Docket No. _____
Exh. TDI-GGM-6

Indiana Bat Habitat Assessment Report

New England Clean Power Link

October 23, 2014

ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802 434-7276 FAX: (802) 329-2259

Table of Contents

Introduction

Arrowwood Environmental (AE) conducted a survey for Indiana Bat (*Myotis sodalist*) habitat in connection with the terrestrial component of the NECPL Project. The survey was conducted in August and September 2014. This report details the methodology employed in conducting the survey and survey findings.

Study Area

The terrestrial corridor within the towns of Benson, West Haven and Fair Haven was searched for the presence of potential bat roosting tree species as described below. The study area was established per recommendation of Scott Darling (VT. F&W and Susi van Oettingen (USFWS)) as communicated by Galen Guerrero-Murphy of TRC Companies, Inc.

The search area covered 14.25 miles between project mile markers 98.2 and 112.45. Within this search area, it was assumed that there exists a maximum 50'-66' accessible ROW along North Lake Road, Old North Lake Road, Hulett Road and Route 22A. In areas with a wider ROW along Route 4, only the northern ROW area of the northern roadway was surveyed. Survey work only occurred within ROW limits.

Indiana Bat Background Information

The Indiana Bat is listed as an Endangered Species under both the United States Endangered Species Act (P.L. 93-205) and Vermont's Endangered Species Law (10 V.S.A., Chapter 123). In Vermont, Indiana Bats are limited in distribution to areas

within the southern Champlain Valley, Taconic and Vermont Valley biophysical regions.

Adult female Indiana Bats both give birth and along with their young utilize day-roosting trees during the summer months in Vermont. This resting or roosting behavior can be as a single bat or in colonies of up to 30 bats in one location. Bats may change roosting trees every few days or remain in the same location for long periods. Often a "primary roosting tree" becomes the main roosting area serving as a staging area for feeding at night, while secondary trees are utilized when wet or especially warm temperatures are encountered by the bat. These secondary trees are usually found within a few hundred meters of the primary tree.

Both shagbark hickory (*Carya ovate*) and black locust (*Robinia pseudoacacia*) are preferred species for roosting. Shagbark hickory bark often exfoliates into long strips that pull away from the tree bole providing excellent cover and shade for the roosting bat. The deeply furrowed bark of the black locust also can provide the necessary cover for day use by the bat.

Larger specimens of other trees can also provide roosting habitat for the bat. These larger specimens often have furrowed bark, and or exfoliating or peeling bark, often associated with diseased or dead limbs utilized by roosting bats. Generally, coniferous forests are not utilized as roosting habitat by the Indiana Bat.

Typically roosting behavior occurs within the forest or forest edge and single isolated trees are not utilized to the same degree. However, bats require warm temperatures during their roosting behavior and trees that receive direct sunlight are sought out for that reason and utilized. Most often bats roost in areas where

a cluster or grouping of appropriate trees are found in close proximity to each other.

Methodology

The Study Area was investigated for the presence of potential summer daytime bat roosting trees.

Per recommendation of Scott Darling (Vt. F&W), only shagbark hickory and black locust trees with a diameter at breast height (DBH) greater than 10" and other species with a DBH greater than 12" were evaluated for Indiana bat roosting characteristics.

The ROW was searched for the presence of trees that met the following criteria which is based on consultation with Scott Darling (Vt. F&W) as communicated by Galen Guerrero-Murphy of TRC.

- Shagbark Hickory >10" DBH
- Black Locust >10" DBH
- Any Spp. >12" DBH, dead or alive, with:
    - Large crevices or cavities
    - Deeply furrowed bark
    - Exfoliating bark

Once a potential roosting tree was located, as much of the tree as possible (given the constraints of being on the ground) was investigated for holes, crevices, the degree of bark furrowing, and the degree of exfoliating bark. If specific tree and site conditions warranted, a pair of 10 x42 binoculars was used to aid in the identification of bark and cavity characteristics. A standardized form was developed and filled out at each tree that met these criteria. At each tree the following information was recorded:

- Date
- Investigator

- Tree species
- Diameter at breast height (DBH)
- Tree cavities (relative size and number of cavities)
- Tree crevices
- Relative degree of bark exfoliation
- Photo ID
- Location ID

A photograph was taken of each tree and a point location was taken with a mapping grade GPS (assumed 20 ' +/- accuracy) at each tree.

