

DEQ Wind Energy Regulatory Advisory Panel (Wind RAP)

Living Resources Subcommittee

October 28, 2009

Draft Meeting Notes

Location: Training Center
5000 Dominion Blvd.
Glen Allen, VA 23060

Start: 9:32 a.m.
End: 5:03 p.m.

Subcommittee Chair: Judy Dunscomb, TNC
Recorder: Debra A. Miller, DEQ

Subcommittee Members Present:

Bob Bisha, Dominion
Tom Smith, DCR
Ray Fernald, DGIF

Subcommittee Members Absent: none

Public Attendees:

Scott Francis, Dominion
Bill Bolin, Dominion
Rick Reynolds, DGIF (Alternate)
Jim Madden, BP Wind

Emil Avram, Dominion (Alternate)
Don Giecek, Invenenergy (Alternate)
Robert Hare, Dominion

Agenda Item: Welcome and introductions

Discussion Leader: Judy Dunscomb

Discussion: All in attendance were welcomed and the agenda for the day was reviewed. The revised criteria document, Living Resources Requirements, will be reviewed "live" and changes made during the meeting.

Agenda Item: Review of Living Resources Requirements Documents

Discussion Leader: Judy Dunscomb

Discussion: The subcommittee reviewed the revised draft language provided. Review was begun on the Post Construction Section. The group discussed in detail many of the issues and during discussion, live edits were made and these changes are captured in Attachment A, beginning on Page 7 at the location highlighted and noted. During the discussions, Carol noted that for some criteria it was suggested that the "details" be an addendum and not directly within the regulation. Discussion highlights included the need for further basis and justification of the \$5K per turbine mitigation cap. Additionally, it was noted that the bat per turbine threshold presented was not fully supported by industry.

Agenda Item: Preconstruction Analysis Section Review

Discussion Leader: Judy Dunscomb

Discussion: The subcommittee began review of the revised draft language regarding pre-construction analysis. The group discussed in detail many of the issues and during discussion, live edits were made and these changes are captured in Attachment A. Please note, the only sections reviewed were Pre-Construction Analysis, Sections 1 and 2. The meeting was concluded prior to review of the entire document. Sections not reviewed are noted by grey highlight and are as follows: Pre-Construction Analysis, Sections 3 through 5; Definitions; Determination of Beneficial Impacts / Significant Adverse Impacts and Mitigation Plan Preparation. It is noted that DGIF had comments on many of these sections which were not reviewed, especially regarding the mitigation plan preparation. These DGIF comments are contained in Attachment B.

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Agenda Item: Recommendation Presentation

Discussion Leader: Judy Dunscomb

Discussion: The group discussed how the recommendations will be presented at the plenary meeting tomorrow. It was noted that an additional meeting may be helpful.

The meeting was adjourned at 5:03pm.

VA Wind RAP Living Resource Requirements

Not Reviewed during 10/28/09 Meeting

Definitions

"Beneficial Impact" is a positive impact to Wildlife or to the general environment in or around the proposed Project Boundary, which is expected to be sustained during construction and/or operation of the wind energy facility.

"VDACS" means the Virginia Department of Agriculture and Consumer Services.

"DCR" means the Virginia Department of Conservation and Recreation.

"DEQ" or "Department" means the Virginia Department of Environmental Quality.

"DGIF" means the Virginia Department of Game and Inland Fisheries.

"Disturbance Zones" means the areas within the project boundary where vegetation management or earth moving activities will occur.

"Ecological Core" means an area of natural land, including forest, marsh, or beach, identified in DCR's natural landscape assessment (www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml) that is not fragmented, such that it provides at least 100 acres of important interior habitat.

"GDPID Index" means the Gross Domestic Product Implicit Price Deflator Index, which shall be based on the index in June of each calendar year.

"Invasive Plant Species" means a non-native plant species that cause, or are likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112), and contained on the Department of Conservation and Recreation's invasive plant species list (http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf).

Loss of Revenue (see Action Item)

"Mitigation" means sequentially avoiding and minimizing impacts to the maximum extent practicable, and then compensating for remaining unavoidable impacts of a proposed action.

"Operator" means the person responsible for the overall operation and site management of a wind energy facility.

"Owner" means the person who owns a small renewable energy project facility or part of a wind energy facility.

"Permit by rule" means provisions of the regulations stating that a facility or activity is deemed to have a permit if it meets the requirements of the provision.

"Pre-Construction" means any time prior to commencing land clearing operations necessary to the installation of energy generating structures at the small renewable energy facility.

"Post-Construction" means any time after commencing operation of the last turbine on the project or phase of that project.

"Project Boundary" means the area of land under ownership, easement, lease under control via any other legal means) by the Applicant that will also be directly impacted by construction and operation of the proposed facility, at ground level or in the air space above such ground level.

"Project boundary" means area encompassed by a wind energy facility that is under common ownership or operating control. Transmission lines leaving a substation shall not be considered to be within the project boundaries.

"Significant Adverse Impact" is an impact to Wildlife that is likely to be detrimental to a species due to the construction or operation of a proposed wind energy facility, based on known presence of the species in or around the proposed Project Boundary.

"Wildlife" means Natural Heritage Resources as defined by the *Code of Virginia* §10.1-209 the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest benefiting the welfare of the citizens of the Commonwealth, Wildlife Species of greatest conservation need, or a state-listed threatened and/or endangered species in the Commonwealth of Virginia at the time an applicant submits an application.

"Wildlife Species" means any animal, insect, or plant that has a species classification.

"Wildlife Analysis" means a comprehensive desktop and field survey to find and map Wildlife and suitable habitat for Wildlife, and for which the field survey shall be conducted over four consecutive seasons or the spring/fall seasons (depending on the species being surveyed), in a period not to exceed 12 months.

"Wind energy facility" means an electric generation facility, whose main purpose is to supply electricity, consisting of one or more wind turbines and other accessory structures and buildings, including substations, meteorological towers, electrical infrastructure, transmission lines and other appurtenant structures and facilities within the project boundaries.

Sections 1 and 2 Reviewed During 10/28/09 Meeting

Pre-Construction Analysis

To fulfill the requirements of §10.1-1197.6, Paragraph B.7, the applicant will conduct Pre -Construction Wildlife Analyses within the Project Boundary. The analysis shall include the following:

1. Mapping: The applicant shall attach detailed maps of the proposed Project Boundary providing the results of the analyses for: 1) habitat, and 2) wildlife resources, and 3) Natural Heritage Resources.
 - a. Habitat Mapping. The applicant will provide a map resulting from the desktop and field surveys within in the Project Boundary. The applicant shall have used the DCR's "The Natural Communities of Virginia, Classification of Ecological Community Groups, 2nd Approximation" (Fleming, Coulling, Patterson and Taverna, Version 2.2. DCR, Division of Natural Heritage, Richmond, VA) as the vegetation standard to describe and map the ecological community groups on the project area. Additional habitat features including Wildlife habitat features (e.g., caves, mines), physiographic features (e.g., rock outcrops, cliffs, wetlands), and Ecological Cores will be mapped. If any Invasive Plant Species are identified within the Project Boundary during the normal course of habitat mapping surveys, they will be flagged in the field and mapped. All Invasive Plant Species identified during the mapping exercise shall be managed given currently acceptable standards during construction activities.
 - b. Wildlife Resources Report. The applicant will provide a Wildlife Resources Report, including a map, of the desktop and field surveys conducted to determine the presence or likely occurrence of Wildlife within the Project Boundary. The applicant will obtain, from DGIF, a report of wildlife species and resources (e.g. trout streams, anadromous fish streams, Threatened and Endangered Species Waters, raptor nests) known or likely to occur within 2 miles of the Project Boundary outlying points (North, South, East, and West). For bats, however, the report shall depict known hibernacula or species occurrence within 20 Kilometers of the Project Boundary outlying points (North, South, East, and West). The relevant DGIF data and report can be obtained by the applicant from the DGIF website at <http://vafwis.org/fwis/>. The Wildlife Report shall provide these reports, maps, and relevant, available details of any Wildlife found onsite, including species, detection location(s), age, size, spatial distribution, and evidence of reproduction.
 - c. Natural Heritage Resources Report. The applicant will provide a map resulting from the desktop and field surveys within in the Project Boundary. This will include a report generated from DCR's Natural Heritage Division database system depicting Natural Heritage Resources known or likely to occur within 2 miles of the Project Boundary outlying points (North, South, East, and West). For bat hibernacula, however, the report shall depict known hibernacula or species occurrence within 20 Kilometers of the Project Boundary outlying points (North, South, East, and West).

Comment [d1]: Change to miles

2. Avian Use Surveys: The applicant will provide a report of the avian use surveys conducted to estimate seasonal use and relative abundance of avian species in the project area, and in particular for raptors.

