

**General Avian Use and Raptor Migration Survey for the
Rocky Forge Wind Project
Botetourt County, Virginia**

**December 2014 – December 2015
Final Report**



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EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. (WEST) conducted year-round avian use and raptor migration surveys for the proposed Rocky Forge Wind Project (Project) in Botetourt County, Virginia. The studies were conducted in accordance with the tiered process outlined in the U.S. Fish and Wildlife Service (USFWS) Final Land-Based Wind Energy Guidelines (WEG) and Eagle Conservation Plan Guidance (ECPG), as well as the Virginia Administrative Code Title 9, Agency 15, Chapter 40 Small Renewable Energy Projects (Wind) Permit by Rule (PBR) requirements. Surveys were developed in coordination with USFWS and Virginia Department of Game and Inland Fisheries (VDGIF) to evaluate the use of the site by diurnal raptors, eagles, state/federally listed species, and Commonwealth of Virginia Species of Greatest Conservation Need (SGCN) Tier I and II species. The objective of the surveys was to evaluate species composition and seasonal and spatial use of the study area by birds.

Surveys were conducted twice monthly from December 18, 2014 through December 14, 2015, at four points established throughout the Project area. Surveys consisted of 5-minute counts for small birds within a 150-meter (m) radius, followed by 2-hour counts for raptors/large birds within an 800-m radius of the surveyor. Raptors/large birds were only counted in the first 20 minutes of each 2-hour count, while only eagles were recorded for the remaining 100 minutes.

Thirty-five small bird species and 13 raptor/large-bird species were recorded using systematic point count survey methods. Use by small birds was highest during the summer (6.25 bird/plot/5-minute survey) and lowest during the winter (3.13 bird/plot/5-minute survey). The species most commonly observed during the small bird surveys included American goldfinch (*Spinus tristis*, n=74), eastern bluebird (*Sialia sialis*, n=38), dark-eyed junco (*Junco hyemalis*, n=37), and indigo bunting (*Passerina cyanea*, n=37). No small birds were observed at heights within the planned rotor swept area. Large bird use was highest during the spring (3.91 bird/plot/20-minute survey) and lowest during the summer (1.33 bird/plot/20-minute survey). The most commonly observed species during large bird surveys included turkey vulture (*Cathartes aura*, n=101), common raven (*Corvus corax*, n=37) and American crow (*Corvus brachyrhynchos*, n=19). Waterfowl, diurnal raptor, vulture and large corvid subtypes were observed within the planned rotor swept area.

Use by raptors was highest during the fall (1.0 bird/plot/20-minute survey) and spring (0.29 bird/plot/20-minute survey) migration periods and lowest during winter (0.07 bird/plot/20-minute survey) and summer (0.25 bird/plot/20-minute survey). The raptor most commonly observed during the large bird surveys was red-tailed hawk (*Buteo jamaicensis*, n=22). Mean annual diurnal raptor use was 0.33 raptors/plot/20-minute survey, which was low when compared to studies at wind energy facilities with similar data.

No federally listed threatened or endangered species were observed during the surveys. One Tier I SGCN was recorded incidentally (peregrine falcon [*Falco peregrinus*], also state threatened, 1 observation) and 2 Tier II SGCN were recorded (bald eagle [*Haliaeetus leucocephalus*], 3 observations; winter wren [*Troglodytes hiemalis*], 2 observations). In addition,

golden eagle (*Aquila chrysaetos*, 8 observations [7 during surveys, 1 incidentally]) was recorded, which along with bald eagle is federally protected under the Bald and Golden Eagle Protection Act (1940). These tallies may represent repeated observations of an individual and/or include observations made incidental to the systematic survey protocol. Overall the Project site presents species composition and seasonal and spatial use patterns for birds typical for the region and likely presents low risk of impact to birds, including rare or special-status species.

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INTRODUCTION

This report presents the results of the 2015 avian surveys conducted by Western EcoSystems Technology, Inc. (WEST) for the Rocky Forge Wind Project (Project) located in Botetourt County, Virginia (Figure 1). Surveys were developed in coordination with U.S. Fish and Wildlife Service (USFWS) and Virginia Department of Game and Inland Fisheries (VDGIF) to evaluate the use of the site by diurnal raptors, eagles, state/federally listed species, and Commonwealth of Virginia Species of Greatest Conservation Need (SGCN) Tier I and II species. The objective of the surveys was to evaluate species composition and seasonal and spatial use of the study area by birds, in accordance with the (USFWS Final Land-Based Wind Energy Guidelines (WEG), USFWS Eagle Conservation Plan Guidance (ECPG), and Virginia Administrative Code Title 9, Agency 15, Chapter 40 Small Renewable Energy Projects (Wind) Permit by Rule (PBR) requirements.

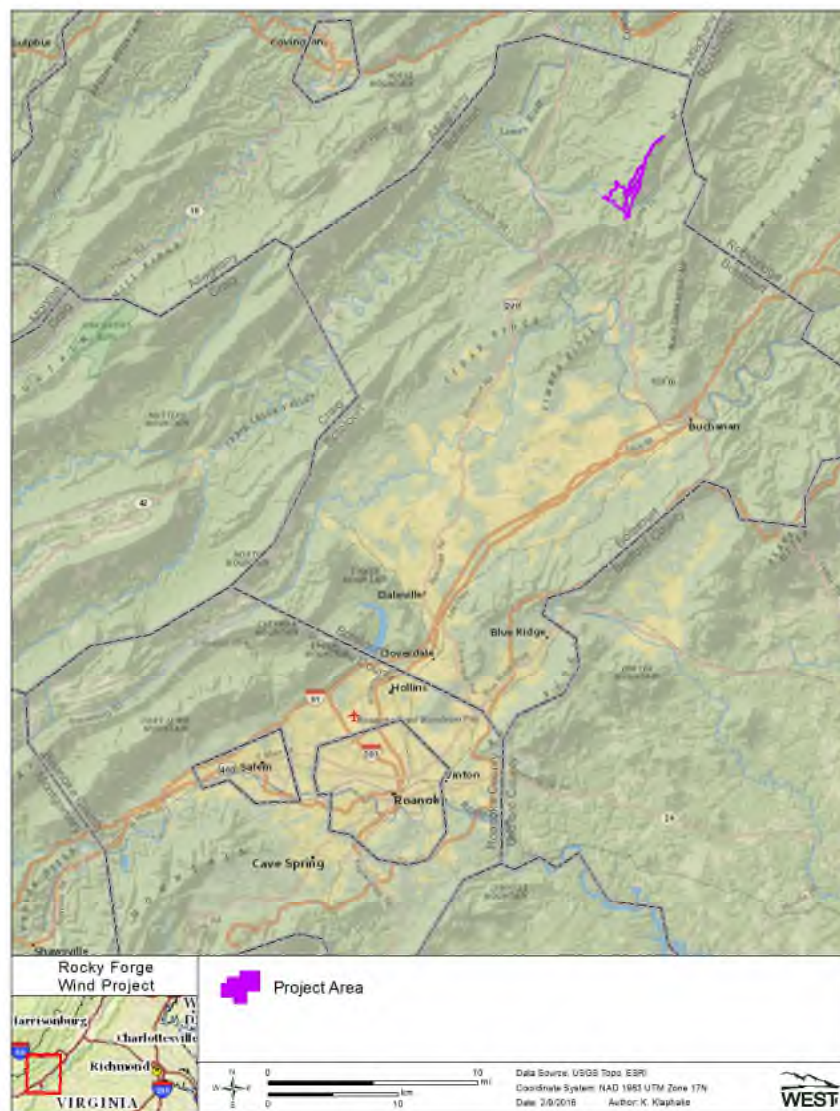


Figure 1. Location of the Rocky Forge Wind Project.

PROJECT AREA

The Project area is located within the Ridge and Valley Ecoregion, an area characterized by alternating forested ridges and agricultural valleys (USEPA 2001) and consists of approximately 365.84 acres of mostly forested habitat (Figure 2). The predominant land cover types within the Project area are deciduous forest (77%), evergreen forest (13%) and mixed forest (5%). Herbaceous vegetation, hay and pasture, and scrub/shrub cover types combined account for less than 5% of the remaining habitat within the Project (Figure 2). The Project area is typical of habitats found throughout the region and is not anticipated to concentrate special-status wildlife species associated with rare or unique habitats.

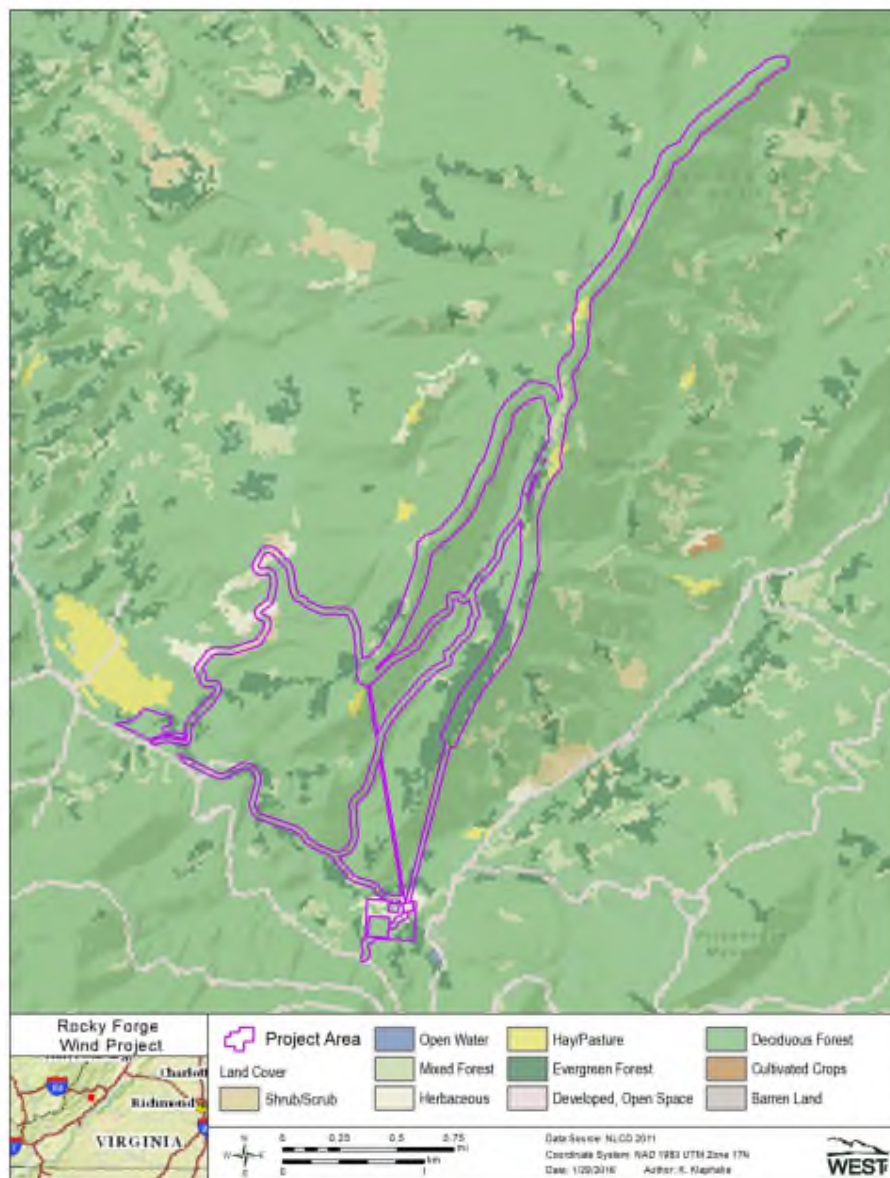


Figure 2. Land cover in the Rocky Forge Wind Project area and surrounding region.

