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Bird Conservation Value of Golf Courses

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BIRD CONSERVATION VALUE OF GOLF COURSES

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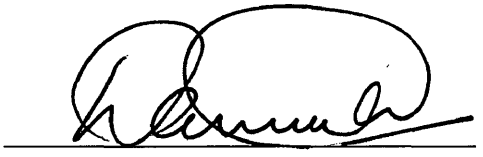
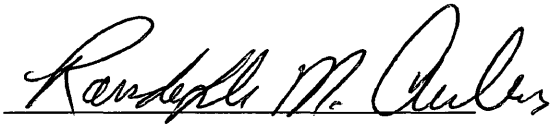


Daniel A. Cristol, Chair



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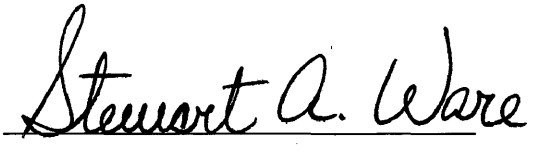

Stewart A. Ware

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ABSTRACT

Many North American bird species are declining due to loss of native habitat. As golf course construction proceeds at an astonishing rate (nearly one opening per day in the U.S.), some have suggested that golf courses provide a replacement for lost native habitat. To examine the relative value golf courses provide to bird conservation in Virginia, I censused the bird communities of 87 Virginia golf courses and 27 other habitats representative of the likely alternatives to golf course development. While golf courses generally supported high numbers of individual birds and species, they supported few birds of conservation concern, defined liberally as birds with Partners in Flight conservation priority scores ≥16. Forested reference sites supported significantly greater densities of birds of conservation concern than golf courses, and golf courses did not differ statistically from agricultural or developed reference sites. Even considering groups of birds that might be expected to thrive on golf courses (forest-dependent Neotropical migrants, open habitat-dependent birds, and wetland-dependent birds), golf courses were of no greater conservation value than forested or developed reference sites. There was a great deal of variation among golf courses in the richness and density of species of conservation concern, so I used Geographic Information Systems to compare land cover variables between courses of highest and lowest conservation value. Percent of forest cover (within the course, within a 250-m buffer, and within a 1.5-km radius of the center of the course) was greater in high-value courses, and percent of developed land (within a 250-m buffer only) was greater in low-value courses. Percent of forest cover within a 1.5-km radius of the center of the course was the best predictor of a given course's conservation value. Golf courses in general do not make a significant contribution to bird conservation in Virginia, as the habitats they replace are likely to support as many or more vulnerable bird species. Therefore, in terms of bird conservation, golf courses should not be considered a surrogate for native habitat or an improvement over other forms of development unless specific considerations are made in their design.

BIRD CONSERVATION VALUE OF GOLF COURSES

INTRODUCTION

Loss of native habitat is a leading cause of decline for many North American bird species (Askins 2000). Habitat loss has been particularly hard on forest birds that migrate to the Neotropics, birds that require early successional habitats, and birds that live in wetlands (Terborgh 1989, Hunter et al. 2001). When land is developed, birds are forced to relocate to other patches of native habitat or acclimate to the new conditions that are created. As undisturbed habitat becomes scarce, it is increasingly important to consider the ecological value of new, created habitats. In some cases, these created habitats may be able to replace the lost functions of native habitat. One created habitat that has the potential to mimic aspects of native forest, early successional habitat, and wetlands is golf courses.

The sport of golf has enjoyed a substantial increase in participation over the last 50 years, expanding from fewer than 5 million to more than 26 million golfers in the United States alone (O'Hara and Beckwith 2002). The increasing popularity of golf led to a boom in golf course construction, with estimates in the late 1980's that courses were opening at the astonishing rate of about one per day in the United States (Balogh and Walker 1992). Between 1987 and 1997, well over 200,000 hectares (ha) were converted to golf courses (Markels 1998).

There are now over 17,000 courses in the U.S. (Golfcourse.com), covering nearly 1,000,000 ha (based on typical golf course area of 56 ha (Brennan 1992)).

Further fueling golf course construction is a recent trend in residential golf course development. The National Golf Foundation reported that 50% of the golf courses under construction in 1989 were associated with housing developments (Garbarine 1996). This trend is not surprising, given the dramatic increase in residential property value brought by proximity to a golf course (Haydu and Hodges 2002) and the lack of zoning restrictions on golf course development. Many municipalities make no distinction between golf courses and other forms of open space, allowing golf course construction in protected rural areas (Whoriskey 2001). Developers are further encouraged to build golf courses by the prospects of lucrative tax breaks awarded for conservation easements on fairways and greens (Stevens and Ottaway 2003). In this scheme, golf course land is designated as a conservation easement, meaning that it is deeded to a land trust or federal agency that will ensure the restriction of development on that land. In return for the loss of market value of the land, developers can claim substantial tax deductions. This practice is b ased on the assumption that golf courses provide ecologically valuable habitat.