Methodologies

- a. Surveys will include sampling during spring (April 1 – June 15) and fall (September 1 – November 15) migration, summer breeding (June 15 – August 30), and over-wintering (November 15 – March 31) use within the Project Boundary.
- b. Depending on the size of the proposed Project Boundary and land cover, one or more fixed points will be established within the Project Boundary where there is a good view along ridges or areas of interest and in a fashion that provides coverage of the entire project area. All birds seen during each survey will be recorded. The date, start, and end time of observation period, point number, species or best possible identification, estimated number of individuals, distance from plot center when first observed, closest distance, height above ground, activity, and habitat will be recorded. The habitat type over which or in which the avian was first observation will be identified. Weather information recorded for each survey will include temperature, wind speed, precipitation, wind direction and cloud cover.
- c. Plot surveys will be scheduled to cover all daylight hours. During a survey day, plots will be visited once. Points should be visited at different times of day throughout a season.
- d. Data from the field surveys will be entered into a database and checked thoroughly for data entry errors. The number of raptors and other species seen during each point count survey will be standardized to a unit area and unit time searched. Use will be expressed as the mean number of observations of a species per 20-min survey per survey plot (800-m radius) or 5-min survey per survey plot for smaller plots (100-m radius). Mean values and 90% confidence intervals will be calculated by season for all species observed and groups and sub-groups of species (e.g., passerines, raptors, *Buteos*)
- e. The resulting avian use data will be compared to data collected at other wind resource areas using similar protocols.
- f. The data gained from fixed-point avian use surveys will be used to assess the existence of avian species also considered to be Wildlife.

Comment [d2]: Action Item – Bob – Check with West on the area v. point count issue.

Not Reviewed During 10/28/09 Meeting

3. Raptor Migration Surveys: The applicant will provide a report resulting from one year (fall and spring) of raptor migration surveys in the Project Boundary, conducted to determine the relative abundance of migrant raptors moving within the proposed Project Boundary. The raptor survey will follow methods recommended by the Hawk Migration Association of North America (HMANA). The

survey period will be based on existing information from established hawk migration sites in Virginia and/or adjacent states and will correspond with the 8-week period when the peak number of migrant hawks would be expected to move through the area. In the spring this period is expected to be approximately mid-March through mid-May and in the fall approximately beginning-September through beginning-November.

Methodologies

a. Surveys will be conducted one day each survey week in the spring and fall for a total of 16 surveys in each migration season. A survey station will be established within the Project Boundary that provides good visibility over long distances along the primary ridgeline or area of interest. The survey period each day will be at least 6 hours from approximately 10:00 AM to 4:00 PM. Observers will watch for migrant raptor continuously during the six hour survey period. Efforts will be made to schedule surveys on days when weather conditions are conducive to hawk migration (e.g., warm clear high pressure conditions). Data will be compiled by survey day and concurrent data from established hawk watch sites will be solicited from HMANA for comparison.

4. Bat Acoustic Surveys: The applicant will provide a report of bat acoustic surveys conducted to determine the presence of and level of bat activity and use within the proposed Project Boundary.

Methodologies

a. Bats will be surveyed within the proposed Project Boundary using currently available acoustic detectors (e.g. AnaBat® or accessible equivalent). It is recommended that the applicant use a pulley-mounted system, or employ a suitable alternative, in conjunction with a meteorological tower to install the acoustical detectors to maximize the reliability/maintainability of the equipment and data.

b. A minimum of two acoustic detectors will be used during the study and sampling will occur from April 15 to October 15. To the extent possible while still maintaining protection of the equipment, the ground based acoustic detector will be tilted toward the sky to maximize the height at which bat calls will be detected. The second acoustic detector station will be established at a minimum height of 30 m above ground level, or the highest practicable height that allows sampling within the proposed turbine rotor-swept-area. A high microphone system will be connected to this second unit and installed within the Project Boundary. Both acoustic units will sample concurrently. The applicant will take all reasonable measures to ensure that each detector achieves a data collection success rate of at least 50% per season during each surveying period.

c. In addition to the index of overall bat activity within the Project Boundary, a relative index of activity by species or species group will also be determined. Bat calls will be identified to

species when possible or to species group if call quality does not allow for positive species identifications. Calls will be identified by comparing visual metrics (e.g., minimum frequency, slope, duration) to reference calls of known bats.

5. **Mist-Netting and/or Harp-Trapping Study:** If the applicant identifies potential for State threatened or endangered bat species to occur within the Project Boundary, including the presence of roosting areas, bat hibernacula, the potential habitat for State threatened or endangered bats, or if a State threatened or endangered bat is observed in the project area, the applicant will conduct a summer mist-netting and/or harp-trapping survey for bats on the site. The survey methods will follow applicable State and/or Federal guidance (e.g. the U.S. Fish and Wildlife Service) guidelines for mist-netting surveys in the Indiana Bat Recovery Plan). The number of sites will be based on the approximate size of the study area or linear distance of proposed turbine/roads strings. The survey will be conducted during the summer season identified in the guidelines, May 15-August 15. Specific details of the survey will be determined by site conditions and survey timing. Netting and/or trapping locations will be determined in the field but will be within the proposed Project Boundary.
 - a. **Captured State Threatened or Endangered Bats:** For all bats captured, standard data such as species, sex, age, reproductive condition, and other notes will be recorded. For every State threatened or endangered bat captured, a radio transmitter will be attached for radio telemetry. The radio telemetry survey will consist of re-locating each tagged bat for 5-10 days post capture (in consultation with the DGIF) or as long as the radio remains active to determine locations of roost trees used by the tagged bat. Each roost tree located will be mapped and identified to species. Approximate age, size, condition, and topographic position will be recorded for each roost tree. Exit counts at sunset will be made at each roost tree located, if possible.

Determination of Beneficial Impacts/Significant Adverse Impacts and Mitigation Plan Preparation

Pursuant to §10.1-1197.6, Paragraph B.8, the Department determine if the information collected in §10.1-1197.6 Paragraph B.7 indicates that Significant Adverse Impacts to Wildlife are likely. If such impacts are found to be likely the applicant shall submit a mitigation plan detailing reasonable actions to be taken by the applicant to avoid, minimize, or otherwise mitigate such impacts.

1. **Determination of Beneficial Impacts**
2. **Determination of Significant Adverse Impact:** The Department shall find that significant adverse impacts are likely whenever wildlife analyses indicate any of the following:
 - a. **Wildlife, Heritage Resources, Ecological Cores, or State Threatened and Endangered Species,** are found to occur within 100 feet of the planned disturbance zone;
 - b. **Migratory or resident songbirds or raptors, breed, forage, roost or migrate through the project boundary;**

c. Bats are observed within the project boundary or hibernacula are determined to occur within 5 km of the project boundary.

3. **Mitigation Plan Preparation:** A mitigation plan shall include a description of the affected natural resource and the impact to be mitigated, a description of actions that will be taken to avoid the stated significant adverse impact, and a plan for their implementation. If the impact cannot reasonably be avoided, the plan shall include a description of actions that will be taken to minimize the stated impact, and a plan for their implementation. If neither avoidance nor minimization is reasonably practicable, the plan shall include a description of other measures that may be taken to offset the stated impact, and a plan for their implementation.

- a. For Wildlife, Heritage Resources, and Ecological Cores, the Applicant shall take all reasonable measures to avoid adverse impacts, or shall demonstrate in the mitigation plan why adverse impacts cannot practically be avoided, and why the proposed actions are reasonable.
- b. For State Threatened and Endangered Species, the applicant shall include in the application documentation indicating that the proposed mitigation plan complies with recommendations from either DCR for plants and insects or DGIF for non-insect animals to avoid adverse impacts. If the proposed mitigation plan does not comply with such recommendations, the applicant shall demonstrate in the mitigation plan why adverse impacts cannot practically be avoided, and why the proposed actions are reasonable.
- c. For Migratory or resident songbirds or raptors, the applicant shall take all reasonable measures to minimize adverse impacts.
- d. For bats, the mitigation plan shall include measures to curtail operation of wind turbines on low wind speed nights when bats are likely to be active at the project, and to monitor the efficacy of these measures. Curtailment measures shall be designed either to reduce bat fatality to an average of no more than 10 bats/turbine/year, up to a cost of \$5,000/turbine/year, or maximize avoided bat fatality up to a cost of \$5,000/turbine/year. If measures are designed to achieve fatality levels of no more than 10/bats/turbine/year, monitoring efforts shall be adequate to detect that level of impact.

10/28/09 Meeting began document review at this point.

Post-Construction Avian and Bat Monitoring Protocol

Post-construction monitoring shall be designed to achieve the following two primary objectives:

- 1) Estimate the level of avian and bat mortality associated with the wind project.
- 2) Determine the treatment regime that allocates costs or revenue losses per turbine/year to maximize reduction in bat or avian mortality.

Comment [d3]: Language needs to reflect that monitoring requirements derive from mitigation triggers.

