor is the major flyway for bats in the Survey Area. The dominant species captured during the present survey was the big brown bat. This suggests a substantial reproductive population resides in, or near, the Bound Brook Survey Area. Given the proximity of housing and the suburban environment that surrounds the Survey Area, many of these bats may be house-roosting individuals.

A decline in bat activity was observed on the second survey night. Although there was intermittent drizzle for approximately the first hour at the beginning of the survey, the decline appears to be consistent with lower capture success typical when, in accordance with standard sampling procedures, nets are maintained in the same location for multiple nights (Brock and Kunz, 1975). The average capture height of more than two meters is consistent with other mist net surveys that utilize horizontal stack nets (Gardner et al., 1989), and support the Recovery Plan's recommendation to use stack nets when appropriate. Although the Recovery Plan recommends checking the nets every 20 minutes, nets were checked every 10 minutes during this survey event to reduce the number of bats that escaped prior to removal. MacCarthy et al. (2006) has shown that a 10-minute sampling interval can increase apparent capture rate by 25%.



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## **APPENDIX A**

### **FIGURES**

## **APPENDIX B**

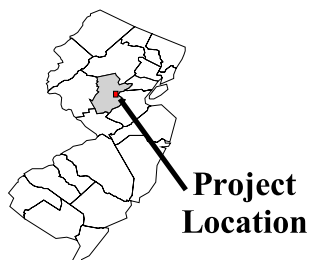
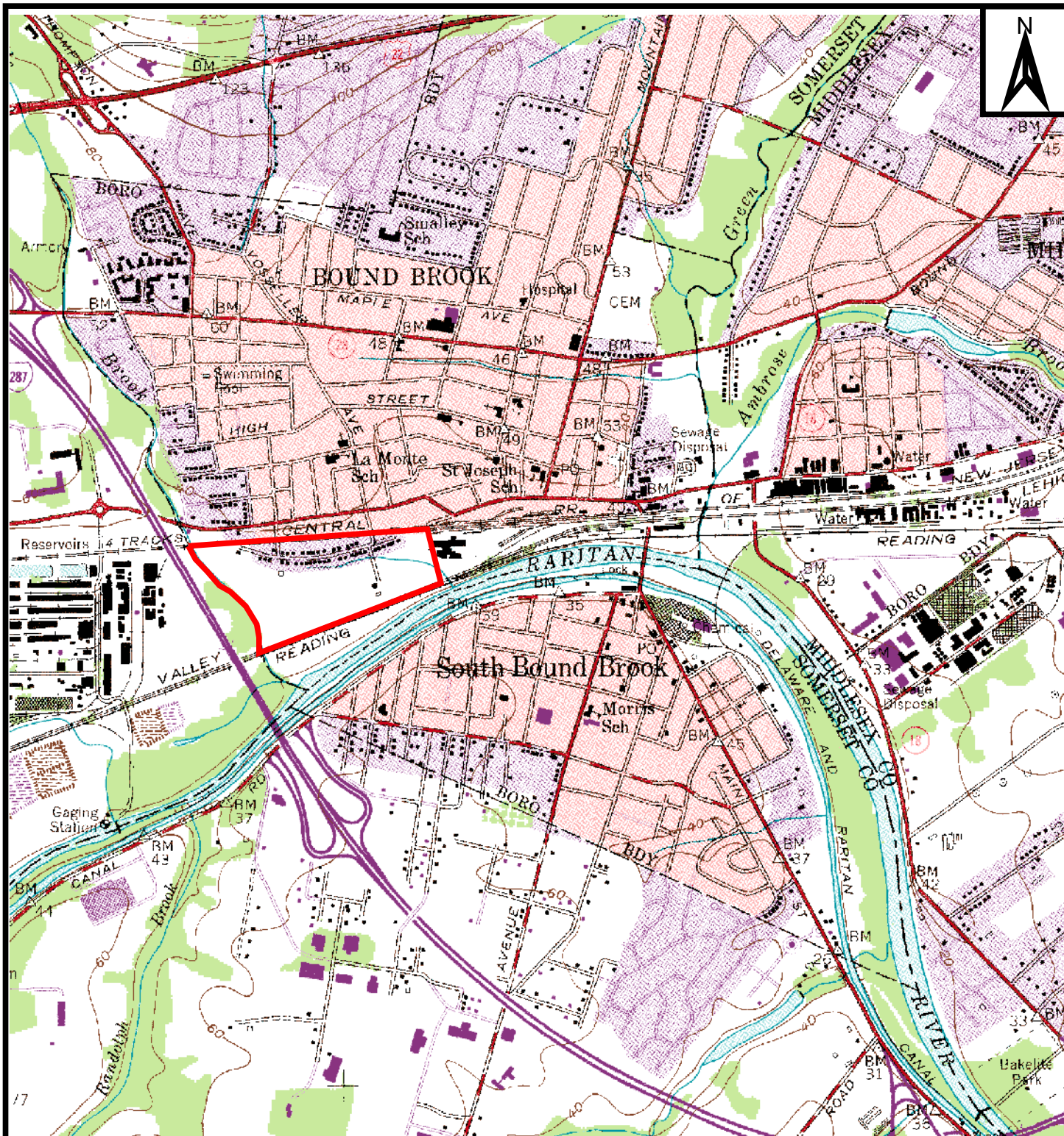
### **WORK SURVEY PLAN AND USEFS PLAN APPROVAL**

**APPENDIX C**  
**PHOTOGRAPHIC DOCUMENTATION**

**APPENDIX D**  
**FIELD DATA FORMS**

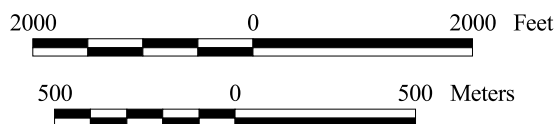
## **APPENDIX E**

### **BAT DNA RESULTS**




Source: USGS 7.5' Series Topographic Quadrangle, Bound Brook, NJ, Revised 1991.