Multiple tree groups:

A single GPS point location was recorded when more than 1 tree of the same species, with similar DBH and bark condition, were in close proximity to each other and generally not found in a linear row such as hedgerow. When multiple trees of the same species, with similar DBH and bark conditions were extended along a linear row a point location was recorded at each end of the row of trees and later coalesced into a single point representing the approximate mid-point location of the group. A single form describing the range in conditions of the trees found within the group was completed.

Isolated Trees:

Although trees that are isolated from surrounding forest patches, i.e. "yard trees", are not typically utilized by roosting Indiana bat (Scott Darling, Vt. F&W, personal communication), isolated trees meeting the criteria were none-the-less identified in the course of this survey. Trees possessing the physical characteristics of potential bat roost trees that were isolated from surrounding forest patches are indicated as "isolated".

Results

116 trees were identified as potential day-roosting Indiana bat trees in the Study Area. Approximate locations (as recorded in the field by mapping grade GPS) of identified trees are contained within the attached GIS data. Shagbark hickories were the most common tree, followed by red maples (*Acer rubrum*), black locust and sugar maple (*Acer saccharum*). Table 1 below displays the numbers of trees of each species, and species percentage of the overall total. An Indiana Bat Tree Data Table is included as Appendix 1.

Table 1.Survey Data Summary

Tree Species	Count	% of Total
Shagbark Hickory	44	38%
Black Locust	22	19%
Red Maple	16	14%
Sugar Maple	13	11%
White Pine	6	5%
White Oak	3	3%
Red Oak	3	3%
Ash spp.	2	2%
Basswood	1	0.9%
Cottonwood	1	0.9%
Unknown	1	0.9%
Bitternut Hickory	1	0.9%
Black Birch	1	0.9%
Elm	1	0.9%
Spruce Spp.	1	0.9%
Grand Total	**116**	**100%**

Data Deliverables

Data collected is presented in two formats. A spreadsheet includes metrics recorded on all trees identified within the Study Area. A GIS point shapefile

identifies the approximate spatial location of each tree. Additional spatial characteristics are included in the GIS data file, including approximate project mile-marker location and reporting road segment location. In addition, the tree metrics from the spreadsheet have been incorporated into the GIS data for a comprehensive compendium of collected data. Photos are included as stand-alone jpg format files, accessible via hyperlink from both the spreadsheet and GIS data provided relative file paths are maintained. The collected metrics are described in the following table:

Table 2.Data Collection Metrics

Column Name	Description
GPS_ID	Unique Identifier tied to spatial location collected via GPS
SppCode	Field code used to identify tree species
Species	Tree species common name- derived from SppCode using lookup table
MinDBH	Minimum DBH when multiple trees recorded at a single location
MaxDBH	Tree DBH, or Maximum DBH when multiple trees recorded at a single location
Photo1	Photo ID
View	Hyperlink to open photo directly from spreadsheet
CavitySz	None/Small/Medium/Large designation for cavities present
CavityCnt	None/Few/Many designation for numbers of cavities present
Furrowing	None/Shallow/Moderate/Deep designation for bark furrowing
Exfoliation	None/Low/Moderate/High designation for bark exfoliation
Snag	Indicated Yes if the tree was a dead or nearly dead standing snag
TreeCnt	Number of trees when multiple trees recorded at a single location or along a linear hedgerow
GroupLenFt	Approximate linear length of grouped trees when multiple trees recorded along a linear hedgerow
Isolated	Yes indicated if tree exists in isolation from forested areas
Comments	Additional comments by surveyor

Note, mile marker references are included in the data table; however the markers refer to the April 2014 project mile posts. Project route, reference points and associated mile markers have since been updated.

Phase 2

Recommended next steps in evaluating potential bat roosting trees within the project area:

1. Identify route locations where tree cutting is likely or preferred.
2. Overlay bat tree locations to identify trees for further assessment.
3. Conduct detailed mapping and identify specific potential bat roosting trees slated for removal based on project requirements.
4. Conduct visual and/or acoustic bat exit surveys of trees identified for removal. Exit surveys should be conducted mid-June to mid-August.
5. Assess surrounding area for potential to provide appropriate alternative roosting sites.

