

**Indiana Bat Habitat Mitigation Guidelines
White Paper**

Necessary Habitats

Maintaining and recovering Indiana bat populations in Vermont require the availability of both maternity colony habitat as well as hibernacula habitat. Maternity colony habitat consists of an interconnected mosaic of suitable roost trees and a diversity of foraging habitat.

Hibernacula habitat is defined as the caves and mines used by hibernating Indiana bats as well as the roosting and foraging habitat located within 1 mile. Because of the low number of Indiana bats hibernating in three Vermont caves/mines (159, 297, and 16), concentrations of Indiana bats around hibernacula are relatively low, the likelihood of habitat use by Indiana bats beyond this distance becomes increasingly low.

Because of the state and federally endangered status of the species, one component of land development project evaluation is the need to avoid incidental take of roosting male and female Indiana bats. Some of the mitigation measures that may be applied are done so not to protect habitat, but to avoid the possibility of take.

Resource Categories

Vermont Fish and Wildlife Department document *Policy and Programs on Development Impacts on Habitat (June 24, 1991)* assigns Resource Categories based on a hierarchy of Department concerns and appropriate mitigation response levels that match the resource values involved. It should be noted that the document defines “mitigation” to include avoidance, restoration, reducing/eliminating impacts over time, and compensation. Resource categories are generally assigned based on the relative value and availability of the habitat for the evaluation species. Specific Resource Categories and their respective requirements are provided below:

Resource Category	Value to Species	Availability	Impacts Allowed	Mitigation
RC 1	Extremely high	Rare statewide	No loss	None allowed
RC 2	High	Rare regionally	No net loss	Allowed on-site only
RC 3	High to medium	Scarce regionally	No net loss	Allowed on and off-site

Maternity colony habitat focuses on the survival and productivity of female maternity colonies. Maternity colony habitat has two components – roost trees and foraging habitat. Roost trees used by maternity colonies consist of both primary roost trees and secondary/alternate roost trees. Roost trees for colonies are limited in availability (particularly the primary roost trees) because of the required size, decay stage, and solar radiation needed to support a colony of

many bats and, hence, warrant Resource Category 2. Foraging habitat is comprised of forestland, forest-agricultural edge, wetlands, streams, and hedgerows and is consequently more available and less specific in nature to warrant Resource Category 3.

Hibernacula habitat is essential to maintain winter populations of Indiana bats in Vermont. Hibernacula habitat is also comprised of two components – the caves/mines used by wintering Indiana bats and the forested lands surrounding the hibernaculum within which bats roost and forage before and after hibernation. Caves/mines used by Indiana bats are extremely limited in availability on a statewide level and should be considered Resource Category 1. The surrounding forestland within 1 mile of the cave/mine requires less specific roost trees than during the maternity season (maternity colonies have either not yet been established or have broken up). As a result, the roosting and foraging habitats associated with hibernacula habitat are more available on a regional level and should both be considered Resource Category 3.

The breakdown of the specific habitats and their respective Resource Categories are shown below:

Maternity Colony Habitat	Roost Trees	Resource Category 2
Maternity Colony Habitat	Foraging Habitat	Resource Category 3
Hibernacula Habitat	Caves/ Mines	Resource Category 1
Hibernacula Habitat	Roosting/Foraging Habitat	Resource Category 3

All three resource categories require no net loss of Indiana bat habitat, but vary in whether impacts, if allowed, can be mitigated on-site vs. off-site.

Mitigation Ratios

While Department evaluations of land development projects place greatest priority on avoiding and reducing impacts, where no such opportunities are feasible for Resource Categories 2 and 3 habitats, compensation may be required either on-site or off-site, respectively. The acreage requirements for such compensation depend on two factors – the species population goals and the ability for the compensated acreage to be successfully managed to enhance its value to the evaluation species.