#### SCALE



#### LEGEND

 Survey Area

**Figure 1. Bound Brook Survey Area, Green Brook Flood Damage Reduction Project, Bound Brook, NJ.**

Prepared For:

US Army Corps of Engineers,  
New York District

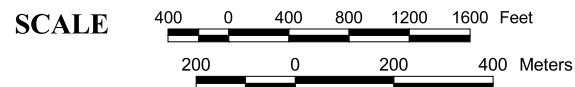
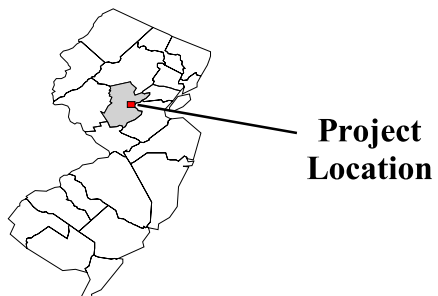
Prepared By:



Date:

10/07





**LEGEND**

- Survey Site 1
- ▲ Survey Site 2
- ✱ Confirmed Roost Location
- Survey Area

**Figure 2. Indiana Bat Survey Locations,  
Green Brook Flood Damage Reduction Project,  
Bound Brook, NJ.**

**Prepared For:** US Army Corps of Engineers, New York District

**Prepared By:**



**Date:**

**10/07**





**Green Brook Flood Damage Reduction Project  
Bound Brook, New Jersey**

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## **INDIANA BAT WORK SURVEY PLAN**

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**JULY 2007**

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FIGURE 2	PROPOSED LOCATIONS OF MIST NET

## 1.0 INTRODUCTION

The United States Army Corps of Engineers, New York District (District), is engaged in a Flood Damage Control Project for the Green Brook Sub Basin, which is located within the Raritan River Basin in north-central New Jersey in the counties of Middlesex, Somerset, and Union. The Green Brook Flood Damage Reduction Project includes approximately 14 miles of levees and floodwalls along Green Brook and its tributaries, and flood proofing in the lower portion of the project area. Due to its size, the Green Brook Flood Damage Reduction Project is broken into construction elements, which are further divided into segments. This report focuses on the R2 Segment of the Bound Brook Project Element, and is scheduled to begin construction in 2008. This segment will involve construction of 3,030 linear feet of levee, construction of a pump station, 730 linear feet of floodwall, and two roller-gate closure structures.

The Bound Brook Project Element, R2 Segment (hereafter referred to as the “Project Area”), is located on a 10-acre property in eastern Somerset County, approximately 8 km southeast of Bridgewater Township and along the southern border of the borough of Bound Brook (Appendix A, Figure 1). The Project site elevation is generally less than 10 m. Dense residential areas abut the Project site to the north (Bound Brook Borough) and southeast (South Bound Brook Borough). A patchy distribution of open space, including fields, parking lots, and small water bodies are available to the west and southwest of the Project Area.

The U.S. Fish and Wildlife Service (USFWS) identified the Project Area as potential habitat for the Indiana bat (*Myotis sodalis*), a Federal and State endangered species. Northern Ecological Associates, Inc. (NEA), in association with North East Ecological Services, LLC (NEES), has been contracted by the District to perform an Indiana bat survey within the Project Area. On June 29, 2007, staff from NEA and NEES conducted a site visit to determine the extent of available habitat for the Indiana bat, as well as to determine potential mist net sampling locations for Indiana bats. This report provides a summary of the site visit and a discussion of the proposed Indiana bat Work Survey Plan, which describes the proposed methodologies and netting areas. Section 2 discusses the survey objectives. Section 3 outlines the general site and habitat characteristics and, Section 4 discusses the survey methodology, including proposed

netting sites, and equipment to be used. A United States Geological Survey (USGS) quadrangle map and an aerial map of proposed netting locations are included in Appendix A. Photographs of proposed netting sites are included in Appendix B.

## **2.0 SURVEY OBJECTIVE**

The Project Area (Bound Brook Element – R2 Segment) within the Green Brook Flood Control Project is located along Middle Brook, in the city of Bound Brook, Somerset County, New Jersey (Appendix A, Figure 1). The Project Area includes approximately 4.1 ha (10 ac) of floodplain and upland forest, and has been identified by USFWS as potential habitat for the Indiana bat, a Federal and State endangered species. According to the USFWS, the Project Area is proximate to known and potential hibernacula and may be utilized as a foraging and roosting site before and after hibernation. In order to comply with permit conditions regarding rare species, a survey is required prior to development/construction on the site to determine the presence or absence of the Indiana bat. Information on the occurrence of the Indiana bat within the Project Area is needed to protect and/or mitigate for potential Project impacts to the species and/or habitat.

### 3.0 INDIANA BAT NATURAL HISTORY

The USFWS listed the Indiana bat as federally endangered in 1967 because of dramatic population declines and destruction of key maternity roosts and hibernacula (Trumbulak et al., 2001, Clawson 2002). Despite almost 40 years of protection, Indiana bat populations continue to decline in their core range, although the cause of the decline is unknown (Clawson 2002). Indiana bats spend the winter months hibernating in caves and abandoned mines throughout the eastern United States. Upon emergence from these hibernacula in the spring, Indiana bats migrate to their summer range, where adult females form reproductive colonies to raise their young. These maternity colonies remain relatively intact from June through August and are generally located under exfoliating bark or in tree cavities (Kurta & Rice 2002). Roost trees are generally located in riparian, floodplain and bottomland forest habitat. Indiana bat roosts appear to have key characteristics that are generally independent of the tree species (Scherer 1999). Specifically, roost trees are large (greater than 36 cm dbh), tall, near water, and in direct sunlight most of the day (Kurta et al., 1993, Menzel et al., 2001, Kurta & Rice 2002). During the summer months, females use multiple roosts and appear to switch between them on a regular basis (Hicks 2003); adult males are believed to live alone or in small groups under exfoliating bark (Ford et al., 2002). Foraging by the Indiana bat is generally concentrated in riparian habitat, although there is growing evidence that they are more diverse in habitat selection.

The Hibernia Mine in Morris County, New Jersey is the only site known to contain Indiana bats in New Jersey. This site was protected in 1994 with a metal gate to prevent disturbance to the roughly 30,000 bats of various species that use the mine throughout the winter. At the last survey, approximately 20 Indiana bats were using the Hibernia Mine (Dutko 1994). The site is located approximately 15.5 miles north of the Green Brook Project site.

New York State has been actively monitoring both the hibernacula and summer habitat of the Indiana bat for the last 10 years. Currently, New York State is known to provide habitat for almost 33,000 Indiana bats during the winter hibernation period, in seven mines spread across six counties. The two largest hibernacula are the Williams Hotel Mine and the Walter Williams Preserve Mine. These mines collectively contain over 21,000 Indiana bats and are both located in Ulster County, New York. Radiotelemetry data collected over the last several years suggests

that many of these bats migrate out of the mines and travel towards the Champlain Valley near eastern New York.