METHODS

Avian Point Count Surveys

Avian point count surveys are the most widely used methodology for pre-construction avian site use characterization and risk analysis (e.g. USFWS “Tier 3” studies [USFWS 2012]), because of their effectiveness and efficiency for characterizing use of selected sites by diurnally-active birds (Ralph et al. 1993, Strickland et al. 2011). The methods used in this study were developed in coordination with the USFWS and VDGIF and considered by VDGIF as meeting the raptor migration survey requirements of the PBR and by USFWS as meeting the requirements of the ECPG.

Survey Methods

Surveys were conducted twice monthly at four points located in representative habitat types, topography, and viewshed within and near the project area (Figure 3). The northernmost point falls outside of the current Project area, which was revised after the points were established. Surveys were carried out during daylight hours and the order in which points were surveyed was alternated in order to approximately cover all daylight hours during each season. To the extent practicable, each point was surveyed approximately the same number of times.

Small bird surveys consisted of 5-minute counts at each point, in which all small birds seen or heard within 150 m (328 feet) were recorded. Small birds were defined as cuckoos, hummingbirds, swifts, woodpeckers and passerines.

Large bird surveys consisted of 2-hour counts at each point, in which all large birds seen within 800 m (2,625 feet) of the surveyor were recorded in the first 20 minutes, and only eagles were recorded in the remaining 100 minutes of each 2-hour count. Large birds were defined as waterbirds, waterfowl, shorebirds, diurnal raptors (i.e., kites, accipiters, hawks, eagles, falcons, northern harrier, and osprey), vultures, upland game birds, doves and pigeons, large corvids, and goatsuckers. The 20-minute portion of the large bird survey allows for standardization and comparison of data with other wind facilities throughout the region, while the 2-hour eagle counts allowed for more robust evaluation of eagle use of the site.

Observations of special-status species (federally listed, state listed or SGCN Tier I or II, or eagles) beyond the 800-m and 150-m radii were recorded as incidental observations to document occurrence, but were excluded from the analysis of systematic survey data.

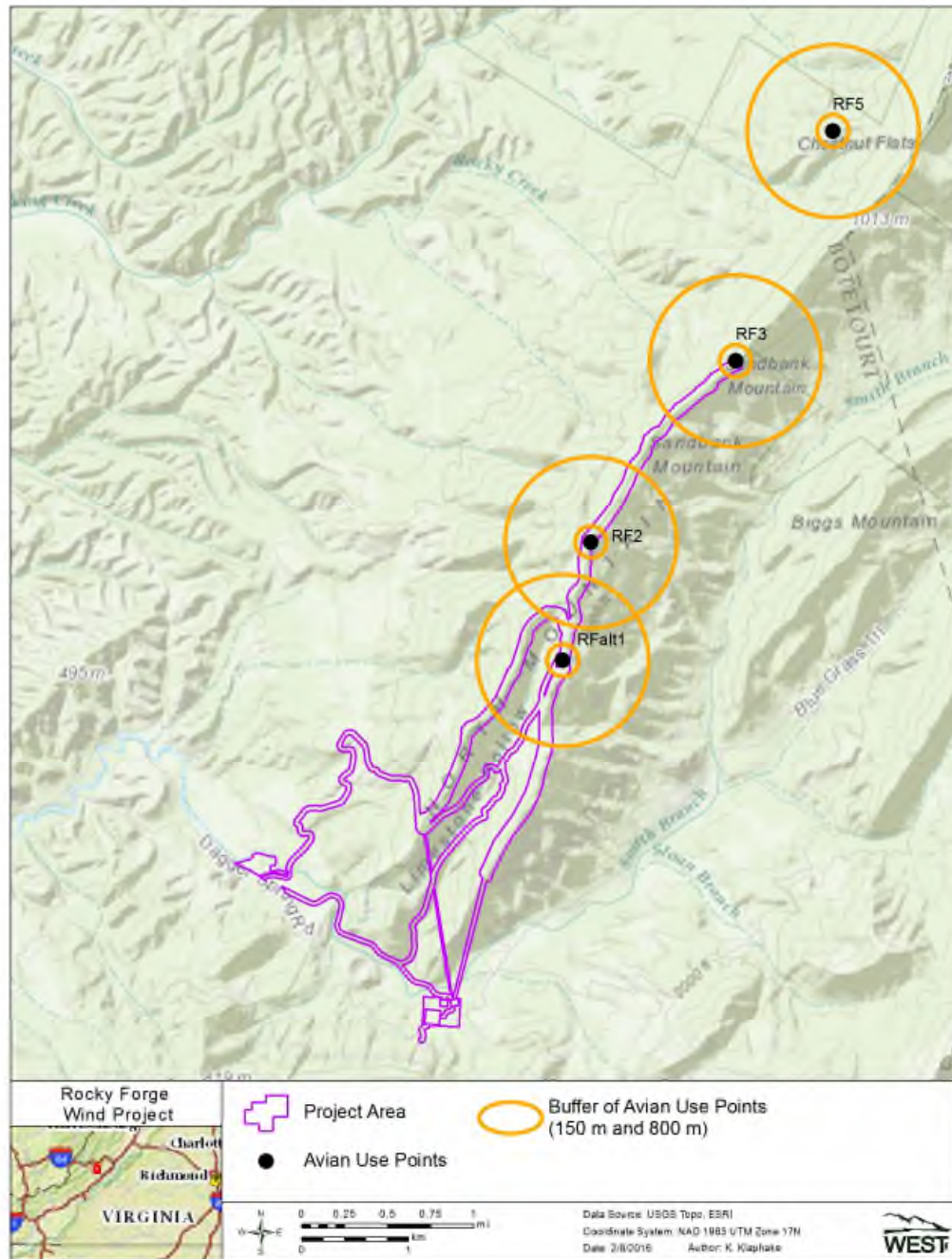


Figure 3. Fixed-point locations for avian use surveys at the Rocky Forge Wind Project.

At each survey point, the date, start and end time of the survey period, and weather information (i.e., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. Bird behavior and habitat type wherein the observation occurred were recorded based upon the point of first observation.

Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16 feet) interval. Other information recorded included whether the observation was visual or auditory and the 10-minute interval of the survey in which the detection first occurred. Locations of diurnal raptors and SGCN recorded during surveys were identified on field maps by unique observation number. Comments were recorded in the comments section of the data sheet.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the Project area. For the purposes of seasonal analyses, seasons were defined as spring (March 15 to June 15), summer (June 16 to September 15), fall (September 16 to November 15) and winter (November 16 to March 14). Spring and fall seasons were used to assess raptor migration.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data was identified using a series of database queries. Irregular codes or data suspected as being questionable were discussed with the observer and/or survey manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks (if provided), and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season for each survey type and included all observations of birds detected, regardless of their distance from the observer. In some cases, the tally may represent repeated sightings of the same individual. Species richness was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season for each survey type. Species diversity and richness were compared among seasons within a respective survey types for fixed-point bird use surveys.

Mean Use and Frequency of Occurrence

For generating standardized fixed-point bird use estimates, all large birds detected within the 800-m radius plot during the first 20 minutes of the 2-hour survey were used in the analysis, and all small birds recorded within a 150-m radius during a 5-minute survey were included in estimates for the 5-minute fixed-point surveys. Standardized estimates of mean bird use (number of birds per plot per survey) were used to compare differences between bird types, seasons, survey points, and other studies where similar methods were used. Mean use by season was calculated separately for the 20-minute and 5-minute fixed-point surveys by summing the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall annual mean use was calculated for each of the survey types as a weighted average of seasonal values by the number of days in each season.

Bird Flight Height and Behavior

Flight height information was used to calculate the percentage of birds observed flying within the rotor-swept height (RSH; estimated to be between 25 and 150 m [82 to 492 feet] above ground level [AGL]) for modern utility-scale turbines. The flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height. The percentage of birds flying within the RSH at any time was calculated using the lowest and highest flight heights recorded.

Spatial Use

Raptor flight paths were qualitatively compared to study area characteristics (e.g., topographic features). The objective of mapping observed large bird locations and flight paths was to identify areas of concentrated use by diurnal raptors and other large birds and/or consistent flight patterns.

RESULTS

A total of 95 small bird counts and 95 large birds use surveys were conducted throughout the one-year survey period. For each survey type, 28 surveys were conducted in spring, 24 during summer, 16 in fall, and 27 in winter (Table 1), for a total of and 7.9 hours for small-birds, 31.7 hours for large birds and 190 hours for eagles. Results from the 5-minute small bird surveys and the 20-minute large bird surveys are presented in the following sections; however, results of the 2-hour eagle use surveys are discussed separately in the Eagle Use section below. For all birds recorded during the surveys, details on the number of observations and groups recorded by species are presented in Appendix A, and details on mean use, percent of use, and frequency of occurrence are presented in Appendix B.

Bird Diversity and Species Richness

A total of 450 individuals of 35 species were recorded during the small bird surveys (Table 1). Small bird diversity was highest during the summer (n=25) and fall (n=22), followed by spring

(n=15) and winter (n=7). Small bird species richness was higher during the summer (4.21 species/150-m plot/5-min survey) and spring (3.36) compared to the fall (1.69) and winter (0.67). Overall species richness was 2.42 bird species/150-m plot/5-minute survey. The following six species composed approximately 57% of all observations made during small bird surveys: American goldfinch (*Spinus tristis*); eastern bluebird (*Sialia sialis*); dark-eyed junco (*Junco hyemalis*); indigo bunting (*Passerina cyanea*); and eastern towhee (*Pipilo erythrophthalmus*), cedar waxwing (*Bombycilla cedrorum*). The remaining species composed less than 4% of all observations. For small birds, the highest overall bird use occurred during the summer (6.25/birds/150-m plot/5-minute survey), followed by spring (5.11), fall (4.19) and winter (3.13).

Table 1. Summary of species richness (species/plot^a/20-minute survey and species/plot^a/5-minute survey), and sample size by season and overall during the fixed-point bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness
20-minute surveys				
Spring	7	28	10	1.14
Summer	6	24	6	0.96
Fall	4	16	7	1.38
Winter	7	27	6	0.44
Large Bird Overall	24	25	29	2.10
5-minute surveys				
Spring	7	28	15	3.36
Summer	6	24	25	4.21
Fall	4	16	22	1.69
Winter	7	27	7	0.67
Small Bird Overall	24	95	35	2.42

^a 800-m radius for large birds and 150-m radius for small birds.

A total of 212 individuals of 13 species were observed during the 20-minute portion of the large bird surveys (Table 1), of which 6 species were diurnal raptors (Table 2). Large bird diversity was highest during the spring (n=10), followed by fall (n=7), summer (n=6), and winter (n=6). Large bird species richness was higher during the fall (1.38 species/800-m plot/20-minute survey) and spring (1.14) compared to the summer (0.96) and winter (0.44). Overall species richness was 2.10 bird species/800-m plot/20-minute survey. Three species (23.1% of all species) composed 74.1% of all observations: turkey vulture (*Cathartes aura*), common raven (*Corvus corax*) and American crow (*Corvus brachyrhynchos*). All other species each accounted for approximately 10% or fewer of the observations. The most abundant bird species observed at a given time was greater white-fronted goose (*Anser albifrons*; 16 individuals in one group).