Indiana bat population goals are to maintain or increase current populations within the southern Champlain Valley in Vermont. As a result, any habitat loss of Resource Category 2 or 3 habitats must be fully compensated. The potential for management to enhance habitats are based on assumptions provided below:

Hibernacula Habitat (Caves/Mines): No impacts allowed

Hibernacula Habitat and Maternity Colony Habitat (Roosting/Foraging Habitat): Without information on the availability or use of roost trees on the project site, it is not possible to distinguish between roosting and foraging habitat. Management of compensation forestland can enhance roosting and foraging habitat availability and quality by 20%. Existing or potential roost trees can be released, recruited

through girdling, or maintained as cull trees in the forest stands. Foraging habitat can be enhanced by forest restoration, creating edge through small patch cuts, and establishing movement corridors. This yields a mitigation ratio of 5:1.

Land Development Project Evaluation – Maternity Colony Habitat

STEP 1: Project Location

Projects located within the boundaries of Indiana bat summer range in Vermont (Fig 1) shall assume presence of Indiana bats unless the project site is outside of a 3-mile radius of any documented maternity colony and bat surveys conducted in accord to *Vermont Fish and Wildlife Department Indiana Bat Survey Guidelines* do not document their presence*.

Proximity to known/documented maternity colonies should also be considered. Projects closer to documented maternity colonies may need to make a greater effort to avoid or reduce impacts, or compensation efforts may be required to be conducted closer to the colony location.

STEP 2: Field Evaluation of Project Site

A field review of the suitability of the project site as Indiana bat habitat should be conducted. The suitability of the site is a critical factor in evaluating the significance of the project's impacts as well as the level of impacts that may be allowed. A habitat suitability assessment should consider potential roost tree availability, forest age, forest patch size, and the diversity and connectivity of foraging habitat.

STEP 3: Evaluation of Remote Imagery

A habitat evaluation may be conducted using remote imagery for an area 3 miles from the project site. The availability and connectivity of high quality maternity colony habitat (i.e., forestland, wetlands, streams, open water, and hedgerows) should be evaluated to determine the potential level of impact of the project. Neutral habitats (i.e., agricultural fields and low density residential housing) and poor quality habitats (i.e., high density residential, commercial, and transportation) should also be evaluated. The evaluation should attempt to maintain quality and neutral habitats while minimizing the growth of poor quality habitats.

Project redesign may be needed as a result of this evaluation in order to eliminate or reduce project impacts. Site plan redesigns should consider maintaining or enhancing connectivity among the quality and neutral habitats. In many instances this will involve interconnecting suitable roosting areas with a diversity of suitable foraging habitat types. Forest patches should be connected to wetlands, streams, and other forest patches. Hedgerows and riparian corridors will be instrumental in maintaining or enhancing connectivity.

STEP 4: Determination of Mitigation Measures

Project impacts will be determined and mitigation measures will be proposed to avoid (e.g., time of year restrictions), restore (e.g., reforestation), or compensate (e.g., forestland management and/or conservation). Mitigation ratios will be applied for compensation. Where feasible, compensation efforts should be applied closer (i.e., within one mile) to any known maternity colony roosting areas.

* Projects outside of known maternity colonies and for which properly conducted bat surveys do not document their presence must still reduce impacts to Maternity Colony Habitat and apply time of year restrictions for project construction. Time of year restrictions are also applied to protect roosting male Indiana bats.

Land Development Project Evaluation – Hibernacula Habitat

STEP 1: Project Location

Projects located within 1 mile radius of Indiana bat hibernacula in Vermont (Fig 2) shall assume presence of Indiana bats.

STEP 2: Field Evaluation of Project Site

A field review of the suitability of the project site as Indiana bat habitat as well as its proximity to the cave/mine should be conducted. The proximity of the project site is a critical factor in evaluating the significance of the project's impacts as well as the level of impacts that may be allowed. A habitat suitability assessment should consider potential roost tree availability, forest age, and the diversity and connectivity of foraging habitat.