#### 4.0 SITE CHARACTERISTICS AND HABITAT

NEA/NEEA bat specialists and a USACE biologist conducted a site visit on June 29, 2007 to become familiar with the Project Area, determine potential net survey locations, and gather all information necessary to develop this work plan. The approximately 4.1 ha (10 ac) Project Area includes a mix of hardwood forest, wetlands, and open meadows within the Raritan River floodplain. The Project Area is bordered by railroad tracks and residential housing to the north, railroad tracks and the Raritan River to the south, Middle Brook to the west, and residential housing to the east (Appendix A, Figure 2). A baseball field is located in the north-central portion of the Project Area, and a small, intermittent, unnamed creek is present in the eastern portion of the site. An access trail is situated in an east-west direction, parallel to the railroad tracks that form the northern and southern borders.

The Project Area is primarily wooded, with a patchy distribution of small clearings (clearings are approximately 0.1 ha). The Project Area is best described as a small, bottomland, floodplain hardwood forest, with tree species and canopy structure typical of bottomland hardwood systems, with periodic flooding and poorly drained soil. Dominant overstory trees within the Project Area include mainly silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and pin oak (*Quercus palustris*), with fewer numbers of black cherry (*Prunus serotina*), American elm (*Ulmus americana*), and eastern sycamore (*Platanus occidentalis*), and shagbark hickory (*Carya ovata*). The understory is relatively open, and is comprised of boxelder (*Acer negundo*), and young silver maple, American elm, and green ash. Ground cover includes dense grasses (*Poa* spp.), poison ivy (*Rhus radicans*), and various fern species.

No open water is present directly within the Project boundary, but two waterways are located along the Project border, and several small water bodies are located within 1.0 km of the Project boundary (Appendix A, Figure 2). Middle Brook flows northwest to southeast along the western property boundary. At the time of the NEA/NEER site visit on June 29th, flow was slow, stream depth was approximately 0.3 m, and the stream channel width was approximately 12-15 m. Based on a USACE evaluation of hydrologic conditions in the Project Area, in late summer, flow in Middle Brook is limited to a narrow, shallow run. The stream banks are lined with dominant deciduous trees, including eastern sycamore, green ash, eastern cottonwood (*Populus deltoides*)

and silver maple. Dense herbaceous ground cover (e.g. pokeweed, *Phytolacca americana*), and woody shrubs (e.g., boxelder) compose the understory community along the stream banks. The overstory trees lining the stream banks are mature and have relatively few low branches such that a high canopy exists above the water channel. There are two known locations along Middle Brook where branches create a low canopy that is conducive to capturing bats. The Raritan River is located approximately 130 m south of the Project boundary and flows southwest to northeast (Appendix A, Figure 2). The river was not viewed during the site assessment, but based on a review of aerial photographs, it is approximately 60 m wide in the section of river south of the Project Area. Based on aerial photographs, several small (approximately 100 m wide) water bodies are located to the southwest, within 1.0 km of the Project Area.

Potential foraging and travel corridor habitat for the Indiana bat was observed in the Project Area during the site assessment, and includes the corridor along Middle Brook and an interspersions of small forest clearings with meadow and wetland edge habitat. Approximately nine tree snags with exfoliating bark were observed within the Project Area (only six are shown on the figure due to figure scale) (Appendix A, Figure 2). Snags were relatively small pin oaks (approximately 30 cm diameter at breast heights [dbh]), with few branches and low percent bark remaining (approximately 15%), and were not projecting above the surrounding canopy. Although the snags did not project above the canopy, they are located in small light gaps, and likely receive high solar insolation during the late morning through mid-day. Loose exfoliating bark was present on each snag, presenting potential roost habitat for Indiana bats. Although the snags observed during the assessment are smaller than typical roost trees used by Indiana bats, the size does fall within the range of documented roosts (USFWS 2007).

## **5.0 SURVEY METHODOLOGY**

### **5.1 SURVEY PROTOCOL**

To document the status of Indiana bats, The Indiana Bat Recovery Team, as part of the Draft Recovery Plan (Clawson et al., 1999; USFWS, 2007) established guidelines (the Guidelines) for conducting biological surveys that are focused on the capture of Indiana bats. The Guidelines define the appropriate timing of the survey (May 15 – August 15) and the appropriate netting equipment (40/1 or 50/2 mist nets), net configurations (7 m high nets or ‘triple stack’ that is up to 20 m wide depending on corridor width), and net spacing (one net site per km of stream habitat and two net sites per square km of forested habitat). The Guidelines also specify appropriate sampling conditions for temperature, precipitation, and moon phase. Lastly, the Guidelines state, “travel corridors such as stream or logging trails typically are the most effective places to net”. In addition to the Recovery Plan Guidelines, the USFWS requires that a qualified professional contractor conduct the work. Such contractors would require both state and Federal permits to capture and handle Indiana bats and have documented proficiency in appropriate research techniques.

The proposed Indiana bat mist netting survey for the Project site will be conducted in accordance with the aforementioned Guidelines. In accordance with the Guidelines, each net at each net location will be sampled for two consecutive nights, between July 23 and August 15, 2007, for a total of eight net nights. Surveys will be conducted during calm, clear weather with temperatures above 10 C. Mist nets will be set under the tree canopy where they are out of the moonlight, particularly when the moon is 2<sup>nd</sup> quarter or greater. The mist net locations and configuration are discussed in section 5.2.

### **5.2 PROPOSED NETTING LOCATIONS AND EQUIPMENT**

Based on site conditions in the Project Area, the protocols recommended by the USFWS for summer sampling for the Indiana bat suggest a total of two net sites for the Bound Brook Element, R2 Segment (USFWS 2007). Each net site consists of two net locations, spaced at least 30 m apart. Based on the on-site assessment, NEES and NEA recommend two net sampling sites. One net site (Site 1) is located on Middle Brook (stream corridor site), and the second site

(Site 2) is located along a small woodland trail running along the southern Project border (forested corridor site) as shown in Appendix A, Figure 2, and Appendix B, Photographs 1 through 6. Two nets will be placed at each site. Site 1 (i.e., Middle Brook) will include one net located approximately 100 m north of the intersection of Middle Brook (Net ID Site 1a) and a bridge associated with the train track located along the southern boundary of the Project Area (Appendix B, Photographs 1, 2, and 7), and a second net (Net ID Site 1b) located approximately 120 m south of the intersection of Middle Brook and a bridge associated with the train track located along the northern boundary (Appendix B, Photographs 3 and 4). These two locations offered the best low canopy riparian sites for net placement observed during the site assessment. Net placement at the second site (Site 2) will be positioned in a manner to target the cluster of pin oak snags (Appendix B, Photograph 8) located in the south central portion of the Project Area (Appendix A, Figure 2). One net (Net ID Site 2a) will be placed along the woodland trail adjacent and to the south of the snag cluster (Appendix B, Photograph 5). The second net (Net ID Site 2b) will be placed along the edge of a small clearing located to the north of the snag cluster (Appendix B, Photograph 6). This net placement strategy should increase the probability of capturing Indiana bats as they potentially emerge from and/or return to the potential roost snags.