References

A Landowner's Guide to Indiana Bat Habitat Stewardship (VT F&W Department) http://www.vtfishandwildlife.com/library/factsheets/nongame_and_Natural_Heritage/Landowner's_Guide_to_Indiana_Bat_Habitat.pdf

Indiana Bat (US F&WS Fact Sheet) http://www.fws.gov/midwest/Endangered/mammals/inba/inbafctsht.html

K. Waltrous, Predicting Minimum Habitat Characteristics of the Indiana Bat in the Champlain Valley of Vermont and New York) 2005 UVM Dissertation

Appendices

Appendix 1

Indiana Bat Tree Data Table

Appendix 1: Indiana Bat Tree Data Table

GPS ID	Species	Min DBH	Max DBH	Photo	Cavity Size	Cavity Count	Furrowing	Exfoliation	Snag	Tree Count	Group Length (ft)	Isolated	Comments
1	Red Maple		32	3285	None	None	M	None		1			
2	Black Locust		12	0118	None	None	D	None		1			
3	Black Locust		20	0117	None	None	D	None		1			multi stem
6	Shagbark Hickory		20	3289	None	None	None	L		1			
7	Red Maple		40	3290	S	Mult.	M	None		1			
8	Red Maple		44	3291	S	Mult.	M	None		1			
9	Shagbark Hickory		24	3292	None	None	None	M		1			
10	Red Maple	36	40	3293	None	None	M	None		1			
11	Red Maple		40	3294	None	None	M	None		1			
11b	Shagbark Hickory		20	3314	None	None	None	M-H		1			also collected as 33
1213	Black Locust	12	20	3295	None	None	M	None		9	175		
14	Shagbark Hickory		14	3296	None	None	None	M-H		1			
16	Sugar Maple		32	3298	None	None	M	None		1			
17	Black Locust		16	3299	None	None	M	None		1			
1819	Black Locust	12	20	3300	None	None	D	None		5	70		
20	Sugar Maple		36	3301	M	Mult.	M	None		1			
21	Red Maple	22	38	3302	L	Mult.	M	M		2			
22	Shagbark Hickory		12	3304	None	None	None	M		1			
2324	Black Locust	22	26	3305	M	Mult.	D	None		3	55		
25	Shagbark Hickory		12	3306	None	None	None	M-H		1			
27	Sugar Maple		34	3307	M-L	Mult.	D	None		1			
28	Shagbark Hickory		14	3308	None	None	S	L		1			
29	Red Oak		22	3309	M-L	Mult.	M	None		1			
29b	Shagbark Hickory		12	3310	None	None	None	M		1			
30	Sugar Maple		18	3311	M	Mult.	M	None		1			
32	Shagbark Hickory		17	3313	None	None	None	H		1			
34	Red Maple		45	3315	M	Mult.	None	M		1			
35	Red Maple		38	3316	M	Mult.	None	M		1			
36b	Shagbark Hickory		16	0119	None	None	None	L-M		1			
37	Black Locust	13	20	3319	None	None	M	None		2			
41	Sugar Maple		28	3326	None	None	None	M		1			
52	Black Birch		14	3338	S	Mult.	None	M	Y	1			
53	Sugar Maple		15	3339	S	Mult.	None	L	Y	1			
54	Shagbark Hickory		17	3340	None	None	None	M	Y	1			
55	Shagbark Hickory		14	3341	None	None	None	M-H		1			
56	Shagbark Hickory		13	3342	None	None	None	M		1			
57	Basswood		26	3345	M-L	Mult.	D	None		1			
58	Shagbark Hickory		17	3346	None	None	None	M		1			
59	Red Maple		54	3347	S-M	Mult.	None	L		1			
60	Red Maple		23	3348	S	Mult.	None	M-H		1			
61	Red Maple		42	3349	M	Mult.	None	M		1			
62	Shagbark Hickory		12	3350	None	None	None	M		1			
64	Shagbark Hickory	18	20	3352	None	None	S	M-H		2			
65	White Oak		26	3353	None	None	None	H		1			
67	Red Maple		38	3354	M-L	Mult.	None	M-H		1			
68	Shagbark Hickory		12	3357	None	None	None	M-H		1			
69	Shagbark Hickory		14	3358	None	None	None	M		1			
70	Red Maple		48	3359	M-L	Mult.	S	L		1			
71	Shagbark Hickory		11	3360	None	None	None	L-M		1			
72	Shagbark Hickory		12	3361	None	None	None	H		1			
73	Shagbark Hickory		20	3362	None	None	None	H		1			
74	Shagbark Hickory		13	3363	None	None	None	L-M		1			
75	Ash spp.		36	3364	M	Mult.	M	None	Y	1			spp not clearly id-able
76	Red Oak		45	3365	M-L	Mult.	D	None	Y	1			
78	Red Oak		26	3367	M-L	Mult.	None	M-H		1			
79	Shagbark Hickory		14	3368	S	Mult.	None	H		1			
80	Shagbark Hickory		12	3369	None	None	None	M		1			
81	Shagbark Hickory		14	3371	None	None	None	H		1			
81b	Unknown		15	3372	M	Mult.	S	L	Y	1			
82	Shagbark Hickory	15	16	3373	None	None	None	H	Y	2			