STEP 3: Evaluation of Remote Imagery

A habitat evaluation may be conducted using remote imagery for an area 1 mile from the hibernaculum. All three current Indiana bat hibernacula are located within primarily forested habitat along the edge of the Taconic or Green Mountains. The availability and connectivity of high quality roosting and foraging habitat is generally present (i.e., forestland, wetlands, streams) and should be evaluated to determine the potential level of impact of the project.

Project redesign may be needed to limit forestland conversion to maintain connectivity to a diversity of suitable foraging sites.

STEP 4: Determination of Mitigation Measures

Project impacts will be determined and mitigation measures will be proposed to avoid (e.g., time of year restrictions, gating), restore (e.g., reforestation), or compensate (e.g., forestland management and/or conservation). Mitigation ratios will be applied for compensation.

Mitigation Measures – Maternity Colony Habitat

Avoid/Reduce Impacts:

- Land development will be shifted to avoid/reduce forestland conversion and fragmentation of roosting and foraging habitat.
- Shift land development away from forest edges by approximately 100 – 150 feet to allow for edge foraging.
- Time of year restrictions on forest clearing or forest management activities will be applied for the period November 1 – April 1.
- Lighting impacts should be addressed through such means as directional lighting, hours of operation.
- Bat houses may be applied as a short-term replacement on sites where roost trees are impacted or limited in number.

Maintain/enhance Maternity Colony Habitat:

- Residual forest management should be directed under a forest and habitat management plan approved by the VT Fish and Wildlife Department and designed to maintain and enhance roost trees and foraging habitat as prescribed in the *Vermont Fish and Wildlife Department Forest Management Guidelines for Indiana Bats*. The guidelines provide prescriptive measures to maintain and promote the availability of roost trees and suitable foraging habitat. Such measures include:
 - Maintain and enhance (i.e., release) potential roost trees
 - Releasing and girdling mature trees
 - Managing foraging habitat through stand condition, maintaining forest roads, and creating small patch cuts
 - Limiting harvesting activities to November 1 – April 1
- Connectivity of foraging habitat should be maintained or enhanced through securing and/or expanding existing hedgerows/riparian corridors, or forested corridors, especially where they are adjacent to neutral or poor quality habitats.
- Forest patches and/or forest corridors can be established where additional movement or foraging habitat is needed.

Compensation of Impacted Habitat:

- Impacted maternity colony habitat must be compensated through conservation easements on acres of suitable roosting and foraging habitat at a mitigation ratio of 5:1.
- Lands protected as compensation must be managed under a forest and habitat management plan approved by the VT Fish and Wildlife Department and designed to maintain and enhance roost trees and foraging habitat as prescribed in the *Vermont Fish and Wildlife Department Forest Management Guidelines for Indiana Bats*.

Mitigation Measures – Hibernacula Habitat

Avoid/Reduce Impacts:

- Land development will be shifted away from the cave/mine in order to avoid all potential effects on its climate, hydrology, or other factors that affect its suitability as a hibernaculum.
- Land development shall be shifted in such a manner as to avoid/reduce forestland conversion of roosting and foraging habitat.

- Time of year restrictions on forest clearing or forest management activities will be applied for the period November 1 – April 1.
- Lighting impacts should be addressed through such means as directional lighting, hours of operation.

Maintain/enhance Hibernacula Habitat:

- Residual forest management should be directed under a forest and habitat management plan approved by the VT Fish and Wildlife Department and designed to maintain and enhance roost trees and foraging habitat as prescribed in the *Vermont Fish and Wildlife Department Forest Management Guidelines for Indiana Bats*. The guidelines provide prescriptive measures to maintain and promote the availability of roost trees and suitable foraging habitat. Such measures include:
 - Maintain and enhance (i.e., release) potential roost trees
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Compensation of Impacted Habitat:

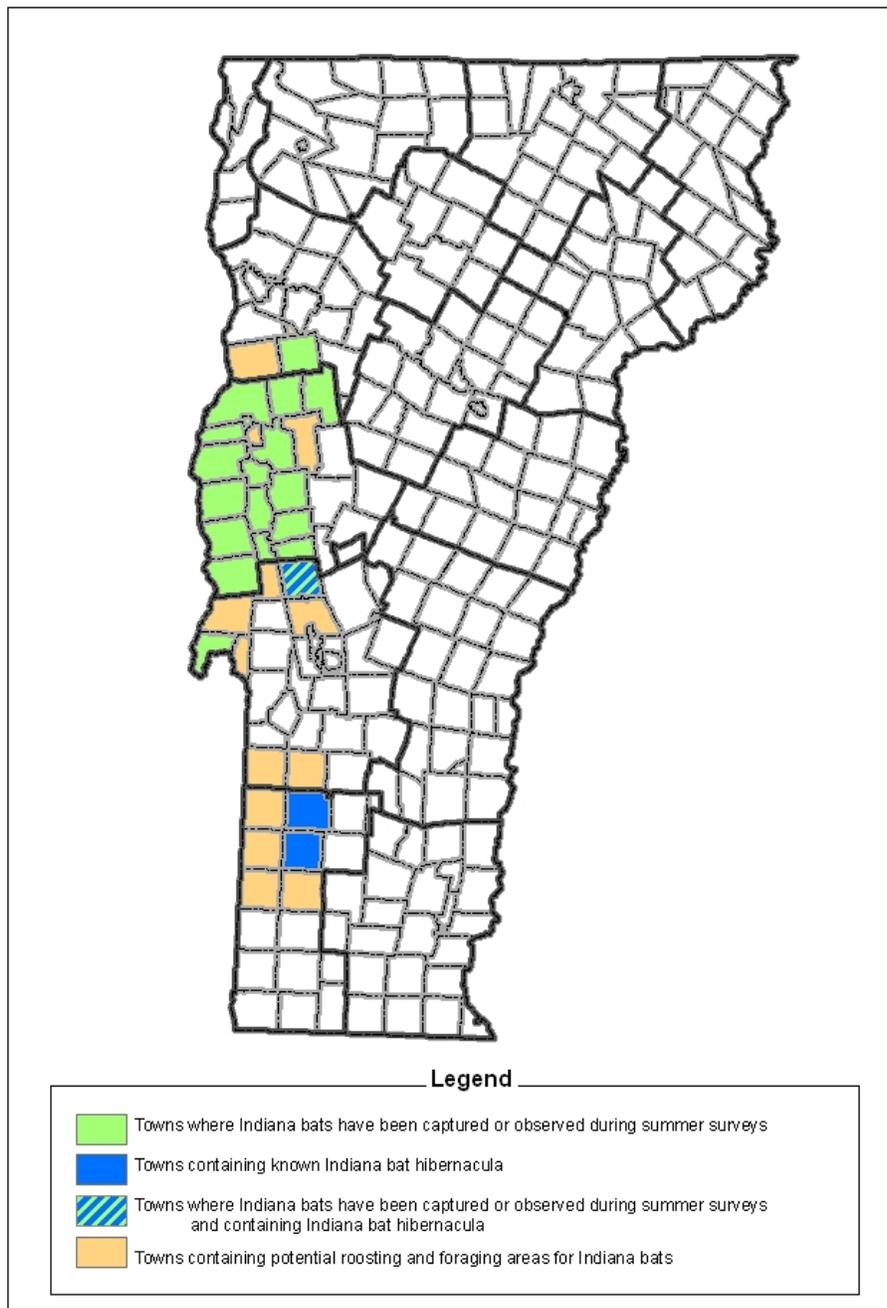
- Impacted hibernacula habitat must be compensated through management restrictions on acres of suitable roosting and foraging habitat at a mitigation ratio of 5:1. Impacts are limited only to direct impacts to roosting and foraging habitat.
- Lands managed/protected as compensation must be managed under a forest and habitat management plan approved by the VT Fish and Wildlife Department and designed to maintain and enhance roost trees and foraging habitat as prescribed in the *Vermont Fish and Wildlife Department Forest Management Guidelines for Indiana Bats*.