Capturing bats in flight will be done using mist nets; thin filament nets (50 denier) with 38 mm mesh size ranging in length from 3 m to 18 m. Nets can be situated in horizontal, vertical, or stacked configurations. We propose to place mist nets in horizontal and vertical configurations so that nets will fill the corridor from side to side, and from the stream or ground level up to the canopy. Horizontally placed nets will cover an extensive area along the ground (< 3 m in height) or immediately above the water to target low-flying bats. Stacking (i.e., nets placed on top of each other) these horizontal nets (usually up to 9m in height) will provide both horizontal and vertical coverage of the corridor. When appropriate, stacked net configurations provide the largest sampling effort for a site. GPS data will be collected for the location of each net and any confirmed significant habitat features used by Indiana bats in the Project Area (i.e., nest or roost sites).

Nets will be opened at sunset and checked every 20 minutes for a 5-hour period each night. Any captured bats will be identified to species, evaluated (at the mist netting capture site) for biological information such as sex, age, and weight, and will be released in a timely manner after capture and processing. As per the special conditions of the New Jersey State Collecting permit, all captured Indiana bats will be banded and hair and tissue samples collected (Appendix C).

### **5.3 REPORTING**

Upon completion of the Indiana bat survey event, NEA will prepare an Indiana Bat Survey Report discussing the findings of the bat mist net survey. Included in the report will be the following: introduction, life history of the Indiana bat, study methods, a discussion of survey results, and conclusions. Appendices will include site sketches and field notes, photographs of the habitat, significant habitat features, mist netting activities, and captured bats, bat capture and radio tracking data sheets, and figures of net locations and significant habitat features (i.e., snags).

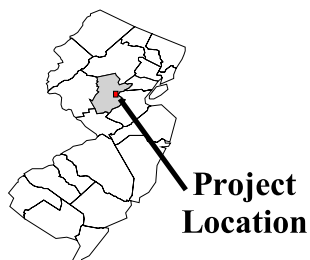
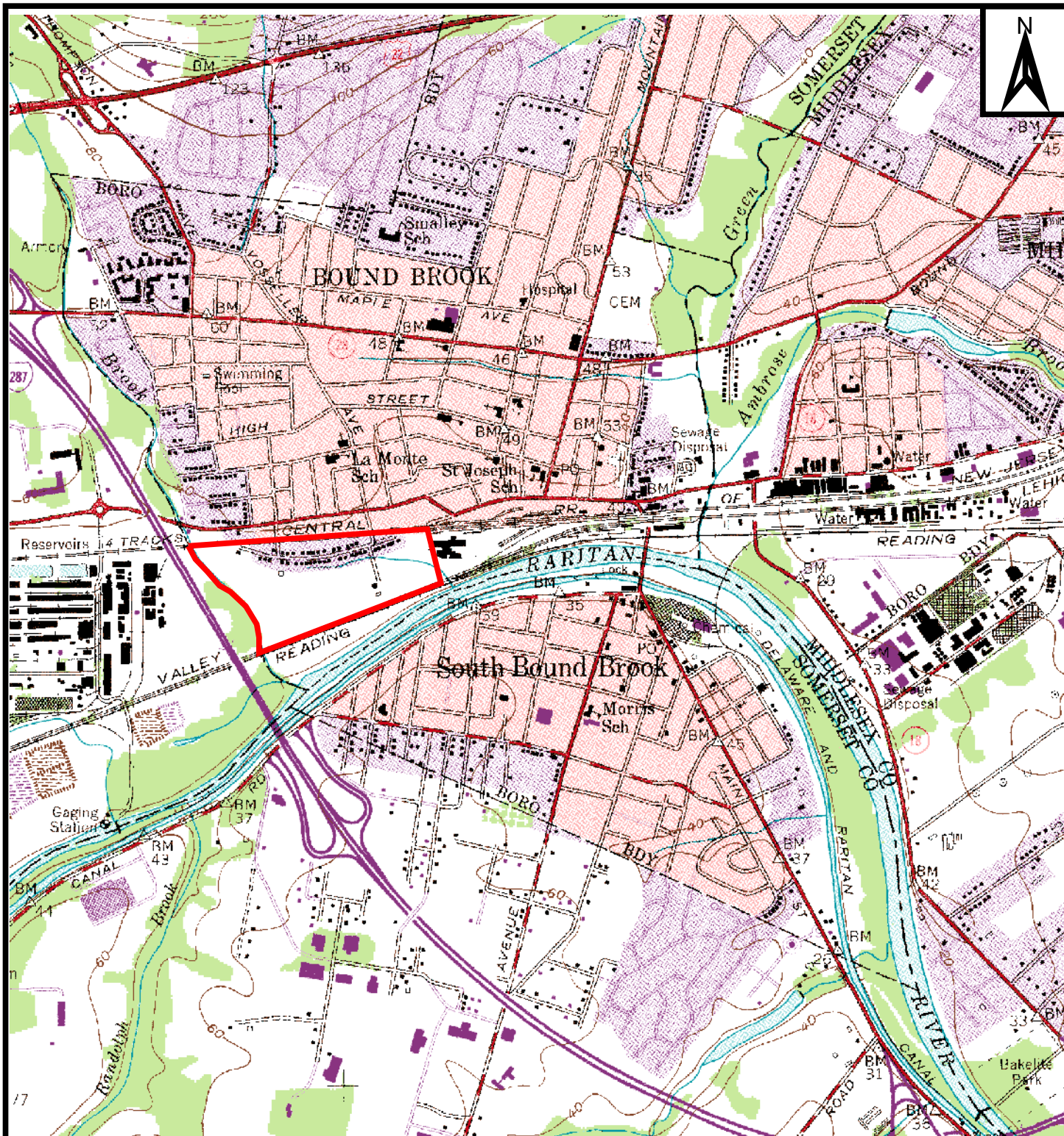
## 6.0 LITERATURE CITED

- Clawson, R.L., V. Brack, R. Currie, M. Harvey, S. Johnson, A. Kurta, J. MacGregor, C. Stihler, M. Tuttle, G. Houf, and K. Tyrell. 1999. Indiana bat (*Myotis sodalis*) revised recovery plan.
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## **APPENDIX A**

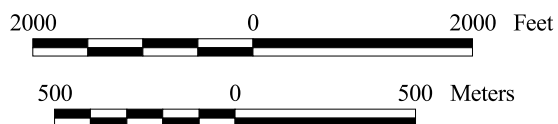
### **FIGURES**





Source: USGS 7.5' Series Topographic Quadrangle, Bound Brook, NJ, Revised 1991.