Table 2. The number of groups and individuals for diurnal raptors observed during the first 20 minutes of fixed-point bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Type / Species	Spring		Summer		Fall		Winter		Overall	
	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
<i>Accipiters</i>	1	1	2	2	3	3	0	0	6	6
Cooper's hawk	0	0	2	2	1	1	0	0	3	3
sharp-shinned hawk	1	1	0	0	2	2	0	0	3	3
<i>Buteos</i>	7	7	4	4	6	13	1	1	18	25
broad-winged hawk	1	1	0	0	0	0	0	0	1	1
red-shouldered hawk	2	2	0	0	0	0	0	0	2	2
red-tailed hawk	4	4	4	4	6	13	1	1	15	22
<i>Eagles</i>	0	0	0	0	0	0	2	2	2	2
golden eagle	0	0	0	0	0	0	2	2	2	2
Overall	8	8	6	6	9	16	3	3	26	33

Bird Use, Percent of Use, and Frequency of Occurrence

Small Birds

Passerines

A 150-m viewshed was used for small birds, therefore descriptive statistics for small bird types are not directly comparable to large birds. Passerine use was highest during the summer (6.04/birds/150-m plot/5-minute survey), compared to the spring (5.07), fall (3.31), and winter (3.13). American goldfinch had the highest use by any single species during the summer and fall (1.21 and 1.12 birds/150-m plot/5-minute survey, respectively). Indigo bunting had the highest mean use during spring (0.61 birds/150-m plot/5-minute survey), while dark-eyed junco had the highest mean use in fall (1.15 birds/150-m plot/5-minute survey). Passerines were observed during all of the surveys in summer and 67.9% of surveys in spring compared to 56.2% and 42.9% of in fall and winter, respectively (Table 3).

Swifts and Hummingbirds

Swifts and hummingbirds were represented by two species: chimney swift (*Chaetura pelagica*) and ruby-throated hummingbird (*Archilochus colubris*). Chimney swift was observed in spring, summer and fall while ruby-throated hummingbird was only recorded during the summer. Swifts and hummingbirds had the highest use during the fall (0.75 bird/150-m plot/5-minute survey) compared to other times of the year (summer=0.21, spring=0.04, and winter = 0.0). Higher use during the fall included twelve observations of chimney swifts that together made up 17.9% of the overall fall bird use. Otherwise, swifts and hummingbirds composed less than 4% of the overall small bird use in the other seasons. Swifts and hummingbirds were observed more frequently during the summer (16.7%) than compared to fall (6.2% of surveys), spring (3.6% of surveys) and winter (0%; Table 3).

Woodpeckers

Hairy woodpecker (*Picoides villosus*) and red-bellied woodpecker (*Melanerpes carolinus*) were the only woodpecker species recorded. Woodpeckers had the highest use during fall (0.12 birds/150-m plot/5-minute survey), the only time of year in which woodpeckers were observed. Woodpeckers composed less than 12.5% of the overall large bird use during the fall and were observed during 12.5% of fall surveys (Table 3).

Large Birds

Waterfowl

Greater white-fronted snow goose was the only species of waterfowl observed. Use by greater white-fronted snow goose was limited to the spring (0.57 bird/800-m plot/20-minute survey), with no geese detected during other times of year. Greater white-fronted snow goose accounted for 15.8% of bird use during spring and was observed in 3.6% of spring surveys (Table 3).

Diurnal Raptors

Diurnal raptor use was highest during the fall (1.0 bird/800-m plot/20-minute survey), followed by spring (0.29), summer (0.25) and winter (0.07). Higher use during the fall was primarily attributable to use of the area by red-tailed hawk (*Buteo jamaicensis*; 0.81 bird/800-m plot/20-minute survey). Red-tailed hawk had the highest use of any diurnal raptor during the spring (0.14) and fall. Cooper's hawk (*Accipiter cooperii*) was the only accipiter observed during summer (0.08 bird/800-m plot/20-minute survey). No bald eagles (*Haliaeetus leucocephalus*) and two golden eagles (*Aquila chrysaetos*) were observed within the first 20 minutes of the 2-hour survey; one additional golden eagle was recorded incidentally, outside of the 800-m viewshed. All golden eagle observations were during winter period. Diurnal raptors were observed during 47.1% of fall surveys, compared to 18.8% of summer surveys, 7.9% of spring and 4.7% of winter surveys (Table 3).

Owls

Barred owl (*Strix varia*) was the only species of owl observed. Use by barred owl was limited to summer (0.04 bird/800-m plot/20-minute survey), with no owls detected during other time of year (Table 3).

Vultures

Turkey vulture (*Cathartes aura*) was the only vulture species observed, and use by turkey vulture was highest during spring (2.46 bird/800-m plot/20-min survey). Turkey vultures were not observed during the winter. Turkey vulture composed 68.3% of overall bird use during the spring, 59.4% during summer and 32.4% in fall. Turkey vultures were observed most frequently during the spring (64.3% of surveys) compared to fall (56.2%) and summer (50%), and winter (0%; Table 3).

Upland Game Birds

Ruffed grouse was the only species of upland game birds detected. Ruffed grouse had relatively low use during the spring (0.04 bird/800-m plot/20-minute survey) and also had low use during the fall (0.12). No ruffed grouse were observed during summer and winter. Ruffed grouse composed less than 6.0% of overall bird use in any season. Ruffed grouse was observed during 12.5% of surveys during the fall compared to 3.6% of surveys in spring (Table 3).

Doves and Pigeons

Doves and pigeons were represented by a single species, mourning dove (*Zenaida macroura*). Mourning dove use was limited to spring (0.07 bird/800-m plot/20-minute survey), with no doves observed during any other time of year. Mourning dove composed less than 2% of the overall large bird use in any season, and were observed in 3.6% of surveys during the spring (Table 3).

Large Corvids

Large corvids observed included American crow and common raven, and use by large corvids was highest during the winter (1.44 birds/800-m plot/20-minute survey). Use by large corvids was relatively consistent during other parts of the year (spring: 0.18; summer: 0.25; and fall: 0.31). Comparatively high use by large corvids during winter was attributable to 31 observations of common raven. Large corvids composed 95.3% of overall bird use in winter, compared to 18.8% during summer, 14.7% during fall, and 5.0% during spring. Large corvids were observed most frequently during the winter (36.9% of surveys) compared to any other season (fall: 25.0%; summer: 16.7%; spring: 10.7%; Table 3).

Table 3. Mean bird use (number of birds/plot^a/20-min survey), percent of total use (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterfowl	0.57	0	0	0	15.8	0	0	0	3.6	0	0	0
Diurnal Raptors	0.29	0.25	1.0	0.07	7.9	18.8	47.1	4.7	21.4	25	37.5	7.1
<i>Accipiters</i>	0.04	0.08	0.19	0	1	6.2	8.8	0	3.6	8.3	18.8	0
<i>Buteos</i>	0.25	0.17	0.81	0.04	6.9	12.5	38.2	2.4	17.9	16.7	25	3.6
<i>Eagles</i>	0	0	0	0.04	0	0	0	2.4	0	0	0	3.6
Owls	0	0.04	0	0	0	3.1	0	0	0	4.2	0	0
Vultures	2.46	0.79	0.69	0	68.3	59.4	32.4	0	64.3	50.0	56.2	0
Upland Game Birds	0.04	0	0.12	0	1.0	0	5.9	0	3.6	0	12.5	0
Doves/Pigeons	0.07	0	0	0	2.0	0	0	0	3.6	0	0	0
Large Corvids	0.18	0.25	0.31	1.44	5.0	18.8	14.7	95.3	10.7	16.7	25.0	36.9
Large Bird Overall	3.61	1.33	2.12	1.51	100	100	100	100				
Passerines	5.07	6.04	3.31	3.13	99.3	96.7	79.1	100	67.9	100	56.2	42.9
Swifts/Hummingbirds	0.04	0.21	0.75	0	0.7	3.3	17.9	0	3.6	16.7	6.2	0
Woodpeckers	0	0	0.12	0	0	0	3	0	0	0	12.5	0
Small Bird Overall	5.11	6.25	4.19	3.13	100	100	100	100				

^a. 800-meter (m) radius plot for large birds and 150-m for small birds

Spatial Use

Use for small birds was highest at points RF5 (5.75 birds/150-m plot/5-minute survey) and RF3 (5.08) compared to the other survey points (Appendices C1 and C3a). Passerine use was highest at point RF5 (5.67 birds/150-m plot/5-minute survey), and ranged from 2.91 to 4.62 at other points (Appendix C3b). Mean use by swifts and hummingbirds was highest at point RF3 (0.62 birds/150-m plot/5-minute survey; Appendix C3c), and woodpeckers were only recorded at points RF2 and RF5 (0.04 birds/150-m plot/5-minute survey at each point; Appendix C3d).

For all large bird species combined, use was highest at point RF5 (3.04 birds/800 m plot/20-minute survey; Appendices C1 and C2a). Large bird use at the remaining points was 2.21 (RF3), 2.09 (RFAlt1) and 1.46 birds (RF2). The highest mean use estimate at point RF5 was largely due to vulture and large corvid use at this point (1.29 birds/800-m/20-minute survey for each group; Appendices C2e and C2h). Waterfowl use was highest at point RFAlt1 (0.7 birds/800-m plot/20-minute survey), the only survey point where waterfowl were observed (Appendix C2b). Diurnal raptor use was highest at point RF3 (0.42 birds/800-m plot/20-minute survey) and ranged from 0.25 to 0.35 at other points (Appendix C2c). Three bird types (owls [Appendix C2d], upland game birds [Appendix C2f], and doves and pigeons [Appendix C2g]) were only observed at a single survey point. Mean use for owls was 0.04 birds/800-m/20-minute survey at point RF2, mean use for upland game birds was 0.12 birds/800-m/20-minute survey at RF5, and mean use for doves and pigeons was 0.08 birds/800-m/20-minute survey at RF3. Vultures were recorded at all of the points, with use ranging from 1.29 birds/800-m plot/20-minute survey at points RF3 and RF5 to 0.78 at RFAlt1 (Appendix C2e). Large corvid use was highest at point RF5 (1.29 birds/800-m plot/20-minute survey) and ranged from 0.26 to 0.42 at other points (Appendix C2h).

Bird Flight Height and Behavior

Flight height characteristics, based upon initial flight height observations and estimated use, were estimated for bird types and species (Tables 4 and 5). All passerines, swifts and hummingbirds, and woodpeckers within the 150 m plots were observed below the RSH.

During the first 20 minutes of the 2-hour large bird use surveys, 98 groups of large birds were observed flying within the 800-m plot, totaling 202 individuals. Overall, 43.6% of flying large birds were recorded within the RSH, 56.4% were below the RSH, and no birds were flying above the RSH of 25 to 150 m (82 – 492 feet) AGL. Waterfowl had the highest percentage of flying birds recorded within the RSH (100%). More than half (61.3%) of flying diurnal raptors were observed within the RSH, while the remaining 38.7% were below the RSH. Diurnal raptors had the second highest percentage of birds within the RSH, primarily attributable to 70.8% of buteo observations recorded at this height. The majority of large corvids (98.1%) was observed flying below the estimate RSH, while 1.9% was recorded within the RSH. Owl and upland game birds were not observed in flight, and all doves and pigeons were observed flying below the RSH (Table 4).

Thirteen species of large birds had between zero and 50 groups observed flying (Table 4). Five of these species were observed flying within the likely RSH during at least 50% of initial observations: turkey vulture, red-tailed hawk, greater white-fronted goose, Cooper’s hawk, and red-shouldered hawk (*Buteo lineatus*). Turkey vulture had a higher number of groups in flight (50 groups in flight) compared to the remaining species (1-14 groups in flight; Appendix C). Greater white-fronted goose had more individuals in flight (n=16) at a given time than did any other group (Appendix A). Three species were only seen flying within the likely RSH; however, observations of Cooper’s hawk and red-shouldered hawk included only three and two groups, respectively. No eagles were observed flying within the RSH. All small birds were observed below the RSH.