Comment [d4]: Goal is to optimize among constraints

The post-construction monitoring study will consist of the following components:

- Seven months of study [April 1 – October 31] for the first year after a project is operational that assess avian and bat fatality through standardized carcass searches, carcass removal trials, and searcher efficiency trials;
- A study designed to investigate the correlation of bat fatalities with project operational protocols, weather-related variables, and the effectiveness of operational adjustments to reduce impacts;
- **Weekly raptor fatality surveys at a subset of turbines from December 1st thru March 31st**

Avian and Bat Mortality Study

Impacts to bats will occur during the active season between April and November. The majority of bat fatalities at wind-energy facilities have occurred during the late summer and fall migration period. The methods for the fatality study are broken into three primary components: (1) standardized carcass searches, (2) searcher efficiency trials, and (3) carcass removal trials.

Comment [d5]: Issue with identification of partial or decomposed carcasses for T&E species.

The number of avian and bat fatalities will be estimated based on the number of avian and bat fatalities found in search plots around turbines and whose death appears related to presence or operation of wind turbines. All carcasses located within areas surveyed, regardless of species, will be recorded and a cause of death determined, if possible, based on field inspection of the carcass. Total number of avian and bat carcasses will be estimated by adjusting for removal bias (e.g., scavenging), searcher efficiency bias, and sampling effort. Carcasses where the cause of death is not apparent will be included in the fatality estimate.

1. Selection of Turbines to be sampled

For wind projects with less than or equal to 20 turbines, 50% of the turbines, rounded up to the nearest whole number, will be selected for inclusion in the study. For wind projects with greater than 20 turbines, **30%** of the turbines, rounded up to the nearest whole number, will be selected for inclusion in the study. The sample of turbines should be selected to provide even coverage of the entire project.

Comment [d6]: DGIF will provide rationale for the numbers of turbines sampled.

For an nine week period from approximately **July 25th thru September 25th**, an additional set of turbines will be selected for inclusion in the study to investigate the correlation of bat fatalities with turbine operation and weather patterns. **A minimum of five additional turbines will be selected for each treatment variable chosen for the study.**

Comment [d7]: See Dr. Arnett presentation for rationale.

Comment [d8]: Need to clarify this with David Young – what is the minimum number of turbines needed for the curtailment study and can you use fatality study turbines to do so? And what is the rationale?

2. Delineation of carcass search plots

Search plots will be established around each sampled turbine and will be delineated in the field and with a GPS for detailed habitat mapping. For most projects, it is likely that search plot size will be

variable and dependent on the area around the turbine that is clear of vegetation. Given the difficulty in finding birds and bats within thick shrub cover or forested areas, the search area will be limited to the cleared areas, and these areas should be maintained as clear as well as possible to facilitate the searches. Efforts will be made to maximize the search plots, such as extending plots along the roads, but searches will not be conducted in forested areas or areas with steep rocky slopes. Adjustments to the fatality estimates will be made to account for the unsampled areas (areas beyond the search plot boundaries) using existing information regarding spatial distribution of fatalities within search plots at this project and at other projects. Detailed limits of the search plots for each turbine will be mapped using GPS units and detailed aerial maps/photos of the development as constructed.

Comment [d9]: Judy will craft this language based on turbine height and visibility classes.

During initial study period, periodic vegetation management (i.e., mowing) may be used to facilitate the search effort by maintaining lower vegetation height in the search plots. If needed because vegetation grows too quickly, an increase in mowing frequency of the search plots may be requested. If possible, all mowing activity of search plots will be conducted immediately following a standardized search to minimize potential carcass removal due to mowing.

Comment [d10]: This section needs further work and thought.

3. Standardized Carcass Searches

Objective: Estimate the number of avian and bat fatalities associated with the wind project.

Personnel trained in proper search techniques should conduct the carcass searches. Carcass search frequency for the 30% of the turbines will be weekly. Transects within search plots will be set approximately 5-6 meters apart in the area to be searched. Searchers (field technicians) will walk at a rate of approximately 45-60 m/min along each transect searching both sides out to 2-3 meters for fatalities. The condition of each carcass found will be recorded using the following condition categories:

- Intact – a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged – an entire carcass, which shows signs of being fed upon by a predator or scavenger, a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.), or a carcass with heavy insect infestation.
- Spots - 10 or more feathers, or 2 or more primary feathers, or a patch of fur attached to skin at one location indicating predation or scavenging.

For all fatalities found, data recorded will include: species, sex and age when possible, date and time collected, GPS location, physical condition (e.g., intact, scavenged, spots), estimated time of death, and any comments that may indicate cause of death. All fatalities located will be photographed as found and mapped on a map of the study area showing the location of the wind turbine and associated facilities such as access roads, substations, and buildings. Dominant vegetation cover and visibility index for the carcass location will also be recorded.

Comment [d11]: Deb - do global replace casualty and mortality with fatality (check on mortality)

4. Searcher Efficiency Trials

Objective: To estimate the percent of avian/bat fatalities that are found by searchers.

Searcher efficiency studies will be conducted in the same areas carcass searches occur and during the entire study period. Searcher efficiency will be estimated by carcass size and visibility class. Estimates of searcher efficiency will be used to adjust the number of carcasses found by correcting for detection bias.)

Comment [d12]: Question for David - where do carcasses come from used in searcher efficiency and bird/bat removal studies?

During the study period, carcasses in each size class (small birds, medium to large birds, bats) for each visibility class (easy, moderate, difficult, very difficult) will be used for searcher efficiency trials. To gain the preferred sample sizes without saturating search plots, trials will be conducted throughout the study period and in all weather conditions. During each week of study, approximately 1-2 large carcasses and 2-3 small avian and bat carcasses will be placed randomly throughout the sample of search plots. All carcasses will be placed at pre-determined random locations within areas being searched prior to the carcass search on the same day. Carcasses will be dropped from shoulder or waist height to simulate a falling avian or bat.)

Comment [d13]: David - is there a point (number of turbines) below which these numbers are no longer appropriate?

Each trial carcass will be discreetly marked so that it can be identified as a study carcass after it is found. The number and location of trial carcasses found during a standardized search will be recorded. The number of carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses, and carcasses removed.

5. Carcass Removal Trials

Objective: To estimate the length of time avian/bat fatalities remain in the search area.

Carcass removal studies will be conducted throughout the study period. Estimates of carcass removal will be used to adjust the number of carcasses found by correcting for removal bias.

All trial carcasses will be placed within 60 m of turbines that are not included in the set of sampled turbines. Reducing the number of planted carcasses near turbines minimizes the possibility of increasing scavenging at the turbines due to an additional food source being provided.

During the study period between 50 and 100 carcasses in each size class (small birds, medium to large birds, bats) for each visibility class (easy, moderate, difficult, very difficult) will be used for carcass removal trials. Typically a given trial will consist of a small number of carcasses randomly placed throughout the study areas. To provide a sufficient sample size, carcasses from each size class will be placed in the field and monitored for 14 days. The trials will be spread throughout the study period to incorporate the effects of varying site, scavenger, and weather conditions.)

Comment [d14]: David - see comment above for searcher efficiency

Experimental carcasses will be marked discreetly so that it can be identified as a study carcass. Experimental carcasses will be left at the location until the end of the trial (14 days), at which time any remaining carcasses or evidence of the carcass (e.g., feather spot) will be removed.

6. Statistical Methods for Estimation of Fatality Rates

The estimate of the total number of wind turbine-related fatalities will be based on four components: 1) observed number of carcasses, 2) searcher efficiency expressed as the proportion of trial carcasses found by searchers, 3) removal rates expressed as the length of time a carcass is expected to remain in the study area and be available for detection by the searchers, and 4) the estimated percent of fatalities that likely fell in non-searched areas based on the distribution of observed fatalities and percent of area searched around turbines.

Statistical methods for calculating the average number of observed carcasses, the estimate of searcher efficiency, the estimate of carcass removal, and the estimate of the total number of fatalities will follow current techniques used in similar studies.

(Insert bat standardized estimators and formulas)

Comment [d15]: Judy - add the standardized estimators

Annual fatality estimates for raptors, species of greatest conservation (sgcn) need birds, all birds combined and bats (if threshold then also sub-groups of bats) will be calculated.

Comment [d16]: David - Clarify if the standardized estimators are used for avian as well as bats

Curtailment Study

For the additional turbines included in the turbine operation and weather study, the search frequency will be daily. (location TBD)

Comment [d17]: Format issue – may need to restructure this section.

In addition to the 30% of sample turbines searched to further quantify bat fatality, 12 additional turbines will be systematically selected from turbines available for surveys for implementing initial management actions related to changes in cut-in speeds. During each night, three treatment regimes (i.e., change in cut-in speeds) with four replicates each will be implemented at the study turbines: 1) fully operational, 2) cut-in speed at X.X m/s, 3) cut-in speed at X.X m/s for X hours. Treatments will be randomly assigned to study turbines each week. Nights will be considered the experimental unit and daily searches will be conducted at the 12 turbines from July 25th to September 25th using methods described above for fatality surveys.