#### SCALE



#### LEGEND

 Project Boundary

**Figure 1. Green Brook Flood Damage Reduction Project - Indiana Bat Survey Site Location, Bound Brook, NJ.**

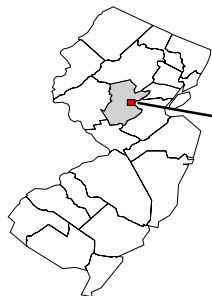
Prepared For: US Army Corps of Engineers, New York District

Prepared By:



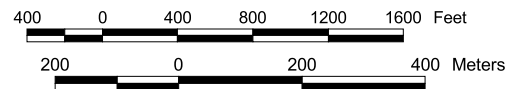
Date:  
07/07





**Project  
Location**

**SCALE**



**LEGEND**

- Proposed Mist Net Location
- Site\_1a - Waterbody
- Site\_1b - Waterbody
- ▲ Site\_2a - Field Edge
- ▲ Site\_2b - Field Edge
- \* Snag
- Project Boundary

**Figure 2. Proposed Mist Net Locations, Indiana Bat Surveys  
for the Green Brook Flood Damage Reduction Project,  
Bound Brook, NJ.**

**Prepared  
For:**

US Army Corps of Engineers, New York District

**Prepared  
By:**



**Date:**

07/07



## **APPENDIX B**

### **PHOTOGRAPHIC DOCUMENTATION**

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Site Visit-Work Plan



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 1  
**Direction:** NW

**Comments:**

Net ID Site 1a, Middle Brook.



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 2  
**Direction:** S

**Comments:**

Net ID Site 1a, Middle Brook.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Site Visit-Work Plan



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 3  
**Direction:** NW

**Comments:**

Net ID Site 1b, Middle Brook.



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 4  
**Direction:** SE

**Comments:**

Net ID Site 1b, Middle Brook.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Site Visit-Work Plan



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 5  
**Direction:** E

**Comments:**

Net ID Site 2a, woodland trail along southern boundary of the project area.



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 6  
**Direction:** NE

**Comments:**

Net ID Site 2b, open field.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Site Visit-Work Plan



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 7  
**Direction:** SW

**Comments:**

Snag located along the Middle Brook shoreline and situated near net Site 1.



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 8  
**Direction:** N

**Comments:**

Snag cluster located between the woodland trail and the open field, near net Site 2.

## **APPENDIX C**

### **NEW JERSEY SCIENTIFIC COLLECTION PERMIT**



**State of New Jersey**  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF FISH & WILDLIFE  
WILDLIFE PERMITS UNIT  
Exotic & Nongame Wildlife Permits  
26 Route 173 West  
Hampton NJ 08827

LISA P. JACKSON  
Commissioner

PHONE: (908) 735-5450 - FAX: 1-908-735-5689  
E-mail Address: EXOTICPERMITS@dep.state.nj.us

## SCIENTIFIC COLLECTING PERMIT

This will certify that the NJ Division of Fish and Wildlife has authorized:

**NORTHERN ECOLOGICAL ASSOCIATES, INC.**  
Noelle Ronan  
10 Lafayette Square, 16<sup>th</sup> Floor  
Buffalo, NY 14203

to collect/possess/release the following native fauna for scientific study:

**PURPOSE OF STUDY:** To determine the presence/absence of Indiana Bats that may be located on the study property.

**SPECIES AND NUMBERS:** Unlimited number of bats, especially the Indiana Bat (*Myotis sodalis*) native to study area locations may be collected.

**LOCATIONS:** Study is planned for a segment of the Green Brook Flood Control Project along Middle Brook, located in Bound Brook, Middlesex County. Netting will occur along Middle Brook, which runs parallel to I-287 and south of State Route 28 and the forested area behind the homes, north of Raritan River and railroad tracks and east of Middle Brook.

**STUDY DATES:** Throughout 2007.

**SPECIAL CONDITIONS:**

1. Bats will be collected using mist nets.
2. **NETS CANNOT BE SET AND LEFT UNATTENDED.**
3. Bats must be released immediately after all pertinent information has been recorded.
4. All Indiana Bats captured should be banded with bands supplied by ENSP. Hair and tissue samples should be collected for all Indiana bats. For bands and collection supplies, contact Melissa Craddock at (908) 735-9281.
5. All capture and banding data must be submitted to Melissa Craddock, NJ Div. of Fish & Wildlife, Endangered and Nongame Species Program, 143 VanSyckels Rd., Hampton, NJ 08827, (908) 735-9281, at the end of this study as well as to the Wildlife Permits Unit by January 31 for the preceding calendar year ending December 31.

**SUBPERMITTEES:** D. Scott Reynolds, Jacques Pierre Veilleux and Stacie Grove.





NEW JERSEY DIVISION OF  
**Fish and Wildlife**  
JON S. CORZINE  
Governor



**State of New Jersey**  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF FISH & WILDLIFE  
WILDLIFE PERMITS UNIT  
Exotic & Nongame Wildlife Permits  
26 Route 173 West  
Hampton NJ 08827

PERMIT NO: SC 27116  
NON-RESIDENT  
Page 2 of 2

LISA P. JACKSON  
Commissioner

PHONE: (908) 735-5450 - FAX: 1-908-735-5689  
E-mail Address: EXOTICPERMITS@dep.state.nj.us

## SCIENTIFIC COLLECTING PERMIT (continued)

**IMPORTANT NOTE: A COPY OF THIS PERMIT AND A COPY OF THE ATTACHED GENERAL CONDITIONS FOR SCIENTIFIC COLLECTING PERMITS MUST BE CARRIED BY ALL PERMITTEES AND SUBPERMITTEES WHILE IN THE FIELD AND SHOWN UPON REQUEST WHILE ENGAGED IN COLLECTION ACTIVITIES. ALL SPECIFIC AND GENERAL CONDITIONS MUST BE STRICTLY ADHERED TO.**

Every effort must be made to preserve natural habitats during research and collecting activities.