Table 4. Flight height characteristics by bird type and raptor subtype recorded within 800-m of a point and during the first 20 minutes of the 2-hour fixed-point bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Bird Type	# Groups Flying	# Ind Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m ^a	> 150 m
Waterfowl	1	16	30	100	0	100	0
Diurnal Raptors	24	31	27.1	96.9	38.7	61.3	0
<i>Accipiters</i>	6	6	23.2	100	66.7	33.3	0
<i>Buteos</i>	17	24	29.2	96	29.2	70.8	0
<i>Eagles</i>	1	1	14.0	100	100	0	0
Owls	0	0	0	0	0	0	0
Vultures	50	99	26.7	100	47.5	52.5	0
Upland Game Birds	0	0	0	0	0	0	0
Doves/Pigeons	1	2	1.0	100	100	0	0
Large Corvids	22	54	14.8	96.4	98.1	1.9	0
Large Birds Overall	98	202	23.9	96.7	56.4	43.6	0
Passerines	63	181	7.6	43	100	0	0
Swifts/Hummingbirds	6	18	6.67	100	100	0	0
Woodpeckers	1	1	3	50	100	0	0
Small Birds Overall	70	200	7.46	45.4	100	0	0

^a The likely “rotor-swept height” for potential collision with a turbine blade, or 25 to 150 m (82 to 492 feet) above ground level.

Eagle Use

A total of 95, 2-hour fixed-point eagle use surveys were conducted during the spring, summer, fall and winter, for a total of 190 hours of eagle survey effort. Three bald eagles and eight golden eagles were observed during the 2-hour count surveys (Table 5; this includes the three golden eagles [two observed during the 20-min surveys and one incidental] discussed in the large bird survey results above).

Table 5. Seasonality¹ of eagle observations during 2-hour fixed-point bird use surveys at the Rocky Forge Wind Project, December 18, 2014 to December 14, 2015.

Bird Type / Species	Number Recorded			
	Spring	Summer	Fall	Winter
<i>Eagles</i>	0	0	0	11
Bald eagle	0	0	0	3
Golden eagle	0	0	0	8

¹Spring (Mar 15 to Jun 15), Summer (Jun 16 to Sep 15), fall (Sep 16 to Nov 15) and winter (Nov 16 to Mar 14)

Flight paths of bald and golden eagles were digitized and mapped and are located in Appendix D. Bald eagles generally flew across the ridges and towards Boggs Hollow. Of the seven golden eagles recorded within the 800 m survey plots, six were within rotor swept heights, two of these flew across the area proposed for turbines (Appendix E). The three observations of bald eagles were recorded at different locations that didn't share obvious landscape features. No obvious flyways or concentration areas were identified for either species.

Special-Status Species

Four special-status species were recorded during these surveys: one Tier I SGCN (peregrine falcon [*Falco peregrinus*] observed incidentally on September 6, 2015, two Tier II SGCN (winter wren [*Troglodytes hiemalis*], and bald eagle), and golden eagle. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA, 1940), and peregrine falcon is listed as state threatened.

DISCUSSION

Small and Large Birds

Most species of birds observed during the surveys were common species typical of forested and edge habitats of Virginia and throughout the region. The most commonly observed small birds included American goldfinch; eastern bluebird, dark-eyed junco; and indigo bunting. Species most often observed in the 20-minute large bird counts included turkey vulture (101 observations), common raven (37 observations) and American crow (19 observations). Most species observed were common, geographically abundant and anticipated to be unaffected by any potential habitat fragmentation related to the Project. Therefore impacts to bird populations during all seasons are unlikely to be significant.

Diurnal Raptors

Raptor use observed during the fixed-point bird surveys ranged from 0.07 in winter to 1 bird/800-m plot/20-minute survey, which is similar to or below most projects in the region. Annual mean diurnal raptor use at the Project (0.33 raptors/800-m plot/20-minute survey) was compared with 46 other wind energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean diurnal raptor use at these wind energy facilities ranged from 0.06 to 2.33 raptors/800-m plot/20-minute survey. A relative ranking of annual mean raptor use was developed based on the results from these wind energy facilities as low (0 – 0.5 raptors/800-m plot/20-minute survey), low to moderate (0.5 – 1.0), moderate (1.0 – 2.0),

high (2.0 – 3.0), and very high (more than 3.0). Under this ranking, annual mean diurnal raptor use within the Project area is considered to be low, ranking as 32nd lowest of the 46 wind energy facilities.

Raptor mortality at the Project will likely be within the range of rates reported at other facilities in the region, which is typically low and is likely to consist of the relatively common and widespread species documented in this survey. Potential impacts to individuals are unlikely to cause significant adverse impacts to local or regional raptor populations. Although there is some potential for habitat loss and displacement of individuals in response to the Project, the habitat present in survey area are prevalent across the local and regional landscape; therefore, any population-level effect of habitat loss and displacement attributable to the Project will most likely be minor.

Eagles

Despite saturating numbers of bald eagles that have resulted in expansion of the species geographic range in Virginia (VDGIF 2016), only three individuals were observed in the project during the course of the surveys. These three bald eagle observations were observed on three separate days during winter (January 16, February 6 and February 7); no bald eagles were detected during any other season. The Project site and surrounding area lack suitable breeding habitat for bald eagles, as described in the spring 2015 eagle nest survey, during which no bald eagle nests or observations were recorded within 4 miles (Tyrell 2016). Data indicate that high quality habitat and resources suitable for use by bald eagles are lacking within the Project area and that susceptibility of bald eagles to collisions with wind turbines is low. This is consistent with operating wind projects along the Appalachian ridgelines where no known bald eagle collision mortalities have been documented.

Golden eagles breeding in Canada migrate along mountainous ridgelines in eastern North America and are believed to winter in Virginia and adjacent states (VDGIF 2016), which is consistent with timing of the eight golden eagle observations recorded during these surveys. No landscape attributes (e.g. large waterbodies) within the Project are expected to attract wintering eagles. Given the low eagle use documented during surveys, and the fact that it is limited to the winter period, susceptibility of golden eagles to collisions with wind turbines is low. This is consistent with operating wind projects along the Appalachian ridgelines for which no known golden eagle collision mortalities have been documented.

Flight path data for the eagles documented in these surveys demonstrate no obvious flyways or concentration areas; therefore, siting turbines to avoid higher risk areas is not warranted.

CONCLUSIONS

Analysis of data collected during the surveys generally indicate that development of the Project is not likely to cause significant adverse impacts to birds, including migrating raptors, eagles, SGCN or other special-status species. Overall, some avian mortality is possible during the operation of the Project. The majority of the raptors observed are widespread, abundant species

with robust populations throughout their range. The low number of eagle observations recorded in 190 hours of observation across four seasons is consistent with the low eagle risk profile presented by wind projects in the region. Based on the apparent low use by eagles, in addition to low susceptibility of bald eagles to wind turbine collision and lack of eagle breeding habitat within or in areas surrounding the Project, eagle risk is likely low.

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**Appendix A. All Bird Types and Species Observed at the Rocky Forge Wind Project from
December 18, 2014 – December 14, 2015**

Appendix A1. Summary of the number of observations and groups recorded by species and large bird type during the first 20-minutes of fixed-point use surveys, regardless of distance from the observer, at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Type / Species	Scientific Name	Spring		Summer		Fall		Winter		Overall	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Waterfowl		1	16	0	0	0	0	0	0	1	16
greater white-fronted goose	<i>Anser albifrons</i>	1	16	0	0	0	0	0	0	1	16
Diurnal Raptors		8	8	6	6	9	16	3	3	26	33
<u>Accipiters</u>		1	1	2	2	3	3	0	0	6	6
Cooper's hawk	<i>Accipiter cooperii</i>	0	0	2	2	1	1	0	0	3	3
sharp-shinned hawk	<i>Accipiter striatus</i>	1	1	0	0	2	2	0	0	3	3
<u>Buteos</u>		7	7	4	4	6	13	1	1	18	25
broad-winged hawk	<i>Buteo platypterus</i>	1	1	0	0	0	0	0	0	1	1
red-shouldered hawk	<i>Buteo lineatus</i>	2	2	0	0	0	0	0	0	2	2
red-tailed hawk	<i>Buteo jamaicensis</i>	4	4	4	4	6	13	1	1	15	22
<u>Eagles</u>		0	0	0	0	0	0	2	2	2	2
golden eagle*	<i>Aquila chrysaetos</i>	0	0	0	0	0	0	2	2	2	2
Owls		0	0	1	1	0	0	0	0	1	1
barred owl	<i>Strix varia</i>	0	0	1	1	0	0	0	0	1	1
Vultures		25	69	15	19	10	11	1	2	51	101
turkey vulture	<i>Cathartes aura</i>	25	69	15	19	10	11	1	2	51	101
Upland Game Birds		1	1	0	0	2	2	0	0	3	3
ruffed grouse	<i>Bonasa umbellus</i>	1	1	0	0	2	2	0	0	3	3
Doves/Pigeons		1	2	0	0	0	0	0	0	1	2
mourning dove	<i>Zenaida macroura</i>	1	2	0	0	0	0	0	0	1	2
Large Corvids		4	5	4	6	4	5	12	40	24	56
American crow	<i>Corvus brachyrhynchos</i>	3	4	3	5	1	1	4	9	11	19
common raven	<i>Corvus corax</i>	1	1	1	1	3	4	8	31	13	37
Overall		40	101	26	32	25	34	16	45	107	212

*one individual was observed outside of the 800 m viewshed.

Appendix A2. Summary of individuals and group observations by small bird type and species for 5-minute fixed-point bird use surveys at the Rocky Forge Wind Project^a from December 18, 2014 to December 14, 2015.

Type / Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Passerines		97	143	102	153	25	53	18	81	242	430
American goldfinch	<i>Spinus tristis</i>	3	7	18	37	8	18	1	12	30	74
barn swallow	<i>Hirundo rustica</i>	0	0	3	7	0	0	0	0	3	7
black-and-white warbler	<i>Mniotilta varia</i>	4	4	0	0	0	0	0	0	4	4
black-capped chickadee	<i>Poecile atricapilla</i>	0	0	0	0	0	0	1	2	1	2
blue-headed vireo	<i>Vireo solitarius</i>	3	6	5	7	1	1	0	0	9	14
blue jay	<i>Cyanocitta cristata</i>	0	0	6	6	4	4	0	0	10	10
Carolina chickadee	<i>Poecile carolinensis</i>	0	0	1	1	2	3	1	1	4	5
Carolina wren	<i>Thryothorus ludovicianus</i>	0	0	0	0	0	0	2	2	2	2
cedar waxwing	<i>Bombycilla cedrorum</i>	2	4	4	12	2	17	0	0	8	33
chestnut-sided warbler	<i>Setophaga pensylvanica</i>	2	3	0	0	0	0	0	0	2	3
chipping sparrow	<i>Spizella passerina</i>	6	8	7	9	0	0	0	0	13	17
dark-eyed junco	<i>Junco hyemalis</i>	3	5	0	0	0	0	7	32	10	37
eastern bluebird	<i>Sialia sialis</i>	5	8	0	0	1	1	4	29	10	38
eastern towhee	<i>Pipilo erythrophthalmus</i>	7	16	12	18	2	2	0	0	21	36
eastern wood-pewee	<i>Contopus virens</i>	4	5	6	6	0	0	0	0	10	11
field sparrow	<i>Spizella pusilla</i>	5	9	4	5	1	2	0	0	10	16
indigo bunting	<i>Passerina cyanea</i>	12	17	12	20	0	0	0	0	24	37
ovenbird	<i>Seiurus aurocapilla</i>	9	11	0	0	0	0	0	0	9	11
pine warbler	<i>Setophaga pinus</i>	0	0	1	1	0	0	0	0	1	1
red-breasted nuthatch	<i>Sitta canadensis</i>	1	1	0	0	0	0	0	0	1	1
red-eyed vireo	<i>Vireo olivaceus</i>	6	8	4	4	0	0	0	0	10	12
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	1	2	0	0	0	0	0	0	1	2
ruby-crowned kinglet	<i>Regulus calendula</i>	1	1	0	0	0	0	0	0	1	1
scarlet tanager	<i>Piranga olivacea</i>	7	9	2	2	0	0	0	0	9	11
song sparrow	<i>Melospiza melodia</i>	2	4	3	3	1	1	0	0	6	8
tree swallow	<i>Tachycineta bicolor</i>	0	0	1	2	0	0	0	0	1	2
tufted titmouse	<i>Baeolophus bicolor</i>	6	7	4	4	1	1	0	0	11	12
white-breasted nuthatch	<i>Sitta carolinensis</i>	3	3	4	4	1	1	2	3	10	11
wood thrush	<i>Hylocichla mustelina</i>	1	1	1	1	0	0	0	0	2	2
worm-eating warbler	<i>Helmitheros vermivorum</i>	3	3	4	4	0	0	0	0	7	7
yellow-rumped warbler	<i>Setophaga coronata</i>	1	1	0	0	1	2	0	0	2	3

Appendix A2. Summary of individuals and group observations by small bird type and species for 5-minute fixed-point bird use surveys at the Rocky Forge Wind Project^a from December 18, 2014 to December 14, 2015.