Comment [d18]: Flag all 30% and make consistent reference number.

Comment [d19]: David - where did the 12 come from and what is the appropriate number to use? Back to issue of how you treat smaller projects? Can fully operational turbines be from your baseline?

Data from these study turbines and the turbines within the 30% pool will be used to estimate atmospheric and biological factors that could be used to predict when bat fatality occurs, which will be used to further refine optimal implementation of management actions.

Biological variables and metrics will include measures of fatality and measures of activity. Number of bats (aggregated and separated by group or species) found per turbine per night and number of fresh

bats (estimated to have occurred the previous night) will be the primary fatality metrics used. Bat activity metrics will include hourly and nightly bat call rates (# bat calls per detector night). Atmospheric variables measured will include weather information including wind speeds, wind direction, temperature, barometric pressure, humidity, and other indices relative to passage of storm fronts and general weather conditions. Weather information will be collected from meteorological towers and wind turbines in the project, and from the National Weather Service. Wind turbine characteristics measured will include, average rpm's, operating time, and energy production.

Bats will be surveyed in the project area using acoustic detectors (e.g. AnaBat® or accessible equivalent). At a minimum three detectors will be deployed to turbines included in the curtailment study - one for each treatment group - from July 25th to September 25th. Each detector will be left at a chosen turbine for 7 consecutive nights before recovery of the systems for data download. Detectors will be placed at ground level on a stand to elevate the microphone at least one meter about ground level.

Comment [d20]: David – do you pick up birds and what is the impact if separate searcher efficiency is needed?

For this study, the number of bat passes per unit time will be the metric of interest and will be used as an index to bat use of the project area. A pass is defined as a train of echolocation calls produced by an individual bat, and consists of a continuous series of ≥ 2 call notes with no pauses between call notes of > 1 second. The number of bat passes will be determined by downloading the calls from the ZCAIMS onto a computer and counting the number of echolocation passes recorded.)

Add underline section Other Studies to Reduce Bat Mortality

Comment [d21]: David - provide justification and need for this acoustic survey during the curtailment study? Is this fair to the smaller developer? Do we need this in regulation?

Optimizing Management Based on Effectiveness and Cost

Comment [d22]: Action Item – Judy – Add language for other studies.

The second objective will be addressed by selecting and testing the optimal management action(s), where optimal is defined as the implementation of management actions to achieve a maximum level of reduction in bat mortality based on the economic constraints. Predictive models of bat mortality as a function of biological variables, atmospheric variables, and wind turbine variables may identify implementation of selective curtailment or other management actions as the optimal management action for maximizing reduction in bat mortality.

Comment [d23]: Reformatting and editing is necessary.

This management action involves developing a model based on empirical data for determining nights of expected high bat mortality in which to implement curtailment of turbines. Curtailment of turbines could involve changing the cut-in speeds or completely shutting down turbines for select nights or periods.

Management Action Effectiveness Determination

Estimated mortality reductions and associated costs will be calculated for various management action alternatives used in the study. Management actions to consider for additional testing or for recommendation will be developed using a cost and effectiveness evaluation based on the study results. For example, if the goal is to reduce tree-roosting bat mortality by 50 percent, then the management action(s) that are estimated or predicted to achieve 50 percent reduction for the minimum cost may be

further tested if high uncertainty exists after the study, or may be recommended for immediate implementation if low uncertainty exists. Further testing may not be required if change in cut-in speeds for the entire study period is selected as an optimal management action. However, if selective curtailment or change in cut-in speeds are selected as a preferred management action, then additional validation may be needed to determine true effectiveness. Effectiveness of management actions, including change in cut-in speeds, will be estimated based on fitting generalized linear mixed models. In addition, predictive models of bat mortality will be developed using the biological, environmental, and wind turbine characteristic variables described above.

Comment [d24]: This needs to be looked at from practical implementation scope. This needs to look at Year 2 on...

Post-Construction Wildlife Mitigation and Management

1. **Post-Construction Mitigation:** After completing the initial 1 year of Post-Construction monitoring, the applicant shall submit a plan consisting of its proposed monitoring and mitigation actions expected to be implemented for the remainder of the project's operating life. The applicant will use the same protocols for fatality searches as found in XXX for follow-up years' efficacy monitoring of **(mitigation)**, except that frequency for fatality searches will be two times a week during the period of curtailment.
2. **Amendment of Mitigation Plan:** After 3 years of post-construction mitigation efforts, the Operator of the facility may initiate a consultation with the Department to propose amendments to the mitigation plan. The Department may amend the mitigation plan if it determines that the proposed amendment will avoid or minimize adverse impacts to a demonstrably equal or greater extent as the mitigation measures being implemented at that time. Alternatively, the Department may amend the mitigation plan if the Operator demonstrates that: the mitigation measures being implemented at that time are not effectively avoiding or minimizing adverse impacts, and; **(the proposed amendments)** are preferable methods to mitigate for ongoing adverse impacts.
3. **Invasive Plant Species Management:** Native plant species appropriate to the site will be utilized as part of the construction and landscaping process. In the ordinary course of construction or operation of the facility, if any Invasive Plant Species are identified, they will be managed following standard protocols for the particular species.

Comment [d25]: Action Item– Rick Reynolds – Draft language that is necessary for Year Two monitoring and the scavenged rate issue.

Comment [d26]: David – please provide information for difference between weekly and twice weekly.

Comment [jkd27]: Do we need a menu here?

Post-Construction Monitoring and Mitigation Financial Cap

After the facility is in commercial operation for one full year, the applicant shall fund monitoring and mitigation activities in subsequent years based upon the recommendations of the year 1 report. The applicant shall incur up to **(but not exceed \$5,000 per turbine)** per calendar year for direct costs and **(lost revenue)** resulting from any monitoring and mitigation. This cap will be annually adjusted beginning on January 1, 2012 using the GDPIPD Index.

Comment [d28]: Action Item– Bob – provide justification for this amount.

Comment [d29]: Action Item– Bob – Define lost revenue (refer to SCC for components of loss revenue)

Reporting

- Annual report that includes:
 - o expenditure and cost of lost revenue
 - o results of monitoring for years when monitoring is performed
 - o curtailment results (when, how long, etc.)
- Incidental reporting for SGCN and T&E wildlife fatalities to **DGIF**

Comment [d30]: Action Item– Bill – Send Dominion environmental impact form to Ray, DGIF.

VA Wind RAP

Living Resource Requirements

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Definitions

“Beneficial Impact” is a positive impact to Wildlife or to the general environment in or around the proposed Project Boundary, which is expected to be sustained during construction and operation of the wind energy facility.

“VDACS” means the Virginia Department of Agriculture and Consumer Services.

“DCR” means the Virginia Department of Conservation and Recreation.

“DEQ” or “Department” means the Virginia Department of Environmental Quality.

“DGIF” means the Virginia Department of Game and Inland Fisheries.

“Disturbance Zones” means the areas within the project boundary where vegetation management or earth moving activities will occur.

“Ecological Core” means an area of natural land, including forest, marsh, or beach, identified in DCR’s natural landscape assessment (www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml) that is not fragmented, such that it provides at least 100 acres of important interior habitat.

Comment [f31]: Review this definition vs Rev1: 100 acres and 100 acres of “interior habitat” are not synonymous.

“GDPIPD Index” means the Gross Domestic Product Implicit Price Deflator Index, which shall be based on the index in June of each calendar year.

Comment [f32]: Is this the most appropriate index to use?

“Invasive Plant Species” means a non-native plant species that causes, or is likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112), and is included on the Department of Conservation and Recreation’s invasive plant species list (http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf).

“Maximum Wildlife Fatality Goal” means a desired maximum level of fatalities per turbine/year, developed through the best science and best professional judgment reasonably available, as applied to a particular taxon or group of wildlife species, to be achieved or aspired to through effective project planning, design, operation, and mitigation.

“Mitigation” means sequentially avoiding and minimizing impacts to the maximum extent practicable, and then compensating for remaining unavoidable impacts of a proposed action.

Comment [f33]: Should we add a definition of “Mitigation Plan?”

“Operator” means the person responsible for the overall operation and site management of a wind energy facility.

Attachment B – DGIF Comments

1 "Owner" means the person who owns a small renewable energy facility or part of a wind energy facility.

2 "Permit by rule" means provisions of the regulations stating that a facility or activity is deemed to have a
3 permit if it meets the requirements of the provision.

4 "Pre-Construction" means any time prior to commencing land clearing operations necessary to the
5 installation of energy generating structures at the small renewable energy facility.

6 "Post-Construction" means any time after commencing commercial wind energy generation at the
7 facility.