GPS ID	Species	Min DBH	Max DBH	Photo	Cavity Size	Cavity Count	Furrowing	Exfoliation	Snag	Tree Count	Group Length (ft)	Isolated	Comments
82b	Bitternut Hickory		16	0011	S	Mult.	None	H		1			
83b	White Oak		25	0012	None	None	D	None		1			
84	Sugar Maple	36	52	3375	M-L	Mult.	None	M-H		2			
85c	Sugar Maple		30	0122	M-L	Mult.	S	I		1			
87	Elm		17	0130	S	Mult.	None	H		1			
88	Shagbark Hickory		11	0017	None	None	None	M	Y	1			outside of row
88b	Spruce Spp.		15	0132	L	Mult.	None	M	Y	1			only 15 ft high
90	Shagbark Hickory	10	12	0019	None	None	None	M-H		4			
91	Shagbark Hickory		11	0020	None	None	None	M		1			
92	Shagbark Hickory		19	0022	None	None	None	H		1			
93	Shagbark Hickory		18	0021	None	None	None	M-H		1			multi stem
94	Cottonwood		32	0023	M	Mult.	D	None		1			multi stem
95	Shagbark Hickory		12	0133	None	None	None	L-M		1			
96	Ash spp.		16	0131	S	Mult.	M	L	Y	1			
96b	Shagbark Hickory		11	0003	None	None	None	L-M		1			
97	Shagbark Hickory		28	0004	L	Mult.	None	H		1			
98	Shagbark Hickory		32	0005	M	Mult.	None	H		1			
99	Red Maple		20	0008	None	None	None	M		1			
101	Shagbark Hickory		35	0016	None	None	None	H		1			
103	White Oak		21	0135	None	None	D	None		1			
105	White Pine		22	0136	S	Mult.	D	None	Y	1			
106	Shagbark Hickory		15	0032	None	None	None	H		1			
107	Shagbark Hickory		11	0033	None	None	None	H	Y	1			
108	Shagbark Hickory		18	0034	S	Mult.	None	M-H		1			
109	White Pine		19	0035	S	Mult.	None	M-H		1			
110	Sugar Maple		12	0036	S	Mult.	None	H	Y	1			
111	White Pine		20	0137	S-M	Mult.	None	M	Y	1			
115	White Pine		18	0041	M	Mult.	D	None	Y	1			
116	White Pine		31	0042	M	Mult.	D	None	Y	1			
118	Red Maple		45	0043	L	Mult.	D	None	Y	1			
119	White Pine		38	0044	M	Mult.	M	None	Y	1			
201	Sugar Maple		34	0127	M	Mult.	D	None		1			others away from ROW
502	Sugar Maple		40	0125	S-L	Mult.	None	L-M		1			
503	Sugar Maple		36	0126	S-L	Mult.	M	None		1			