Type / Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Swifts/Hummingbirds		1	1	4	5	1	12	0	0	6	18
chimney swift	<i>Chaetura pelagica</i>	1	1	1	2	1	12	0	0	3	15
ruby-throated hummingbird	<i>Archilochus colubris</i>	0	0	3	3	0	0	0	0	3	3
Woodpeckers		0	0	0	0	2	2	0	0	2	2
hairy woodpecker	<i>Picoides villosus</i>	0	0	0	0	1	1	0	0	1	1
red-bellied woodpecker	<i>Melanerpes carolinus</i>	0	0	0	0	1	1	0	0	1	1
Overall		98	144	106	158	28	67	18	81	250	450

^a Regardless of distance from observer.

Appendix B. Mean Use, Percent of Use, and Frequency of Occurrence for Large and Small Birds Observed during Fixed-Point Bird Use Surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015

Appendix B1. Mean large bird use (number of large birds/800 meter plot/20-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterfowl	0.57	0	0	0	15.8	0	0	0	3.6	0	0	0
greater white-fronted goose	0.57	0	0	0	15.8	0	0	0	3.6	0	0	0
Diurnal Raptors	0.29	0.25	1	0.07	7.9	18.8	47.1	4.7	21.4	25	37.5	7.1
<i>Accipiters</i>	0.04	0.08	0.19	0	1	6.2	8.8	0	3.6	8.3	18.8	0
Cooper's hawk	0	0.08	0.06	0	0	6.2	2.9	0	0	8.3	6.2	0
sharp-shinned hawk	0.04	0	0.12	0	1	0	5.9	0	3.6	0	12.5	0
<i>Buteos</i>	0.25	0.17	0.81	0.04	6.9	12.5	38.2	2.4	17.9	16.7	25	3.6
broad-winged hawk	0.04	0	0	0	1	0	0	0	3.6	0	0	0
red-shouldered hawk	0.07	0	0	0	2	0	0	0	7.1	0	0	0
red-tailed hawk	0.14	0.17	0.81	0.04	4	12.5	38.2	2.4	10.7	16.7	25	3.6
<i>Eagles</i>	0	0	0	0.04	0	0	0	2.4	0	0	0	3.6
golden eagle	0	0	0	0.04	0	0	0	2.4	0	0	0	3.6
Owls	0	0.04	0	0	0	3.1	0	0	0	4.2	0	0
barred owl	0	0.04	0	0	0	3.1	0	0	0	4.2	0	0
Vultures	2.46	0.79	0.69	0	68.3	59.4	32.4	0	64.3	50	56.2	0
turkey vulture	2.46	0.79	0.69	0	68.3	59.4	32.4	0	64.3	50	56.2	0
Upland Game Birds	0.04	0	0.12	0	1	0	5.9	0	3.6	0	12.5	0
ruffed grouse	0.04	0	0.12	0	1	0	5.9	0	3.6	0	12.5	0
Doves/Pigeons	0.07	0	0	0	2	0	0	0	3.6	0	0	0
mourning dove	0.07	0	0	0	2	0	0	0	3.6	0	0	0
Large Corvids	0.18	0.25	0.31	1.44	5	18.8	14.7	95.3	10.7	16.7	25	36.9
American crow	0.14	0.21	0.06	0.33	4	15.6	2.9	22	10.7	12.5	6.2	15.5
common raven	0.04	0.04	0.25	1.11	1	3.1	11.8	73.2	3.6	4.2	18.8	21.4
Overall	3.61	1.33	2.12	1.51	100	100	100	100				

Appendix B2. Mean small bird use (number of small birds/150 meter plot/5-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Rocky Forge Wind Project, December 18, 2014 to December 14, 2015.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Passerines	5.07	6.04	3.31	3.13	99.3	96.7	79.1	100	67.9	100	56.2	42.9
American goldfinch	0.25	1.21	1.12	0.57	4.9	19.3	26.9	18.3	10.7	62.5	43.8	4.8
barn swallow	0	0.29	0	0	0	4.7	0	0	0	12.5	0	0
black-and-white warbler	0.14	0	0	0	2.8	0	0	0	14.3	0	0	0
black-capped chickadee	0	0	0	0.1	0	0	0	3	0	0	0	4.8
blue-headed vireo	0.21	0.29	0.06	0	4.2	4.7	1.5	0	10.7	20.8	6.2	0
blue jay	0	0.25	0.25	0	0	4	6	0	0	25	25	0
Carolina chickadee	0	0.04	0.19	0.04	0	0.7	4.5	1.1	0	4.2	12.5	3.6
Carolina wren	0	0	0	0.07	0	0	0	2.3	0	0	0	7.1
cedar waxwing	0.14	0.5	1.06	0	2.8	8	25.4	0	7.1	16.7	12.5	0
chestnut-sided warbler	0.11	0	0	0	2.1	0	0	0	7.1	0	0	0
chipping sparrow	0.29	0.38	0	0	5.6	6	0	0	21.4	29.2	0	0
dark-eyed junco	0.18	0	0	1.15	3.5	0	0	36.9	10.7	0	0	22.6
eastern bluebird	0.29	0	0.06	1.08	5.6	0	1.5	34.6	17.9	0	6.2	15.5
eastern towhee	0.57	0.75	0.12	0	11.2	12	3	0	25	50	12.5	0
eastern wood-pewee	0.18	0.25	0	0	3.5	4	0	0	14.3	25	0	0
field sparrow	0.32	0.21	0.12	0	6.3	3.3	3	0	17.9	16.7	6.2	0
indigo bunting	0.61	0.83	0	0	11.9	13.3	0	0	32.1	45.8	0	0
ovenbird	0.36	0	0	0	7	0	0	0	28.6	0	0	0
pine warbler	0	0.04	0	0	0	0.7	0	0	0	4.2	0	0
red-breasted nuthatch	0.04	0	0	0	0.7	0	0	0	3.6	0	0	0
red-eyed vireo	0.29	0.17	0	0	5.6	2.7	0	0	21.4	16.7	0	0
rose-breasted grosbeak	0.07	0	0	0	1.4	0	0	0	3.6	0	0	0
ruby-crowned kinglet	0.04	0	0	0	0.7	0	0	0	3.6	0	0	0
scarlet tanager	0.32	0.08	0	0	6.3	1.3	0	0	25	4.2	0	0
song sparrow	0.14	0.12	0.06	0	2.8	2	1.5	0	7.1	12.5	6.2	0
tree swallow	0	0.08	0	0	0	1.3	0	0	0	4.2	0	0
tufted titmouse	0.25	0.17	0.06	0	4.9	2.7	1.5	0	21.4	16.7	6.2	0
white-breasted nuthatch	0.11	0.17	0.06	0.12	2.1	2.7	1.5	3.8	10.7	16.7	6.2	8.3
wood thrush	0.04	0.04	0	0	0.7	0.7	0	0	3.6	4.2	0	0
worm-eating warbler	0.11	0.17	0	0	2.1	2.7	0	0	10.7	16.7	0	0
yellow-rumped warbler	0.04	0	0.12	0	0.7	0	3	0	3.6	0	6.2	0

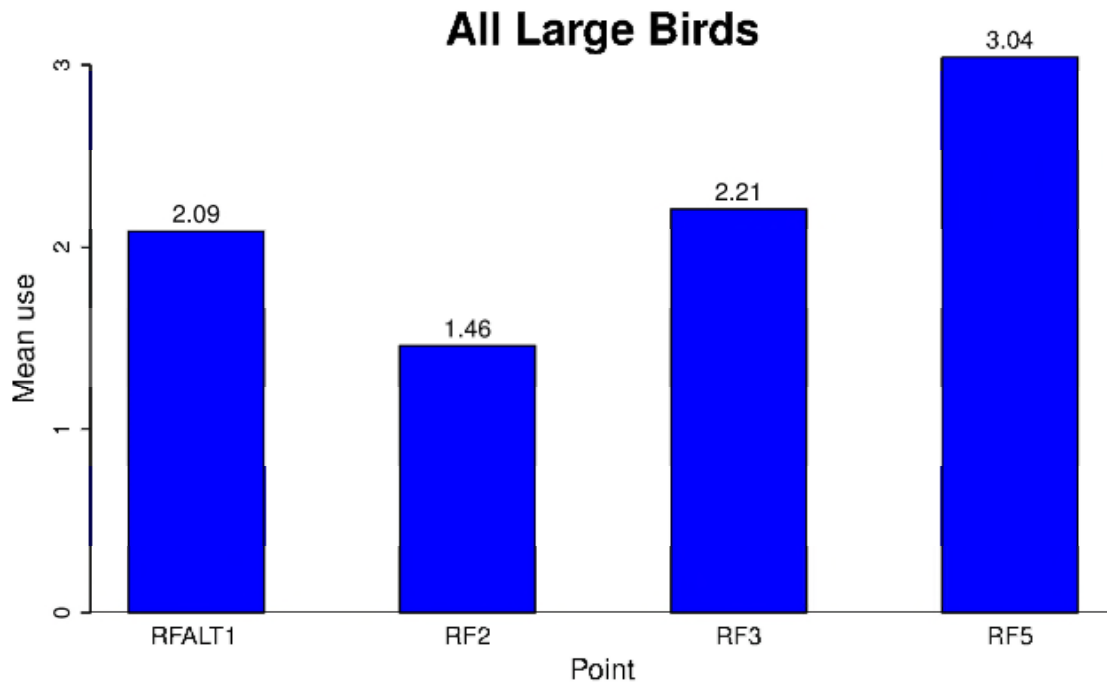
Appendix B2. Mean small bird use (number of small birds/150 meter plot/5-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Rocky Forge Wind Project, December 18, 2014 to December 14, 2015.