8 "Project Boundary" means the area of land under ownership, easement, lease under control via any
9 other legal means) by the Applicant that will also be directly impacted by construction and operation of
10 the proposed facility, at ground level or in the air space above such ground level.

11 "Project boundary" means area encompassed by a wind energy facility that is under common ownership
12 or operating control. Transmission lines leaving a substation shall not be considered to be within the
13 project boundaries.]

Comment [f34]: Need to be merged

14 "Significant Adverse Impact" is an impact to Wildlife or Natural Heritage Resources that is likely to be
15 detrimental to wildlife or Natural Heritage Resources due to the construction or operation of a
16 proposed wind energy facility, based on its known or likely presence in or around the proposed Project
17 Boundary.

18 "Wildlife" (*Code of Virginia* §29.1-100) means all species of wild animals, wild birds, and freshwater fish
19 in the public waters of this Commonwealth. For purposes of this regulation, "Wildlife" includes any
20 marine or estuarine species of wild animal or fish found within the Commonwealth.

21 "Natural Heritage Resources" (*Code of Virginia* §10.1-209) means the habitat of rare, threatened, or
22 endangered plant and animal species, rare or state significant natural communities or geologic sites, and
23 similar features of scientific interest benefiting the welfare of the citizens of the Commonwealth.

24 "Species of Greatest Conservation Need" means any species so designated (Tiers I-IV) in the Virginia
25 Wildlife Action Plan (citation).

26 "State Threatened or Endangered Species" means any wildlife species designated as a Virginia
27 Endangered or Threatened species by the Department of Game and Inland Fisheries pursuant to the
28 Code of Virginia (§29.1-563-570) and the Virginia Administrative Code (§4VAC15-citation).

29 ("Wildlife Analysis" means a series of desktop and field surveys to identify and map Wildlife and suitable
30 habitats for Wildlife, and for which the field surveys shall be conducted within a period not to exceed 12
31 consecutive months), unless the applicant desires to conduct these assessments over a longer period.)

Comment [jkd35]: I don't have a good suggestion right now, but I think this will have to be modified to fit with what the other natural resource issues being addressed by the landscape committee.

32 "Wind energy facility" means an electric generation facility, whose main purpose is to supply electricity,
33 consisting of one or more wind turbines and other accessory structures and buildings, including

Comment [f36]: Do we need to define this term?

Attachment B – DGIF Comments

1 substations, meteorological towers, electrical infrastructure, transmission lines and other appurtenant
2 structures and facilities within the project boundaries.

3 **Pre-Construction Analysis**

4 To fulfill the requirements of §10.1-1197.6, Paragraph B.7, the applicant will conduct Pre -Construction
5 Wildlife Analyses within the Project Boundary. The analysis shall include the following:

6 6. Mapping: The applicant shall attach detailed maps of the proposed Project Boundary providing the
7 results of analyses for: 1) habitat, and 2) wildlife resources, and 3) Natural Heritage Resources.

8 a. Habitat Mapping. The applicant will provide a map resulting from the desktop and field
9 surveys within in the Project Boundary. The applicant shall have used the DCR's "The
10 Natural Communities of Virginia, Classification of Ecological Community Groups, 2nd
11 Approximation" (Fleming, Coulling, Patterson and Taverna, Version 2.2. DCR, Division of
12 Natural Heritage, Richmond, VA) as the vegetation standard to describe and map the
13 ecological community groups on the project area. Additional habitat features including
14 Wildlife habitat features (e.g., caves, mines), physiographic features (e.g., rock outcrops,
15 cliffs, wetlands), and Ecological Cores will be mapped. If any Invasive Plant Species are
16 identified within the Project Boundary during the normal course of habitat mapping surveys,
17 they will be flagged in the field and mapped. All Invasive Plant Species identified during the
18 mapping exercise shall be managed given currently acceptable standards during
19 construction activities.

Comment [f37]: This should be rephrased

20 b. Wildlife Resources Report. The applicant will provide a Wildlife Resources Report, including
21 a map, of the desktop and field surveys conducted to determine the presence or likely
22 occurrence of Wildlife within the Project Boundary. The applicant will obtain, from DGIF, a
23 report of wildlife species and resources (e.g. trout streams, anadromous fish streams,
24 Threatened and Endangered Species Waters, raptor nests) known or likely to occur within 2
25 miles of the Project Boundary outlying points (North, South, East, and West). For bats,
26 however, the report shall depict known hibernacula or species occurrence within 20
27 Kilometers of the Project Boundary outlying points (North, South, East, and West). The
28 relevant DGIF data and report can be obtained by the applicant from the DGIF website at
29 <http://vafwis.org/fwis/>. The Wildlife Report shall provide these reports, maps, and relevant,
30 available details of any Wildlife found onsite, including species, detection location(s), age,
31 size, spatial distribution, and evidence of reproduction.

32 c. Natural Heritage Resources Report. The applicant will provide a report generated from
33 DCR's Natural Heritage Division database system depicting Natural Heritage Resources
34 known or likely to occur within 2 miles of the Project Boundary outlying points (North,
35 South, East, and West). For bat hibernacula, however, the report shall depict known
36 hibernacula or species occurrence within 20 Kilometers of the Project Boundary outlying
37 points (North, South, East, and West).

Attachment B – DGIF Comments

1 7. Avian Use Surveys: The applicant will provide a report of the avian use surveys conducted to
2 estimate seasonal use and relative abundance of avian species in the project area, and in particular
3 for raptors.

4 Methodologies

Comment [f38]: This section is being revised by DGIF to emphasize transect surveys with integrated point -counts.

- 5 a. Surveys will include sampling during spring (April 1 – June 15) and fall (September 1 –
6 November 15) migration, summer breeding (June 15 – August 30), and over-wintering
7 (November 15 – March 31) use within the Project Boundary.
- 8 b. Depending on the size of the proposed Project Boundary and land cover, one or more fixed
9 points will be established within the Project Boundary where there is a good view along
10 ridges or areas of interest and in a fashion that provides coverage of the entire project area.
11 All birds seen during each survey will be recorded. The date, start, and end time of
12 observation period, point number, species or best possible identification, estimated number
13 of individuals, distance from plot center when first observed, closest distance, height above
14 ground, activity, and habitat will be recorded. The habitat type over which or in which the
15 avian was first observation will be identified. Weather information recorded for each survey
16 will include temperature, wind speed, precipitation, wind direction and cloud cover.
- 17 c. Plot surveys will be scheduled to cover all daylight hours. During a survey day, plots will be
18 visited once. Points should be visited at different times of day throughout a season.
- 19 d. Data from the field surveys will be entered into a database and checked thoroughly for data
20 entry errors. The number of raptors and other species seen during each point count survey
21 will be standardized to a unit area and unit time searched. Use will be expressed as the
22 mean number of observations of a species per 20-min survey per survey plot (800-m radius)
23 or 5-min survey per survey plot for smaller plots (100-m radius). Mean values and 90%
24 confidence intervals will be calculated by season for all species observed and groups and
25 sub-groups of species (e.g., passerines, raptors, *Buteos*)
- 26 e. The resulting avian use data will be compared to data collected at other wind resource areas
27 using similar protocols.
- 28 f. The data gained from fixed-point avian use surveys will be used to assess the existence of
29 avian species also considered to be Wildlife.

30 8. Raptor Migration Surveys: The applicant will provide a report resulting from one year (fall and
31 spring) of raptor migration surveys in the Project Boundary, conducted to determine the relative
32 abundance of migrant raptors moving within the proposed Project Boundary. The raptor survey will
33 follow methods recommended by the Hawk Migration Association of North America (HMANA). The
34 survey period will be based on existing information from established hawk migration sites in Virginia
35 and/or adjacent states and will correspond with the period when the peak number of migrant hawks
36 would be expected to move through the area. In the spring this period typically would be is

Attachment B – DGIF Comments

1 expected to be approximately mid-March through mid-May and in the fall approximately beginning-
2 September through beginning November.

Comment [f39]: Review dates

3 Methodologies

4 b. Surveys will be conducted one day each survey week in the spring and fall for a total of 16
5 surveys in each migration season. A survey station will be established within the Project
6 Boundary that provides good visibility over long distances along the primary ridgeline or
7 area of interest. The survey period each day will be at least 6 hours from approximately
8 10:00 AM to 4:00 PM. Observers will watch for migrant raptors continuously during the six
9 hour survey period. Efforts will be made to schedule surveys on days when weather
10 conditions are conducive to hawk migration (e.g., warm clear high pressure conditions).
11 Data will be compiled by survey day and concurrent data from established hawk watch sites
12 will be solicited from HMANA for comparison.

Comment [f40]: Adjust as necessary

13
14 9. Bat Acoustic Surveys: The applicant will provide a report of bat acoustic surveys conducted to
15 determine the presence of and level of bat activity and use within the proposed Project Boundary.