Monitor Impacts

- When the cave/mine is owned by the applicant, Vermont Fish and Wildlife Department must be granted access to the hibernacula to conduct monitoring of bat populations.
- Establish an escrow account to provide funds to gate the cave/mine should human activity (including pets) threaten hibernating bats.

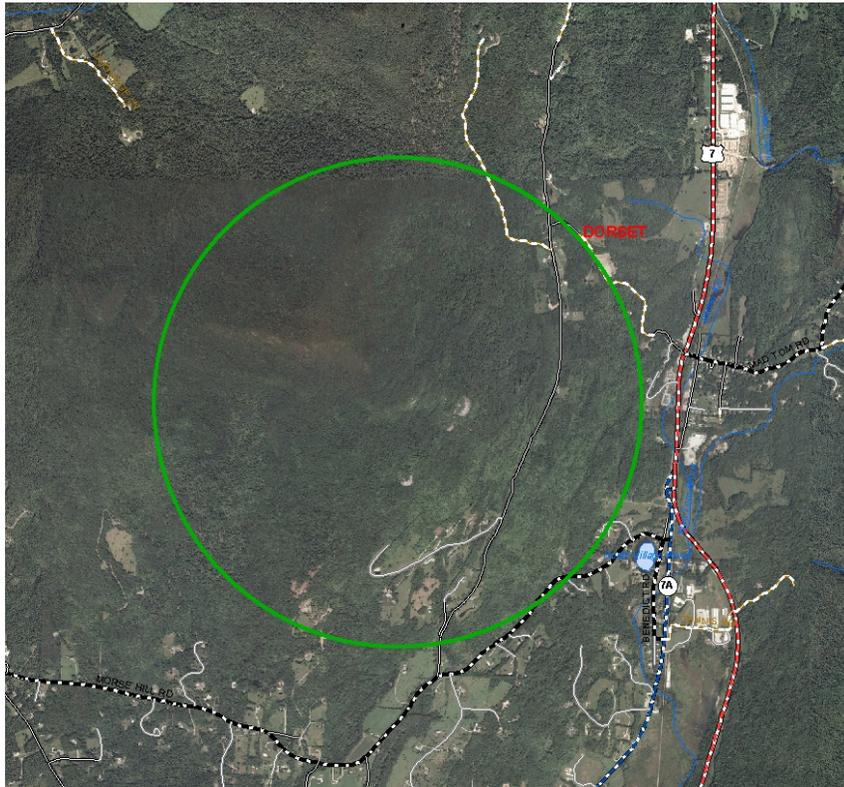