Type / Species	Mean Use				% of Use				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Swifts/Hummingbirds	0.04	0.21	0.75	0	0.7	3.3	17.9	0	3.6	16.7	6.2	0
chimney swift	0.04	0.08	0.75	0	0.7	1.3	17.9	0	3.6	4.2	6.2	0
ruby-throated hummingbird	0	0.12	0	0	0	2	0	0	0	12.5	0	0
Woodpeckers	0	0	0.12	0	0	0	3	0	0	0	12.5	0
hairy woodpecker	0	0	0.06	0	0	0	1.5	0	0	0	6.2	0
red-bellied woodpecker	0	0	0.06	0	0	0	1.5	0	0	0	6.2	0
Overall	5.11	6.25	4.19	3.13	100	100	100	100				

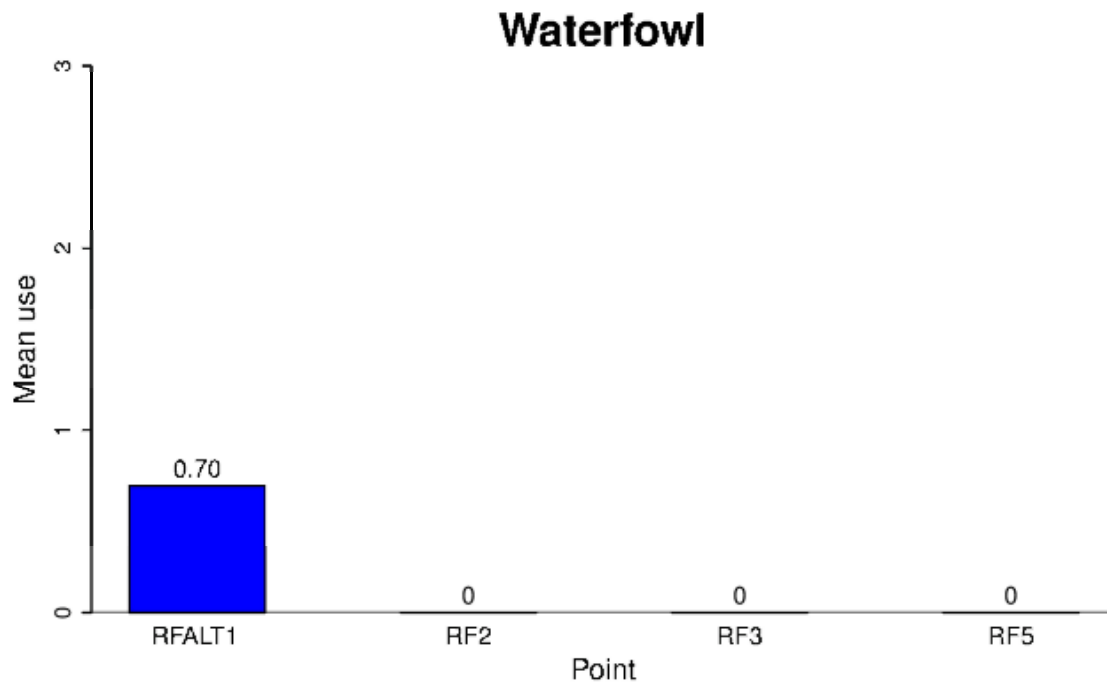
Appendix C. Mean Use by Point for All Birds, Major Bird Types, and Diurnal Raptor Subtypes during Fixed-Point Bird Use Surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015

Appendix C1. Mean use for large birds (number of birds/800 m plot/20-minute survey), and small birds (number of birds/150 m plot/5-minute survey) by point for all major bird types and diurnal raptors observed at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.

Bird Type	Survey Point			
	RFALT1	RF2	RF3	RF5
Large Birds/20-minute survey				
Waterfowl	0.7	0	0	0
Diurnal Raptors	0.35	0.25	0.42	0.33
<i>Accipiters</i>	0.09	0.04	0.08	0.04
<i>Buteos</i>	0.26	0.21	0.33	0.25
<i>Eagles</i>	0	0	0	0.04
Owls	0	0.04	0	0
Vultures	0.78	0.79	1.29	1.29
Upland Game Birds	0	0	0	0.12
Doves/Pigeons	0	0	0.08	0
Large Corvids	0.26	0.38	0.42	1.29
All Large Birds	2.09	1.46	2.21	3.04
Small Birds/5-minute survey				
Passerines	2.91	4.62	4.46	5.67
Swifts/Hummingbirds	0.04	0.04	0.62	0.04
Woodpeckers	0	0.04	0	0.04
All Small Birds	2.96	4.71	5.08	5.75

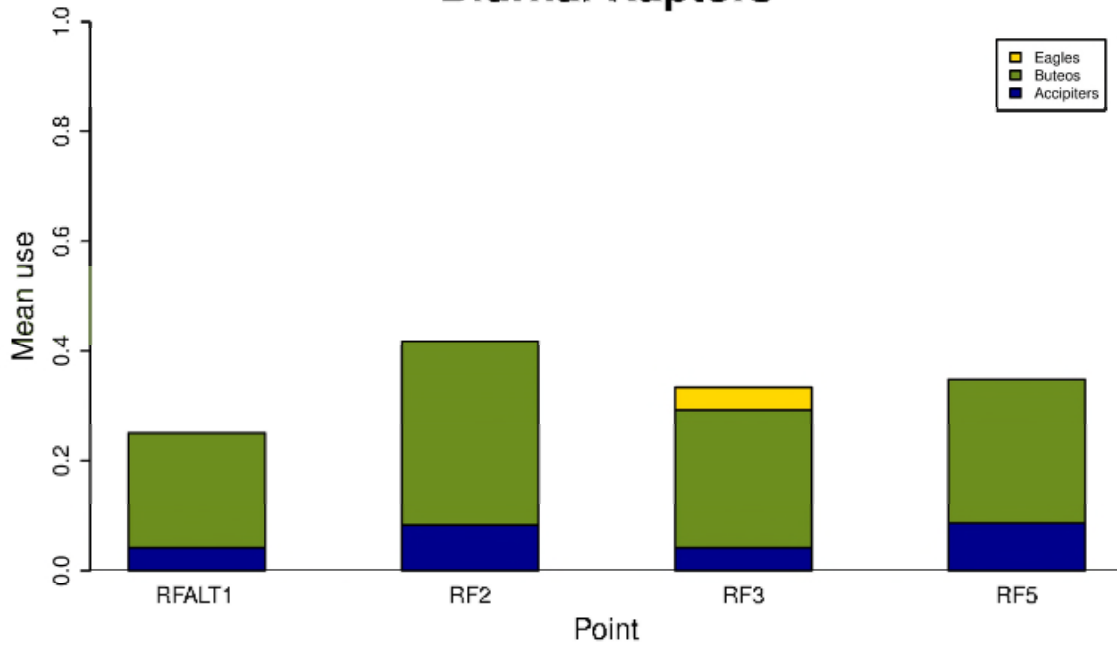


Appendix C2a. Mean use by point for all large birds at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.



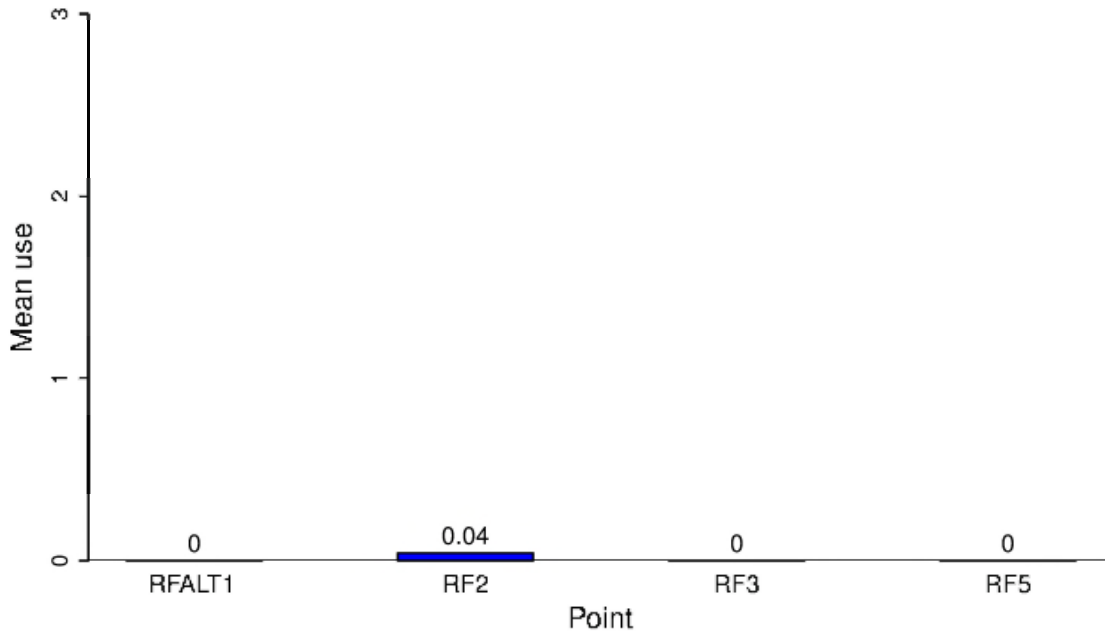
Appendix C2b. Mean use by point for waterfowl at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Diurnal Raptors



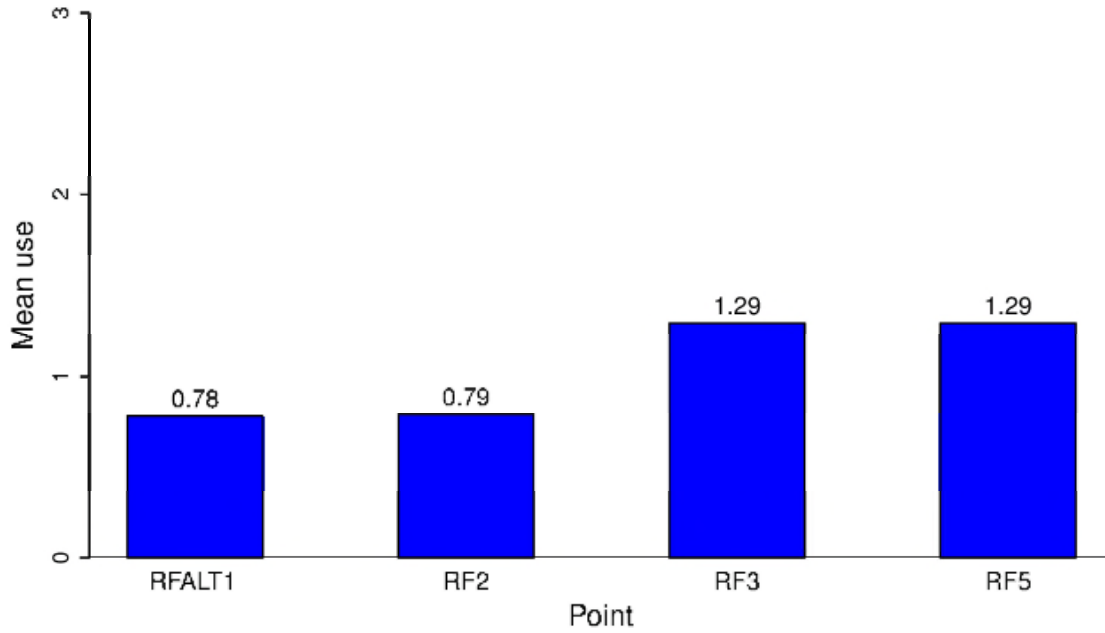
Appendix C2c. Mean use by point for diurnal raptors at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Owls