Any sightings or captures of Endangered and Threatened Wildlife must be reported to the Division of Fish and Wildlife. The collection of New Jersey State Endangered and Threatened Species is **STRICTLY PROHIBITED** unless otherwise authorized.

An annual report must be submitted to the New Jersey Division of Fish and Wildlife, Wildlife Permits Unit by January 31 for the preceding calendar year ending December 31. End of year report should include purpose of study, study design, conservation value of study, methods, data collected and results.

DATE ISSUED: JUNE 13, 2007  
THIS PERMIT EXPIRES DECEMBER 31, 2007  
FEE PAID: \$22.00

DIRECTOR  
DIVISION OF FISH & WILDLIFE

c:  
-Central Region Law Office  
-Melissa Craddock, ENSP, NJ Div. of Fish & Wildlife  
-file



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
927 North Main Street  
Pleasantville, New Jersey 08232  
Phone: (609) 646-9310 Fax: (609) 646-0352  
<http://njfieldoffice.fws.gov>



In Reply Refer To:  
2007-I-0840

Ms. Kimberly Rightler  
U.S. Army Corps of Engineers, New York District  
Environmental Branch, Planning Division  
26 Federal Plaza  
New York, New York 10278-0090  
Fax Number: (212) 264-0961

JUL 30 2007

Reference: Green Brook Flood Damage Reduction Project, R2 Segment  
Bound Brook Borough, Somerset County, New Jersey

The U.S. Fish and Wildlife Service (Service) has reviewed the work plan for Indiana bat (*Myotis sodalis*) surveys to be conducted at the above-referenced project site. The Indiana bat is federally listed as an endangered species pursuant to Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The Service has made the following determination regarding the subject work plan:

- ☒ The work plan meets the Service's survey guidelines for the Indiana bat, represents an acceptable level of effort, and appropriately targets potentially suitable habitats within the project site.
- ☐ The work plan is inconsistent with the Service's survey guidelines for the Indiana bat or has the following deficiencies:

(List here or attach)

As a reminder, a valid Scientific Collecting Permit from the New Jersey Department of Environmental Protection (NJDEP) is required to capture bats in New Jersey and must be in your possession when in the field. Survey results must be submitted to the Service and to the NJDEP.

Reviewing Biologist:

Authorizing Supervisor:

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 1

**Direction:** SW

**Comments:**

Net ID Site 1a, Middle Brook.



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 2

**Direction:** NW

**Comments:**

Net ID Site 1a, Middle Brook.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 3

**Direction:** SW

**Comments:**

Net ID Site 1b, Middle Brook.



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 4

**Direction:** NW

**Comments:**

Net ID Site 1b, Middle Brook.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 5  
**Direction:** E

**Comments:**

Net ID Site 2a, woodland trail along southern boundary of the project area.



**Photographer:** Ronan  
**Date:** 6/29/07  
**Photo No.:** 6  
**Direction:** NE

**Comments:**

Net ID Site 2b, edge of open field.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 6/29/07

**Photo No.:** 7

**Direction:** SW

**Comments:**

Snag located along the Middle Brook shoreline and situated near net Site 1.



**Photographer:** Ronan

**Date:** 6/29/07

**Photo No.:** 8

**Direction:** N

**Comments:**

Snag cluster located between the woodland trail and the open field, near net Site 2.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan  
**Date:** 8/8/07  
**Photo No.:** 9  
**Direction:** W

**Comments:**

Net set up at Site 1a,  
Middle Brook.



**Photographer:** Ronan  
**Date:** 8/8/07  
**Photo No.:** 10  
**Direction:**

**Comments:**

Bat processing – wing  
measurements.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan  
**Date:** 8/9/07  
**Photo No.:** 11  
**Direction:**

**Comments:**

Bat processing – weight.



**Photographer:** Ronan  
**Date:** 8/9/07  
**Photo No.:** 12  
**Direction:**

**Comments:**

Bat processing – tissue collection.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 13

**Direction:**

**Comments:**

Eastern red bat.



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 14

**Direction:**

**Comments:**

Big brown bat.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 15

**Direction:**

**Comments:**

Little brown myotis.



**Photographer:** Ronan

**Date:** 8/8/07

**Photo No.:** 16

**Direction:**

**Comments:**

Radio-tagged little brown myotis.

## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/9/07

**Photo No.:** 17

**Direction:** NW

**Comments:**

Tracking the radio tagged little brown myotis.



**Photographer:** Ronan

**Date:** 8/10/07

**Photo No.:** 18

**Direction:** W

**Comments:**

Location of radio tagged little brown myotis roost site. The roost area is located under the roof eave mid-way between the roof peak and the gutter.



## PHOTOGRAPHIC RECORD

**Company:** US Army Corps of Engineers, NY District  
**Project:** Green Brook Flood Damage Reduction Project  
Indiana Bat Survey Event



**Photographer:** Ronan

**Date:** 8/9/07

**Photo No.:** 19

**Direction:**

**Comments:**

Roosting radio tagged little brow bat.



**Photographer:** Ronan

**Date:** 8/9/07

**Photo No.:** 20

**Direction:**

**Comments:**

Captured northern flying squirrel.

Starting Date: 8 August 2007  
Total Sample Nights: 2

Project Name: GREENBROOK  
Site Name: BROOK - SITE 2

Project Pg 1 of 3  
Site Pg 1 of 2

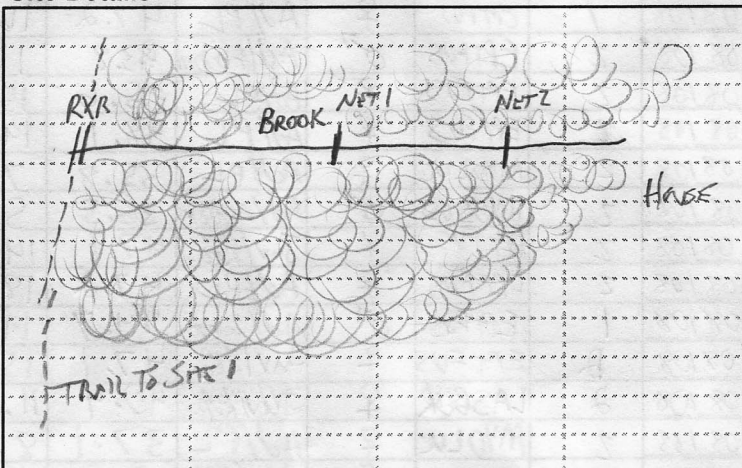
Weather: 08/AUG/2007

start time: 2010 moon: NONE VISIBLE  
end time: 0122 Sky: 0 (Hazy)  
START  $T_a$  Wind: 0  
weather: 30.3, RH = 71.8%  
End  $T_a$  = 26.2, RH = 77.2%