Scott Darling
January 7, 2008

Vermont's Indiana Bat Range

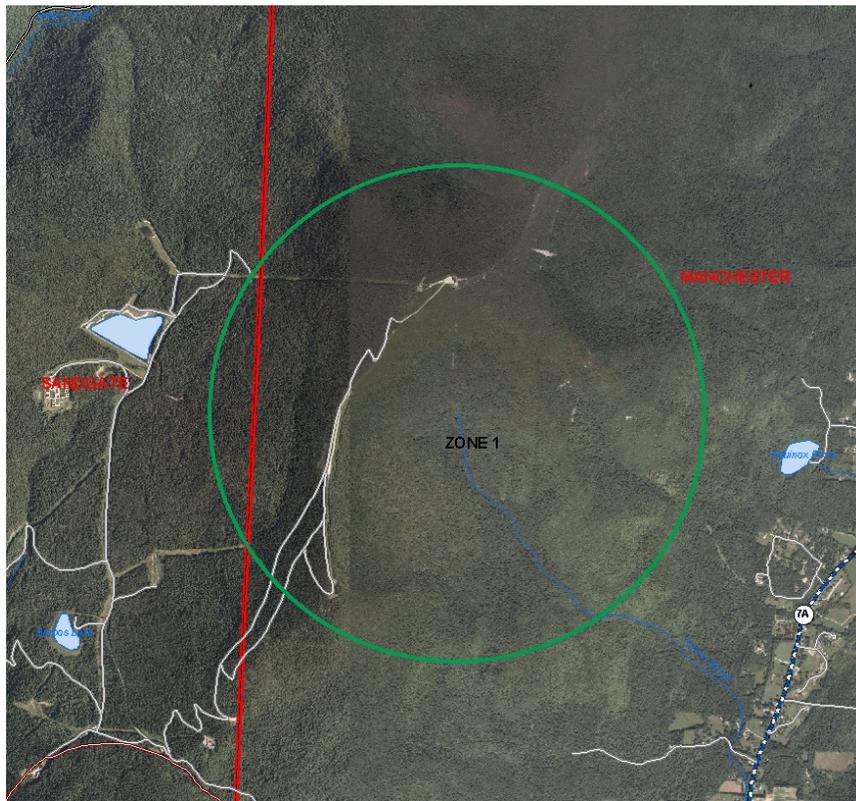


Updated 10/2007

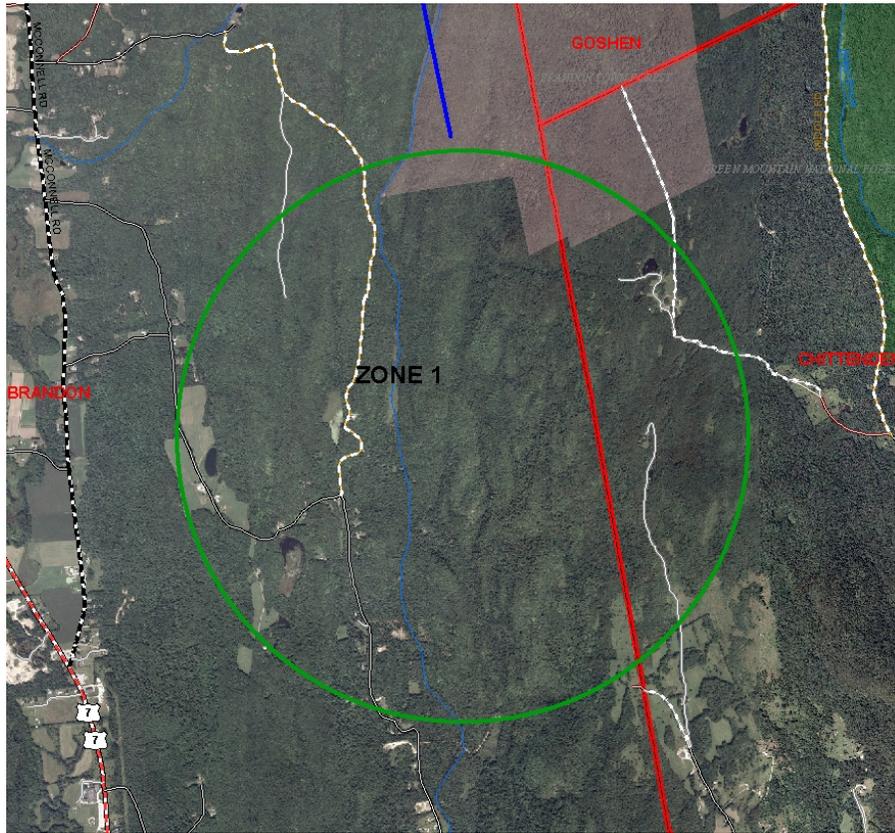
Figure 1. Range of Indiana bat in Vermont



Aeolus Cave, Dorset



Skinner Hollow Cave, Manchester



Brandon Silver Mine, Brandon

Figure 2. Hibernacula habitat within 1 mile radius of Indiana bat hibernacula