16
17 Methodologies

18 a. Bats will be surveyed within the proposed Project Boundary using currently available
19 acoustic detectors (e.g. AnaBat® or accessible equivalent). It is recommended that the
20 applicant use a pulley-mounted system, or employ a suitable alternative, in conjunction with
21 a meteorological tower to install the acoustical detectors to maximize the
22 reliability/maintainability of the equipment and data.

23 b. A minimum of two acoustic detectors per ridgeline or per met tower, whichever is greater,
24 will be used during the study and sampling will occur from April 1 through October 31. To
25 the extent possible while still maintaining protection of the equipment, the ground-based
26 acoustic detector will be tilted toward the sky to maximize the height at which bat calls will
27 be detected. The second acoustic detector station will be established at a minimum height
28 of 30 m above ground level, or the highest practicable height that allows sampling within
29 the proposed turbine rotor-swept-area. A high microphone system will be connected to this
30 second unit and installed within the Project Boundary. Both acoustic units will sample
31 concurrently. The applicant will take all reasonable measures to ensure that each detector
32 achieves a data collection success rate of at least 50% per season during each surveying
33 period. For purposes of this survey, the seasons shall be spring - April 1 through June 15;
34 summer – June 16 through July 31; and fall – August 1 October 31. If a data collection
35 success rate of at least 50% per season is not achieved, then an assumption of likely
36 significant bat use within the Project Boundary shall be made.

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1 c. In addition to the index of overall bat activity within the Project Boundary, a relative index
2 of activity by species or species group will also be determined. Bat calls will be identified to
3 species when possible or to species group if call quality does not allow for positive species
4 identifications. Calls will be identified via discriminant function analysis by comparing
5 metrics (e.g., minimum frequency, slope, duration) to reference calls of known bats.

6 10. Mist-Netting and/or Harp-Trapping Study: If the applicant, Wildlife Resources Report, or Natural
7 Heritage Resources Report identifies potential for State threatened or endangered bat species to
8 occur within the Project Boundary through observation or documented occurrence of a listed
9 species of bat, roosting areas, bat hibernacula, or potential habitat for State threatened or
10 endangered bats, the applicant will conduct a summer mist-netting and/or harp -trapping survey for
11 bats on the site. The survey methods will follow applicable State and/or Federal guidance (e.g. the
12 U.S. Fish and Wildlife Service) guidelines for mist-netting surveys in the Indiana Bat Recovery Plan).
13 The number of sites will be based on the approximate size of the study area or linear distance of
14 proposed turbine/roads strings. The survey will be conducted during the summer season identified
15 in the guidelines, May 15-August 15. Specific details of the survey will be determined by site
16 conditions and survey timing. Netting and/or trapping locations will be determined in the field but
17 will be within the proposed Project Boundary.

Comment [f41]: Provide citation

18 a. Captured State Threatened or Endangered Bats: For all bats captured, standard data such
19 as species, sex, age, reproductive condition, and other notes will be recorded. For every
20 State threatened or endangered bat captured, a radio transmitter will be attached for radio
21 telemetry. The radio telemetry survey will consist of tracking each tagged bat for the
22 duration of the transmitter (typically about 2 weeks) to determine daily movements and
23 locations of roost trees used by each tagged bat. Each roost tree located will be mapped
24 and identified to species. Approximate age, size, condition, and GPS location will be
25 recorded for each roost tree. Exit counts at sunset will be made at each roost tree located,
26 if possible.)

Comment [f42]: Let's hrase this to get the best bang for our buck.

27
28 **Determination of Beneficial Impacts / Significant Adverse Impacts and Mitigation Plan Preparation**
29 Pursuant to §10.1-1197.6, Paragraph B.8, the Department will determine whether the information
30 collected in §10.1-1197.6 Paragraph B.7 indicates that Significant Adverse Impacts to Wildlife are likely.
31 If such impacts are found to be likely the applicant shall submit a mitigation plan detailing reasonable
32 actions to be taken by the applicant to avoid, minimize, or otherwise mitigate such impacts.

33 4. Determination of Beneficial Impacts

Comment [r43]: Do we want something here? If not, should delete from header above.

34 5. Determination of Significant Adverse Impact: The Department shall find that significant adverse
35 impacts are likely whenever wildlife analyses indicate any of the following:

36 a. Natural Heritage Resources or Ecological Cores are found to occur within 100 feet of the
37 planned disturbance zone;

Attachment B – DGIF Comments

- 1 b. Wildlife Species of Greatest Conservation Need or State Threatened or Endangered Species
2 are documented within 2 miles of the Project Boundary, or are determined likely to breed,
3 forage, roost, or migrate within or across the Project Boundary;
- 4 c. Bats have been documented or are observed within the project boundary, or hibernacula
5 are determined to occur within 20 km of the project boundary.

6 6. Mitigation Plan Preparation: A Mitigation Plan shall include a description of the affected natural
7 resources and the impacts to be mitigated, a description of actions that will be taken to avoid the
8 stated significant adverse impacts, and a plan for their implementation. If the impacts cannot
9 reasonably be avoided, the plan shall include a description of actions that will be taken to minimize
10 the stated impacts, and a plan for their implementation. If neither avoidance nor minimization is
11 reasonably practicable, the plan shall include a description of other measures that may be taken to
12 offset the stated impacts, and a plan for their implementation.

13 The Mitigation plan shall initially designate whether the project owner/operator chooses to pursue
14 Option 1 or Option 2, described below, for the first three years of project operation. After the third
15 year of project operation, the project owner/operator may request to change to the other option as
16 an amendment to the Mitigation Plan as provided for in Section ???? of this regulation.

17
18 Option 1. In concert with other mitigatory measures, the owner/operator may seek to reduce
19 estimated fatality rates of bats, and of avian Species of Greatest Conservation Need, to levels
20 that are equal to or less than the designated Maximum Wildlife Fatality Goals for those cohorts
21 of species as described below. If this option is selected, the project owner/operator shall not be
22 required to spend more than \$10,000 per turbine during the first year of commercial
23 operations; \$7,500 per turbine in the second and third years of commercial operation, and
24 \$5,000 per turbine each year thereafter for the life of the project on combined expenses for
25 wildlife monitoring and mitigation, in pursuit of these goals. If the Maximum Wildlife Fatality
26 Goals for birds and bats, and other wildlife mitigatory requirements can be achieved and
27 documented through lower expenditures, the annual monitoring and mitigatory expenditures
28 shall be reduced accordingly.

29
30 Option 2. The owner/operator may commit to expenditure of at least \$10,000 per turbine in the
31 first year of commercial operation; \$7,500 per turbine in each of the second and third years of
32 commercial operation, and \$5,000 per turbine each year thereafter to maximize reduction of
33 wildlife mortality as reasonably practicable and, upon coordination with and approval of specific
34 projects by DEQ, DGIF, and DCR, to pursue or fund appropriate research or habitat
35 enhancement alternatives related to wind energy generation impacts on wildlife resources.

36
37 Under either option (1) or (2) above; monitoring efforts implemented pursuant to the Mitigation
38 Plan shall be adequate to provide valid estimates of bird and bat mortality, and to evaluate the
39 efficacy of turbine curtailment or other measures implemented to reduce wildlife mortality.

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- 1 a. For Wildlife Resources generally, Natural Heritage Resources, and Ecological Cores, the
2 Applicant shall take all reasonable measures to avoid adverse impacts, or shall demonstrate
3 in the mitigation plan why adverse impacts cannot practically be avoided, and why the
4 proposed actions are reasonable.
- 5 b. For State Threatened and Endangered species, the applicant shall include in the application
6 documentation indicating that the proposed mitigation plan complies with
7 recommendations from DCR for plants and insects, and from DGIF for non-insect animals to
8 avoid adverse impacts. If the proposed mitigation plan does not comply with such
9 recommendations, the applicant shall demonstrate in the mitigation plan why adverse
10 impacts cannot practically be avoided, and why the proposed actions are reasonable. It is
11 recognized that, pending project-specific issuance of a federal incidental take permit
12 pursuant to a Habitat Conservation Plan (HCP) developed by the applicant in consultation
13 with the U.S. Fish and Wildlife Service and VDGIF, the authorized and legal level of take for
14 Endangered or Threatened wildlife species other than insects is zero (0). There is no
15 provision in the Virginia Endangered Species Act to allow for incidental take of state-listed
16 wildlife species. Implementation of an HCP or other protective strategy for listed species,
17 however, upon approval by VDGIF, would establish the project operator's intent to protect
18 these species, and likely deter prosecution in the event of unauthorized and unintentional
19 take of a listed species.
- 20 c. For birds generally, the Mitigation Plan shall include measures to reduce fatalities of
21 migratory or resident birds generally, and of avian Species of Greatest Conservation Need in
22 particular. These mitigatory measures shall be designed in accordance with either Option 1
23 or Option 2, above. If the owner/operator chooses to mitigate in accordance with Option 1,
24 the Maximum Wildlife Fatality Goal for birds shall be 10 SGCN birds or fewer per
25 turbine/year.
- 26 d. For raptors, the Mitigation Plan initially shall focus on monitoring of raptor fatalities through
27 turbine searches implemented for birds and bats generally, and through reporting of
28 incidental raptor fatalities; and shall include payment of a fee for each documented raptor
29 fatality in accordance with the Schedule of Wildlife Replacement Costs provided annually by
30 the DGIF to the Commonwealth's judges and attorneys for assessment of fines associated
31 with unauthorized take of raptors.
- 32 e. For bats, the Mitigation Plan initially shall include measures to curtail operation of wind
33 turbines on low wind speed nights when bats are likely to be active at the project, and to
34 monitor the efficacy of these measures. These mitigatory measures shall be designed in
35 accordance with either Option 1 or Option 2, above. If the owner/operator chooses to
36 mitigate in accordance with Option 1, the Maximum Wildlife Fatality Goal for bats shall be
37 10 bats or fewer per turbine/year; that total being further subject to apportionment
38 (approximately) among four cohorts or species of bats as follows: 4 migratory tree bats (i.e.,