Weather: 09/AUG/2007

start time: Data as of 2100 moon: Not visible  
end time: 1:22 Sky: 2  
START Wind: 1  
weather:  $T_a = 25.3, RH = 68.7%$

#### Site Details



Dominant Vegetation:

1 \_\_\_\_\_ 3 \_\_\_\_\_  
2 \_\_\_\_\_ 4 \_\_\_\_\_

Trapping Details: 08/AUG/07

Net #	Net Type	GPS lat	GPS long	Net Habitat	Total Captures	Total Species
<u>1</u>	<u>9m TRIPW</u>			<u>set across brook</u>	<u>7</u>	<u>2</u>
<u>2</u>	<u>9m TRIPW</u>			<u>set across brook</u>	<u>24</u>	<u>3</u>

Trapping Details: / /

Net #	Net Type	GPS lat	GPS long	Net Habitat	Total Captures	Total Species

ANABAT Details: / /

Anabat #	GPS lat	GPS long	Sampling Habitat	Total Calls	Total Species

ANABAT Details: / /

Anabat #	GPS lat	GPS long	Sampling Habitat	Total Calls	Total Species

Sky Code
<u>0</u> clear
<u>1</u> scattered clouds
<u>2</u> cloudy or overcast
<u>3</u> fog or drizzle
<u>4</u> sustained rain

Beauford Wind Scale
<u>0</u> calm (0 mph)
<u>1</u> light wind (1-3 mph)
<u>2</u> light breeze (4-7 mph)
<u>3</u> gentle breeze (8-12 mph)
<u>4</u> moderate breeze (13-18 mph)

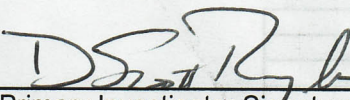


# Capture Data

	Date	Net #	Species	Gender	Life History	Forearm (mm)	Mass (g)	Band ID	Time	Comments
1	08/08	1	EPTFUS	♀	Ad/PL	47.2	16.0	L 4,5::	20:36	1.5m
2	08/08	2	EPTFUS	♂	Ad/Abdom	43.8	11.5	L 4,5::	20:30	7m
3	08/08	2	EPTFUS	♀	Ad/PL	45.6	15.5	L 4,5::	20:38	7m
4	08/08	2	EPTFUS	♀	Ad/PL	48.1	19.25	L 4,5::	20:42	9.5m
5	08/08	2	MYOLUX	♀	Ad/PL	35.8	7.0	L 4,5::	20:50	6m
6	08/08	2	MYOSOD	♂	Ad/Abdom	36.5	5.5	NJDFW25350	21:06	4m
7	08/08	2	EPTFUS	♀	Juv/Non Rep.	47.1	14.0	L 4,5::	21:15	4m
8	08/08	2	EPTFUS	♀	Ad/PL	47.2	18.0	L 4,5::	21:30	4.5m
9	08/08	1	EPTFUS	♂	Ad/Scrot.	44.7	19.5	L 4,5::	21:22	0.25m
10	08/08	1	EPTFUS	♀	Juv/Non Rep.	47.1	15.5	L 4,5::	20:55	.5m
11	08/08	2	LASBOR	♀	Juv/Rep.	40.4	11.0	L 4,5::	21:37	1.0m
12	08/08	2	MYOLUX	♀	Ad/PL	37.1	8.0	L 4,5::	21:43	1.0m
13	08/08	1	EPTFUS	♀	Juv/Non Rep.	47.4	15.5	L 4,5::	21:40	8.0m
14	08/08	2	EPTFUS	♂	Ad/Scrot	43.2	16.0	L 4,5::	21:53	4.0m
15	08/08	2	EPTFUS	♀	Ad/PL	47.8	23.75	L 4,5::	22:10	8.5m
16	08/08	2	LASBOR	♀	Ad/PL	40.2	16.0	L 4,5::	22:14	5m
17	08/08	2	EPTFUS	♂	Ad/Scrot	44.7	15.5	L 4,5::	22:31	4m
18	08/08	2	EPTFUS	♂	Ad/Abdom	44.2	17.0	L 4,5::	22:33	8m
19	08/08	2	EPTFUS	♀	Ad/PL	42.7	18.25	L 4,5::	23:20	2m
20	08/08	2	EPTFUS	♀	Ad/PL	47.8	18.0	L 4,5::	23:35	2m
21	08/08	2	EPTFUS	♀	RECAPTURE	SEE #8			24:00	2m
22	08/08	2	EPTFUS	♀	Ad/PL	47.9	23.25	L 4,5::	24:16	2m
23	08/08	1	MYOLUX	♂	Ad/Abdom	36.7	7.25	L 4,5::	24:25	1.5m
24	1									
25	08/09	1	MYOLUX	♀	Ad/PL	39.1	9.75	R 4,5::	21:07	1m
26	08/09	2	MYOLUX	♀	Ad/PL	36.2	8.0	R 4,5::	20:50	3m
27	08/09	2	EPTFUS	♀	Juv/Non Rep.	43.7	14.5	R 4,5::	20:57	3m
28	08/09	2	MYOLUX	♀	Ad/PL	37.3	6.0	R 4,5::	21:29	2m
29	08/09	2	MYOLUX	♀	Ad/PL	37.4	7.5	R 4,5::	23:20	3m
30	08/09	1	EPTFUS	♀	Juv/Non Rep.	47.4	14.75	R 4,5::	23:23	4.5m

## Radiotag Summary

	Date	ID Number	Tag #	Freq	Capture Time	Release Time	Other Data
1	08/08		110343	150.098			Holohi BD-2N 0.4g Transmitter
2	1						Best Freq: 150.0968
3	1						
4	1						

  
 Primary Investigator Signature

5 Oct 2007  
 Date

Δ Note: Testes Enlarged



# Capture Data

	Date	Net #	Species	Gender	Life History	Forearm (mm)	Mass (g)	Band ID	Time	Comments
1	08/09	2	LASBOR	♂	ESCAPED				0:15	3m
2	08/09	2	EPTFUS	♀	Juv/Non Rep	47.3	14.75	R4,S:.	0:15	2m
3	/								:	
4	/								:	
5	/								:	
6	/								:	
7	/								:	
8	/								:	
9	/								:	
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27	/								:	
28	/								:	
29	/								:	
30	/								:	