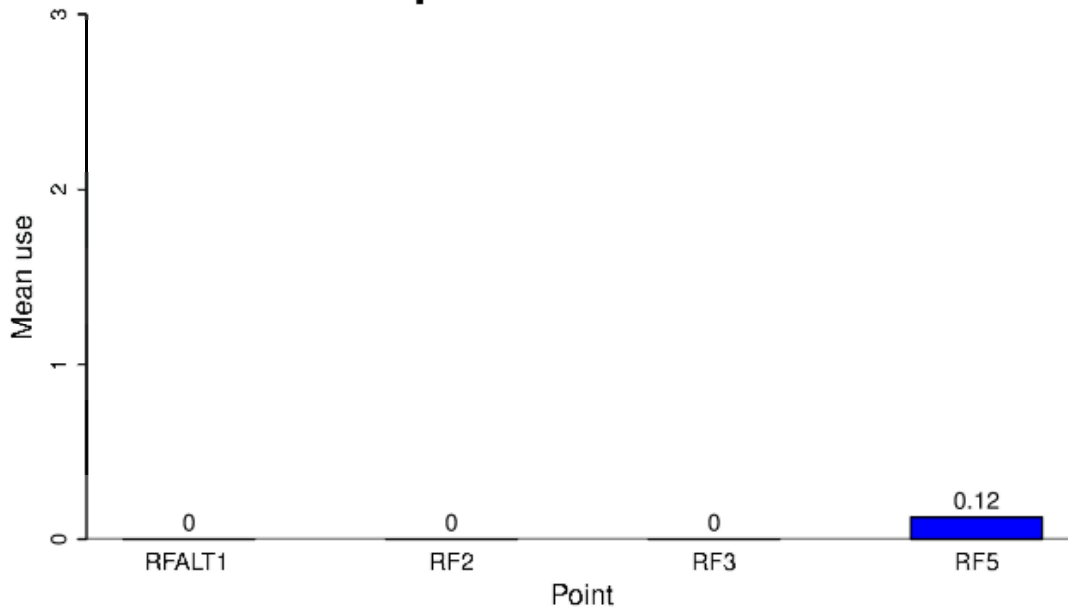
Appendix C2d. Mean use by point for owls at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Vultures



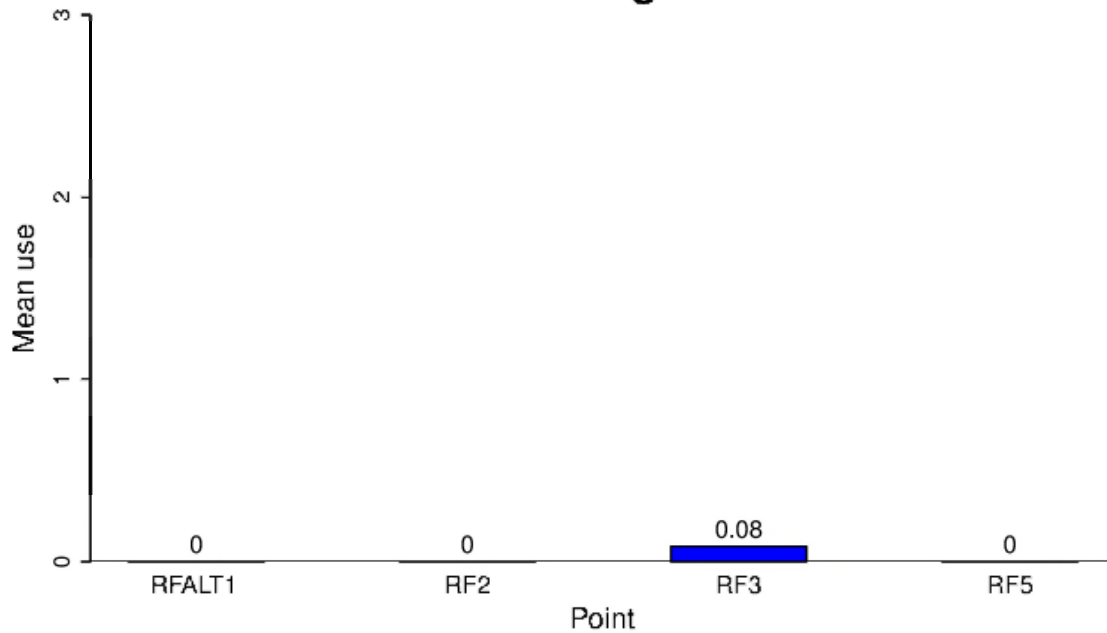
Appendix C2e. Mean use by point for vultures at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Upland Game Birds



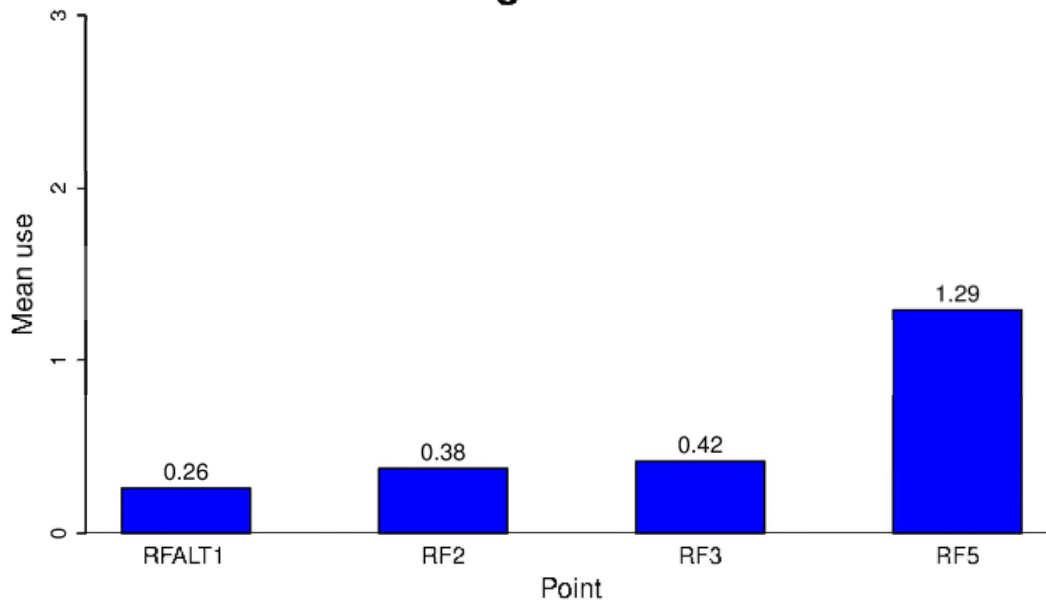
Appendix C2f. Mean use by point for upland game birds at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Doves/Pigeons

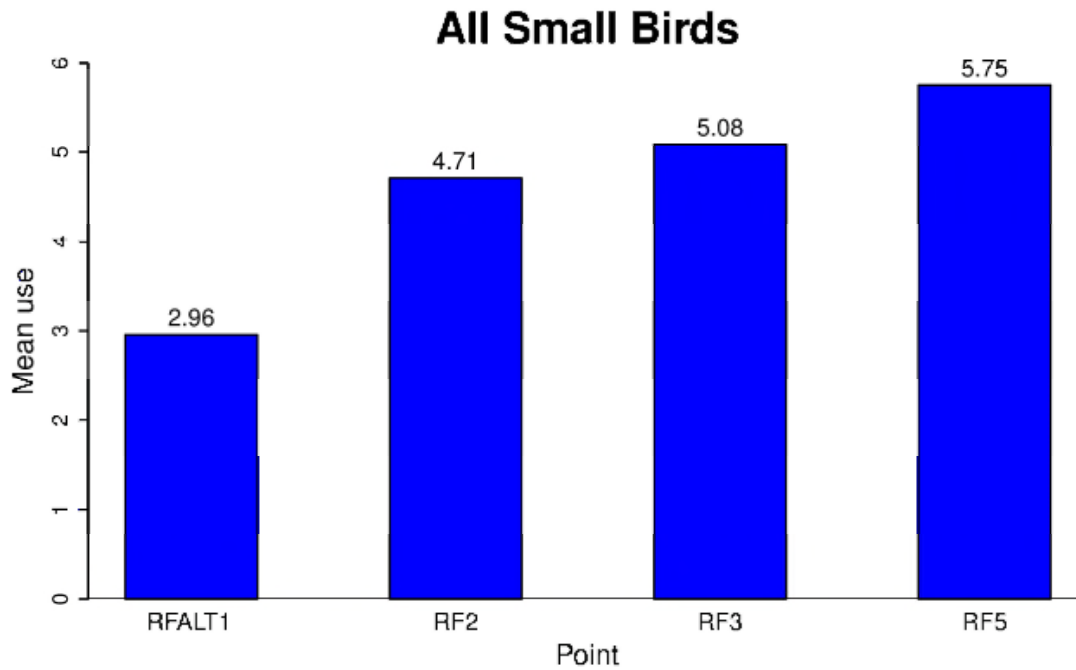


Appendix C2g. Mean use by point for dove and pigeon at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

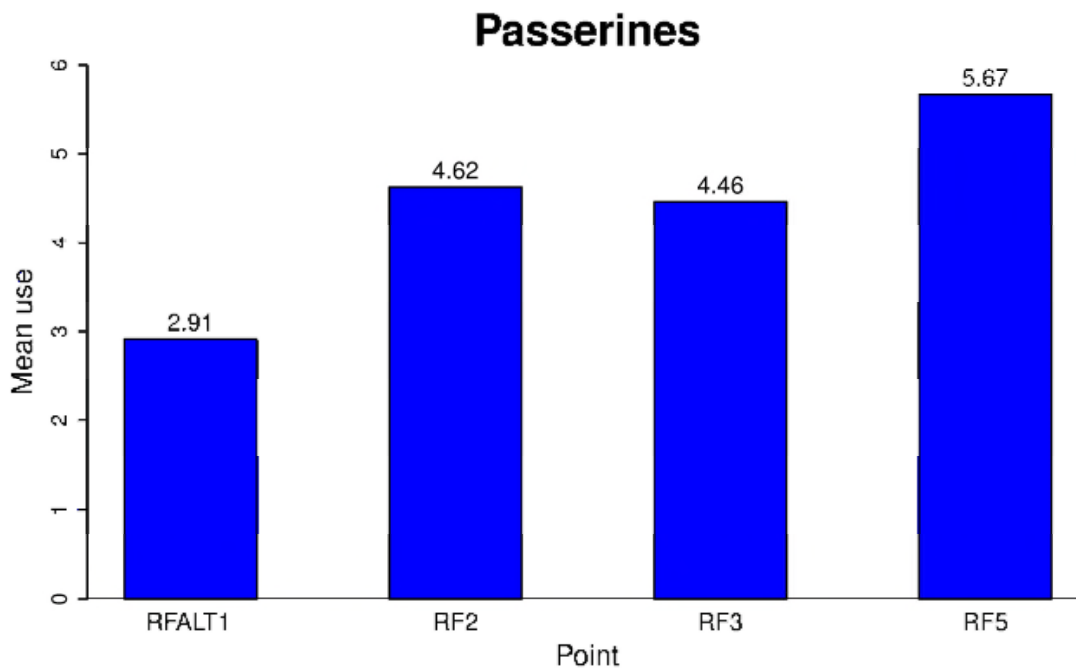
Large Corvids



Appendix C2h. Mean use by point for large corvids at the Rocky Forge Wind Project during the first 20 minutes of the two-hour fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

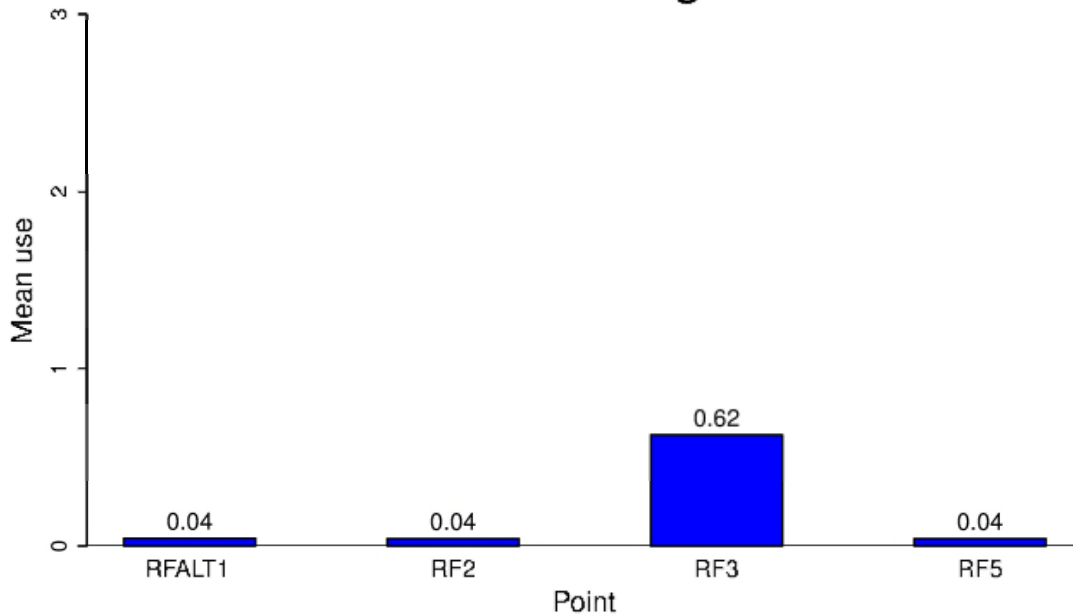


Appendix C3a. Mean use by point for small birds at the Rocky Forge Wind Project during 5-minute fixed-point bird use surveys from December 18, 2014 to December 14, 2015.