Attachment B – DGIF Comments

1 red, hoary, and silver-haired bats) per turbine/year; 1 eastern pipistrelle per turbine/year;
2 0.5 eastern small-footed myotis per turbine/year; and 5 “other” bats per turbine/year.

3
4 Meeting review of 10/28/09 began with the below section.

5 **Post-Construction Avian and Bat Monitoring Protocol**

6 The following post-construction monitoring protocol is designed to document and quantify impacts to
7 avian and bat resources from wind project development.

8
9 There are three primary objectives associated with the study:

- 10 3) Estimate the level of avian and bat mortality associated with the wind project.
- 11 4) Develop recommendations for management actions to reduce bat mortality at the
12 wind project through conducting a curtailment study.
- 13 5) Determine the treatment regime that allocates costs or revenue losses per
14 turbine/year to maximize reduction in bat mortality.

15
16 The post-construction monitoring study will consist of the following components:

- 17 • Seven months of study [April 1 – October 30] for the first year after a project is operational that
18 assess avian and bat mortality through standardized carcass searches, carcass removal trials,
19 and searcher efficiency trials;
- 20 • A study designed to investigate the correlation of bat casualties with project operational
21 protocols, weather-related variables, and the effectiveness of operational adjustments to
22 reduce impacts.

23
24 **Avian and Bat Mortality Study**

25 Impacts to bat will occur during the active season between April and November. The majority of bat
26 casualties at wind-energy facilities have occurred during the late summer and fall migration period. On
27 an annual basis, the study period can be divided into spring from approximately April 1 to June 15,
28 summer June 16 to August 15, and fall August 16 to October 31. These periods cover the peak of the
29 spring raptor and songbird (April-May, September-October) and fall bat (August-September) migrations.
30 The methods for the fatality study are broken into three primary components: (1) standardized carcass
31 searches, (2) searcher efficiency trials, and (3) carcass removal trials.

32
33 The number of avian and bat fatalities will be estimated based on the number of avian and bat fatalities
34 found in search plots around turbines and whose death appears related to collision with turbines. All
35 carcasses located within areas surveyed, regardless of species, will be recorded and a cause of death
36 determined, if possible, based on field inspection of the carcass. Total number of avian and bat
37 carcasses will be estimated by adjusting for removal bias (e.g., scavenging), searcher efficiency bias, and
38 sampling effort. Carcasses where the cause of death is not apparent will be included in the fatality

1 estimate.

2

3 Selection and Delineation of Carcass Search Plots

4

5 For wind projects with greater than 15 turbines, 30% of the turbines will be selected for inclusion in
6 the study. For wind project with less than 15 turbines 5 turbines will be selected for inclusion in the
7 study. The sample of turbines should be selected to provide even coverage of the entire project.

8

9 For an eight week period from approximately August 1 through September 30, and additional set of
10 turbines will be selected for inclusion in the study to investigate the correlation of bat fatalities with
11 turbine operation and weather patterns. A minimum of five additional turbines will be selected for
12 each treatment variable chosen for the study.

13

14 Search plots will be established around each sampled turbine and will be delineated in the field and
15 with a GPS for detailed habitat mapping. For most projects, it is likely that search plot size will be
16 variable and dependent on the area around the turbine that is clear of vegetation. Given the
17 difficulty in finding birds and bats within thick shrub cover or forested areas, the search area will be
18 limited to the cleared areas, and these areas should be maintained as clear as well as possible to
19 facilitate the searches. Efforts will be made to maximize the search plots, such as extending plots
20 along the roads, but searches will not be conducted in forested areas or areas with steep rocky
21 slopes. Adjustments to the fatality estimates will be made to account for the unsampled areas
22 (areas beyond the search plot boundaries) using existing information regarding spatial distribution
23 of fatalities within search plots at this project and at other projects. Detailed limits of the search
24 plots for each turbine will be mapped using GPS units and detailed aerial maps/photos of the
25 development as constructed.

26

27 Periodic vegetation management (i.e., mowing) will be used to facilitate the search effort by
28 maintaining lower vegetation height in the search plots. If needed because vegetation grows too
29 quickly, an increase in mowing frequency of the search plots may be requested. If possible, all
30 mowing activity of search plots will be conducted immediately following a standardized search to
31 minimize potential carcass removal due to mowing.

32

33 Scheduling/Timing

34

35 The study period will be divided into spring (April 15 to June 15), summer (June 16 to August 15) and
36 fall (August 16 to October 31). This study period is designed to incorporate the key months for
37 spring and fall raptor and passerine migration, and bat migration in the fall. It will also estimate the
38 effect of the wind project on resident species during the summer. Carcass search frequency for the
39 30% of the turbines will be weekly. For the additional turbines included in the turbine operation
40 and weather study, the search frequency will be daily.

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Standardized Carcass Searches

Objective: To systematically search a sample of the project for avian and bat fatalities that are attributable to collision with turbines or met towers.

Personnel trained in proper search techniques should conduct the carcass searches. Transects within search plots will be set approximately 5-6 meters apart in the area to be searched. Searchers (field technicians) will walk at a rate of approximately 45-60 m/min along each transect searching both sides out to 2-3 meters for casualties. The condition of each carcass found will be recorded using the following condition categories:

- Intact – a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged – an entire carcass, which shows signs of being fed upon by a predator or scavenger, a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.), or a carcass with heavy insect infestation.
- Feather Spot - 10 or more feathers or 2 or more primary feathers at one location indicating predation or scavenging.

For all casualties found, data recorded will include: species, sex and age when possible, date and time collected, GPS location, physical condition (e.g., intact, scavenged, feather spot), estimated time of death, and any comments that may indicate cause of death. All casualties located will be photographed as found and mapped on a map of the study area showing the location of the wind turbine and associated facilities such as access roads, substations, and buildings. Dominant vegetation cover and visibility index for the carcass location will also be recorded.

Searcher Efficiency Trials

Objective: To estimate the percent of avian/bat fatalities that are found by searchers.

Searcher efficiency studies will be conducted in the same areas carcass searches occur and during the entire study period. Searcher efficiency will be estimated by carcass size and visibility class. Estimates of searcher efficiency will be used to adjust the number of carcasses found by correcting for detection bias.

During the study period, between 50 and 100 carcasses in each size class (small birds, medium to large birds, bats) for each visibility class (easy, moderate, difficult, very difficult) will be used for searcher efficiency trials. To gain the preferred sample sizes without saturating search plots, trials will be conducted throughout the study period and in all weather conditions. During each week of study, approximately 1-2 large carcasses and 2-3 small avian and bat carcasses will be placed randomly throughout the sample of search plots. All carcasses will be placed at pre-determined

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1 random locations within areas being searched prior to the carcass search on the same day.
2 Carcasses will be dropped from shoulder or waist height to simulate a falling avian or bat.

3
4 Each trial carcass will be discreetly marked so that it can be identified as a study carcass after it is
5 found. The number and location of trial carcasses found during a standardized search will be
6 recorded. The number of carcasses available for detection during each trial will be determined
7 immediately after the trial by the person responsible for distributing the carcasses, and carcasses
8 removed.

9 10 Carcass Removal Trials

11 Objective: To estimate the length of time avian/bat fatalities remain in the search area.

12
13 Carcass removal studies will be conducted throughout the study period. Estimates of carcass
14 removal will be used to adjust the number of carcasses found by correcting for removal bias..

15
16 All trial carcasses will be placed within 60 m of turbines that are not included in the set of sampled
17 turbines. Reducing the number of planted carcasses near turbines minimizes the possibility of
18 increasing scavenging at the turbines due to an additional food source being provided.