## Radiotag Summary

	Date	ID Number	Tag #	Freq	Capture Time	Release Time	Other Data
1	/						
2	/						
3	/						
4	/						

Primary Investigator Signature

Date

Starting Date: 8 August 2007  
 Total Sample Nights: 2

Project Name: GREEN BROOK  
 Site Name: TRAIL - SITE 2

Project Pg 3 of 3  
 Site Pg 1 of 1

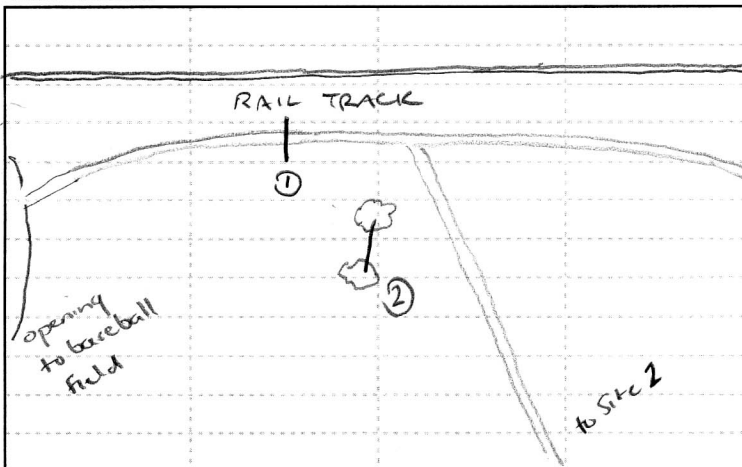
Weather: 08/AUG/2007

start time: 2010 moon: none visible  
 end time: 0120 Sky: 0  
 Wind: 0  
 weather: start  $T_a$  30.3C RH 71.8%  
 end  $T_a$  26.2C RH 77.2%

Weather: 09/AUG/2007

start time: 2000 moon: none visible  
 end time: 0115 Sky: 2  
 Wind: 1  
 weather: start  $T_a$  25.3C RH 68.7%

#### Site Details



Dominant Vegetation:

1 \_\_\_\_\_ 3 \_\_\_\_\_  
 2 \_\_\_\_\_ 4 \_\_\_\_\_

Trapping Details:    /    /   

Net #	Net Type	GPS lat	GPS long	Net Habitat	Total Captures	Total Species
<u>1</u>	<u>6m double</u>			<u>set across trail</u>	<u>0</u>	<u>0</u>
<u>2</u>	<u>6m double</u>			<u>set between canopy trees</u>	<u>0</u>	<u>0</u>

Trapping Details:    /    /   

Net #	Net Type	GPS lat	GPS long	Net Habitat	Total Captures	Total Species

ANABAT Details:    /    /   

Anabat #	GPS lat	GPS long	Sampling Habitat	Total Calls	Total Species

ANABAT Details:    /    /   

Anabat #	GPS lat	GPS long	Sampling Habitat	Total Calls	Total Species

Sky Code
<u>0</u> clear
<u>1</u> scattered clouds
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Beauford Wind Scale
<u>0</u> calm (0 mph)
<u>1</u> light wind (1-3 mph)
<u>2</u> light breeze (4-7 mph)
<u>3</u> gentle breeze (8-12 mph)
<u>4</u> moderate breeze (13-18 mph)



# Capture Data

	Date	Net #	Species	Gender	Life History	Forearm (mm)	Mass (g)	Band ID	Time	Comments
1	/								:	
2	/								:	
3	/								:	
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30	/								:	

NO CAPTURES

## Radiotag Summary

	Date	ID Number	Tag #	Freq	Capture Time	Release Time	Other Data
1	/						
2	/						
3	/						
4	/						

  
 Primary Investigator Signature

5 Oct 2007  
 Date

-----Original Message-----

From: maarten.vonhof@wmich.edu [mailto:maarten.vonhof@wmich.edu]  
Sent: Wednesday, September 19, 2007 12:06 PM  
To: Noellle Ronan  
Subject: Re: Indiana Bat Collecting Permit

Hi Noelle,  
The sample you sent me came from a *Myotis lucifugus*, and not a  
*sodalis*.

Cheers,

Maarten

Maarten Vonhof  
Assistant Professor, Department of Biological Sciences and  
Environmental Studies Program  
Western Michigan University  
Kalamazoo, MI 49008-5410  
Phone: (269) 387-5626, Fax: (269) 387-5609  
E-mail: maarten.vonhof@wmich.edu

Noellle Ronan wrote:

Hi Maarten,  
I was wondering if you could give me an estimate of when we might expect  
results for the potential Indiana bat tissue samples I submitted a couple  
weeks ago.

Thanks very much.

Noelle

Noelle Ronan  
Associate Environmental Scientist  
Northern Ecological Associates, Inc.  
10 Lafayette Square, 16th Floor  
Buffalo, NY 14203  
(716) 849-9419

# WESTERN MICHIGAN UNIVERSITY



Department of Biological Sciences  
College of Arts and Sciences

Noelle Ronan  
Associate Environmental Scientist  
Northern Ecological Associates, Inc.  
10 Lafayette Square, 16th Floor  
Buffalo, NY 14203

October 30, 2007

Dear. Ms. Ronan,

In regards to the bat tissue sample you sent to me in August, 2007 from a putative *Myotis sodalis*:

I have sequenced a portion of the mitochondrial COI gene for this sample, and after comparing this sample to a reference database of over 500 sequences from all North American bat species, I can confidently state that this sample was a *M. lucifugus*, and not a *M. sodalis*. The sequence was identical to other *M. lucifugus* samples, and had greater than 5% sequence divergence from *M. sodalis* sequences. A neighbor-joining analysis clearly places the *M. lucifugus* haplotype corresponding to your sample in a clade with other *M. lucifugus* sampled from eastern North America.

Please do not hesitate to contact me further if you have any questions.

Best regards,

A handwritten signature in blue ink that reads "Maarten Vonhof".

Dr. Maarten Vonhof  
Dept. of Biological Sciences  
Western Michigan University  
1903 W. Michigan Avenue  
Kalamazoo, MI 49008-5410  
Phone: (269) 387-5626  
Email: maarten.vonhof@wmich.edu