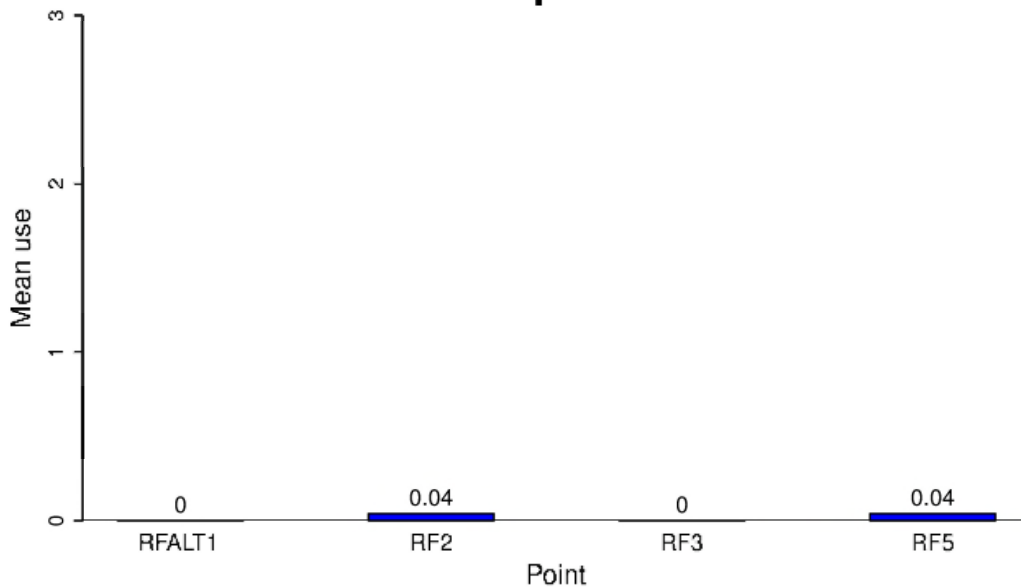
Appendix C3b. Mean use by point for passerines at the Rocky Forge Wind Project during 5-minute fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Swifts/Hummingbirds



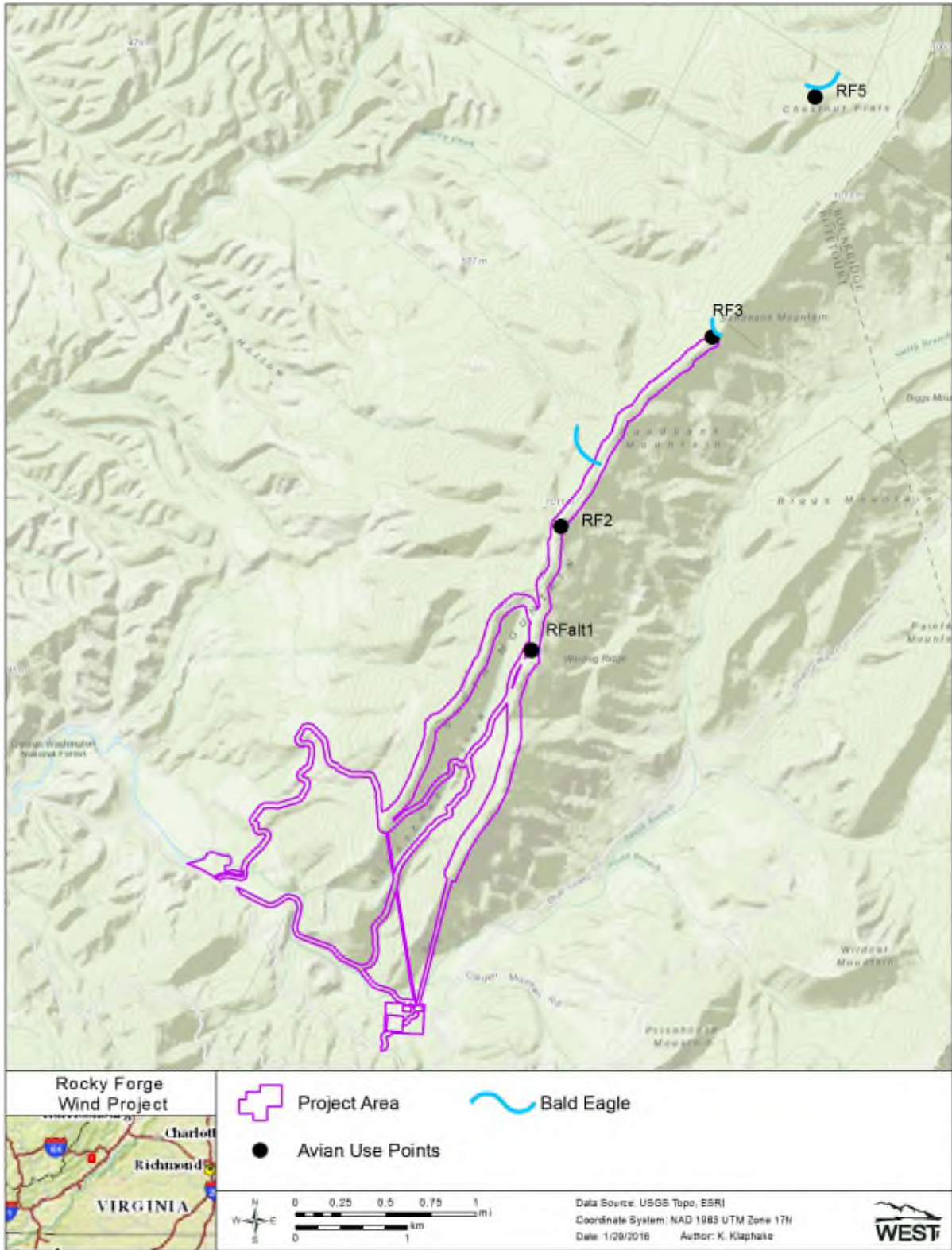
Appendix C3c. Mean use by point for swifts and hummingbirds at the Rocky Forge Wind Project during 5-minute fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

Woodpeckers

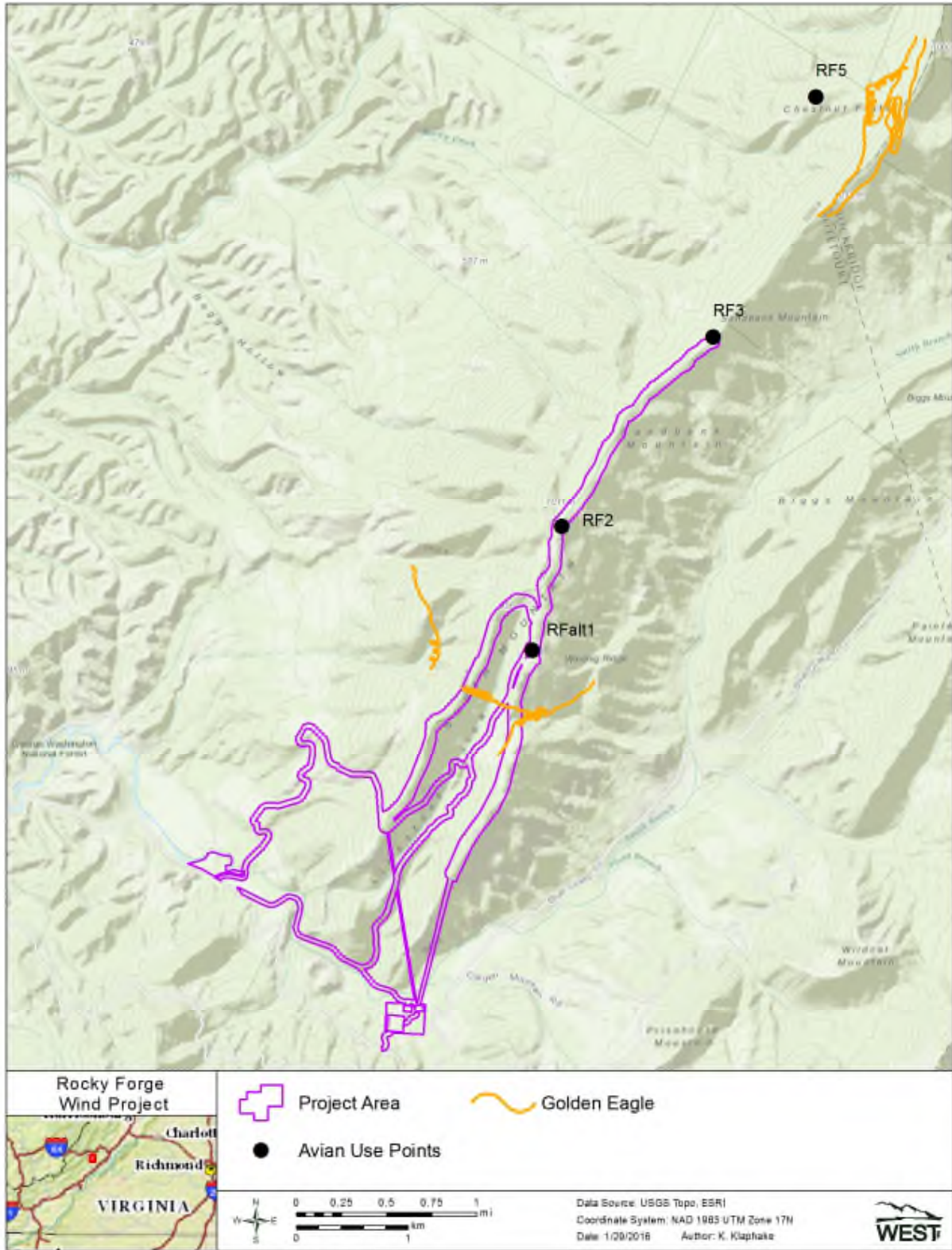


Appendix C3d. Mean use by point for woodpeckers at the Rocky Forge Wind Project during 5-minute fixed-point bird use surveys from December 18, 2014 to December 14, 2015.

**Appendix D. Eagle Flight Paths Observed during Fixed-Point 2-Hour Bird Use Surveys at
the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015**



Appendix D. Flight paths of bald eagles observed during 2-hour bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.



Appendix D. Flight paths of golden eagles observed during 2-hour bird use surveys at the Rocky Forge Wind Project from December 18, 2014 – December 14, 2015.