19
20 During the study period between 50 and 100 carcasses in each size class (small birds, medium to
21 large birds, bats) for each visibility class (easy, moderate, difficult, very difficult) will be used for
22 carcass removal trials. Typically a given trial will consist of a small number of carcasses randomly
23 placed throughout the study areas. To provide a sufficient sample size, carcasses from each size
24 class will be placed in the field and monitored for 14 days. The trials will be spread throughout the
25 study period to incorporate the effects of varying site, scavenger, and weather conditions.

26
27 Experimental carcasses will be marked discreetly so that it can be identified as a study carcass.
28 Experimental carcasses will be left at the location until the end of the trial (14 days), at which time
29 any remaining carcasses or evidence of the carcass (e.g., feather spot) will be removed.

30 31 32 Statistical Methods for Estimation of Fatality Rates

33
34 The estimate of the total number of wind turbine-related fatalities will be based on four
35 components: 1) observed number of carcasses, 2) searcher efficiency expressed as the proportion of
36 trial carcasses found by searchers, 3) removal rates expressed as the length of time a carcass is
37 expected to remain in the study area and be available for detection by the searchers, and 4) the
38 estimated percent of casualties that likely fell in non-searched areas based on the distribution of
39 observed casualties and percent of area searched around turbines.

40

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1 Statistical methods for calculating the average number of observed carcasses, the estimate of
2 searcher efficiency, the estimate of carcass removal, and the estimate of the total number of
3 casualties will follow current techniques used in similar studies.

4
5 Annual fatality estimates for raptors, passerines, nocturnal migrant passerines, other birds, all birds
6 combined and bats will be calculated. Information from the project site will be used to assess
7 mortality in relation to weather variables. The wind speed, direction, temperature, precipitation
8 and any other data available from the project site (e.g., turbines or met tower) will be requested and
9 used in an analysis to correlate numbers of fatalities from the turbines where daily searches occur.
10 Information from the project production (operations) monitoring will be used to assess mortality in
11 relation to turbine operation. The turbine operation data, for example hours per night of operation,
12 rotations per minute (rpm), from the turbines where scheduled searches take place will be
13 requested and used in an analysis to correlate observed and adjusted numbers of fatalities with
14 turbine operations.

15 Curtailment Study

16 In addition to the 30% of sample turbines searched to further quantify bat mortality, 12 additional
17 turbines will be systematically selected from turbines available for surveys for implementing initial
18 management actions related to changes in cut-in speeds. During each night, three treatment regimes
19 (i.e., change in cut-in speeds) with four replicates each will be implemented at the study turbines: 1)
20 fully operational, 2) cut-in speed at X.X m/s, 3) cut-in speed at X.X m/s for X hours. Treatments will be
21 randomly assigned to study turbines each week. Nights will be considered the experimental unit and
22 daily searches will be conducted at the 12 turbines from August 1 to September 30 using methods
23 described above for fatality surveys.

24
25
26 Data from these study turbines and the turbines within the 30% pool will be used to estimate
27 environmental and biological factors that could be used to predict when bat mortality occurs, which will
28 be used to further refine optimal implementation of management actions.

29
30 Biological variables and metrics will include measures of fatality and measures of activity. Number of
31 bats (aggregated and separated by group or species) found per turbine per night and number of fresh
32 bats (estimated to have occurred the previous night) will be the primary fatality metrics used. Bat
33 activity metrics will include hourly and nightly bat call rates (# bat calls per detector night).
34 Environmental variables measured will include weather information including wind speeds, wind
35 direction, temperature, barometric pressure, humidity, and other indices relative to passage of storm
36 fronts and general weather conditions. Weather information will be collected from meteorological
37 towers and wind turbines in the project, and from the National Weather Service. Wind turbine
38 characteristics measured will include, average rpm's, operating time, and energy production.

39
40 Bats will be surveyed in the project area using acoustic detectors (e.g. AnaBat® or accessible equivalent).
41 At a minimum three detectors will be deployed to turbines included in the curtailment study - one for
42 each treatment group – from August 1 to September 30. Each detector will be left at a chosen turbine

1 for 7 consecutive nights before recovery of the systems for data download. Detectors will be placed at
2 ground level on a stand to elevate the microphone at least one meter about ground level.
3

4 For this study, the number of bat passes per unit time will be the metric of interest and will be used as
5 an index to bat use of the project area. A pass is defined as a train of echolocation calls produced by an
6 individual bat, and consists of a continuous series of ≥ 2 call notes with no pauses between call notes of
7 > 1 second. The number of bat passes will be determined by downloading the calls from the ZCAIMS
8 onto a computer and counting the number of echolocation passes recorded.
9

10 Optimizing Management Based on Effectiveness and Cost

11
12 The third objective will be addressed by selecting and testing the optimal management action(s), where
13 optimal is defined as the implementation of management actions to achieve a maximum level of
14 reduction in bat mortality based on the economic constraints. Predictive models of bat mortality as a
15 function of biological variables, environmental variables, and wind turbine variables may identify
16 implementation of selective curtailment or other management actions as the optimal management
17 action for maximizing reduction in bat mortality.
18

19 This management action involves developing a model based on empirical data for determining nights of
20 expected high bat mortality in which to implement curtailment of turbines. Curtailment of turbines
21 could involve changing the cut-in speeds or completely shutting down turbines for select nights or
22 periods.
23

24 Management Action Effectiveness Determination

25
26 Estimated mortality reductions and associated costs will be calculated for various management action
27 alternatives used in the study. Management actions to consider for additional testing or for
28 recommendation will be developed using a cost and effectiveness evaluation based on the study results.
29 For example, if the goal is to reduce tree-roosting bat mortality by 50 percent, then the management
30 action(s) that are estimated or predicted to achieve 50 percent reduction for the minimum cost may be
31 further tested if high uncertainty exists after the study, or may be recommended for immediate
32 implementation if low uncertainty exists. Further testing may not be required if change in cut-in speeds
33 for the entire study period is selected as an optimal management action. However, if selective
34 curtailment or change in cut-in speeds are selected as a preferred management action, then additional
35 validation may be needed to determine true effectiveness. Effectiveness of management actions,
36 including change in cut-in speeds, will be estimated based on fitting generalized linear mixed models. In
37 addition, predictive models of bat mortality will be developed using the biological, environmental, and
38 wind turbine characteristic variables described above.
39

40 Post-Construction Wildlife Mitigation and Management

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- 1 4. Post-Construction Mitigation: After completing the initial 1 year of Post-Construction monitoring
2 and any Significant Adverse Impacts are confirmed, the applicant shall submit a plan consisting of its
3 proposed monitoring and mitigation actions expected to be implemented for the remainder of the
4 project’s operating life. If it is determined by the applicant that Significant Adverse Impacts are not
5 confirmed, then the applicant will review the results with the DEQ within 60 days of completion of
6 such findings, and if agreed, no further mitigation by the applicant will be required.
7
- 8 5. Amendment of Mitigation Plan: After 3 years of post-construction mitigation efforts, the Operator of
9 the facility may initiate a consultation with the Department to propose amendments to the
10 mitigation plan. The Department may amend the mitigation plan if it determines that the proposed
11 amendment will avoid or minimize adverse impacts to a demonstrably equal or greater extent as the
12 mitigation measures being implemented at that time. Alternatively, the Department may amend
13 the mitigation plan if the Operator demonstrates that: the mitigation measures being implemented
14 at that time are not effectively avoiding or minimizing adverse impacts, and; the proposed
15 amendments are preferable methods to mitigate for ongoing adverse impacts.
- 16
- 17 6. Invasive Plant Species Management: Native plant species appropriate to the site will be utilized as
18 part of the construction and landscaping process. In the ordinary course of construction or
19 operation of the facility, if any Invasive Plant Species are identified, they will be removed and
20 discarded from the site.

Comment [jkd44]: Do we need a menu here?

21
22 **Post-Construction Monitoring and Mitigation Financial Cap**
23

24 After the facility is in commercial operation for one full year, the applicant shall fund monitoring and
25 mitigation activities in subsequent years based upon the recommendations of the year 1 report. The
26 applicant shall incur up to but not exceed \$5,000 per turbine per calendar year for direct or indirect
27 costs or lost revenue resulting from any monitoring and mitigation. This cap will be annually adjusted
28 beginning on January 1, 2012 using the GDPIPD Index. If upon review of the results of the initial 1-year
29 Post-Construction monitoring program that is determined by the applicant and the DEQ that there are
30 no Significant Adverse Impacts, then the applicant will not be required to continue any monitoring or
31 begin any mitigation for that Wildlife Species. If applicable, the applicant will be required to file a report
32 every 5th anniversary of the last turbine placed in commercial operation at the wind energy facility
33 illustrating how the funds are applied to natural resource monitoring and mitigation at the operating
34 facility.
35