Despite the recent surge in golf course construction, there is little agreement as to whether golf courses are beneficial to wildlife. A poll of the general public in London, England revealed that opinion regarding the ecological value of golf courses is largely determined by whether or not the respondent is a golfer (Gange and Lindsay 2002). Golfers defended the ecological role of golf

courses, while non-golfers responded that golf courses destroy natural habitats. This disagreement is not settled in the scientific literature, as there is relatively little published research on the suitability of golf courses as wildlife habitat.

Several authors have suggested that properly designed courses can provide valuable habitat (Green and Marshall 1987, Brennan 1992, Terman 1997, Gange et al. 2003), citing that as little as 21% of the golf course may be required for the game itself (i.e., fairways, tees, and greens) (Brennan 1992). The remaining land can be left in a semi-natural state, performing the ecological functions of native habitat. This assertion, however, is only partially supported by scientific research. The few studies of birds on golf courses show that golf courses certainly provide habitat for some birds, but don't necessarily support the same birds as native habitat (Moul and Elliott 1994, Blair 1996, Terman 1997).

Terman (1997) compared a "naturalistic" golf course (one designed to include features of the surrounding natural landscape) with a nearby nature reserve and found similar species richness values for both sites, but lower diversity (Simpson and Shannon indices) on the golf course. This was due primarily to high numbers of a few widely distributed species (American robin, European starling, American tree sparrow (scientific names in Appendix A)), which lowered the evenness of the golf course bird community.

Widely distributed species also had an effect in a study by Blair (1996), which found that a golf course supported the greatest bird diversity (Shannon index) when compared with several other habitat types along a gradient of urbanization. Least urban along this gradient was a biological preserve, next a

public recreation area, golf course, residential neighborhood, office park, and finally a business district. The moderately developed golf course had the greatest heterogeneity of resources, and this, Blair hypothesized, allowed it to support the greatest diversity of birds. The high Shannon diversity value on the golf course was supported by the addition of several widely distributed species, which Blair termed "suburban adaptable" species. Several of these species (e.g., American robin, northern mockingbird, European starling) were not present in the biological preserve, presumably due to their affinity for the high quantity and variety of resources associated with moderate levels of development. Furthermore, over 40% of the species found in the biological preserve were not found on the golf course. Blair concluded that golf courses, although supporting high densities of birds and high diversities, may not support many of the birds associated with undeveloped, native habitat.

A recent study by Gange and Lindsay (2002) also found higher bird diversities on two golf courses when compared to adjacent agricultural habitats (former cropland, horse pasture, and cocoa plantation). One golf course had similar diversity and species composition to adjacent natural grassland, suggesting that the course might support species dependent upon native habitat. The identities of each species are not reported, however, so it is not possible to rule out the possibility that golf course numbers were driven by more widespread, adaptable species as in the previously described studies.

To better understand the potential impact of replacing existing habitat with golf courses, I set two objectives for this study: 1) to determine a conservation

value of golf courses by critically examining which birds use them and by comparing bird use of golf courses to that of other available habitats; and 2) to determine what land cover characteristics of a golf course and its surroundings are most important in establishing its conservation value.

Objective 1: Conservation value of golf courses

To accomplish my first objective, I organized censuses of breeding birds on 87 golf courses and 27 non-golf course reference sites. The reference sites represent the most common habitat types in Virginia, and therefore are the habitats most likely to be present at a site before a golf course is built. In this manner, bird use of golf courses can be evaluated in terms of the habitat that would be present if golf courses were not.

Golf courses have been shown to support common species (Moul and Elliott 1994, Blair 1996, Terman 1997), but a better indicator of conservation value is the extent to which they support species that are declining or threatened in the region. Therefore, I performed analyses restricted to these species of conservation concern for golf courses and reference sites.

Depending on their design, golf courses may provide habitat for particular guilds of vulnerable species: 1) forest-dependent Neotropical migrants could be supported if courses contain large, unfragmented tracts of woodland; 2) species requiring open habitat could benefit from the use of native grasses and maintenance of shrub-scrub in rough areas; and 3) wetland-dependent species could use water hazards designed to include native wetland vegetation (Terman

1997, Gillihan 2000). I compare the ability of golf courses and reference sites to support these guilds.

Another way to assess ecological value is through ecological rank analysis (Croonquist and Brooks 1991). In this analysis, the ecological value of a site is evaluated by the degree to which it is able to support particular types of species. I compare the ecological rank scores of species on golf courses to those of species on reference habitats for four ecological categories: migratory behavior, habitat specificity, wetland-dependence, and conservation priority.

Objective 2: Effect of land cover variables on conservation value

My second objective was to determine the land cover characteristics of golf courses and their surroundings that predict bird use. For each course, I examined the land cover of three areas:

a) *The golf course proper.* Course designers and managers have a great deal of control over the landscape within the course. It would be beneficial to know how golf courses can be designed and maintained to maximize their value as bird habitat.

b) *The buffer zone around the golf course.* Bird use of a golf course may be affected by the immediate surroundings of the course. This information could be taken into account in the designing of courses as well as in the planning for development of larger areas.

c) *The larger area surrounding the golf course.* Perhaps the larger landscape context is what determines bird use of a golf course. Understanding

the role of large-scale landscape effects could be useful in deciding where to build golf courses and in determining which golf courses have the potential to contribute to regional bird conservation.

METHODS

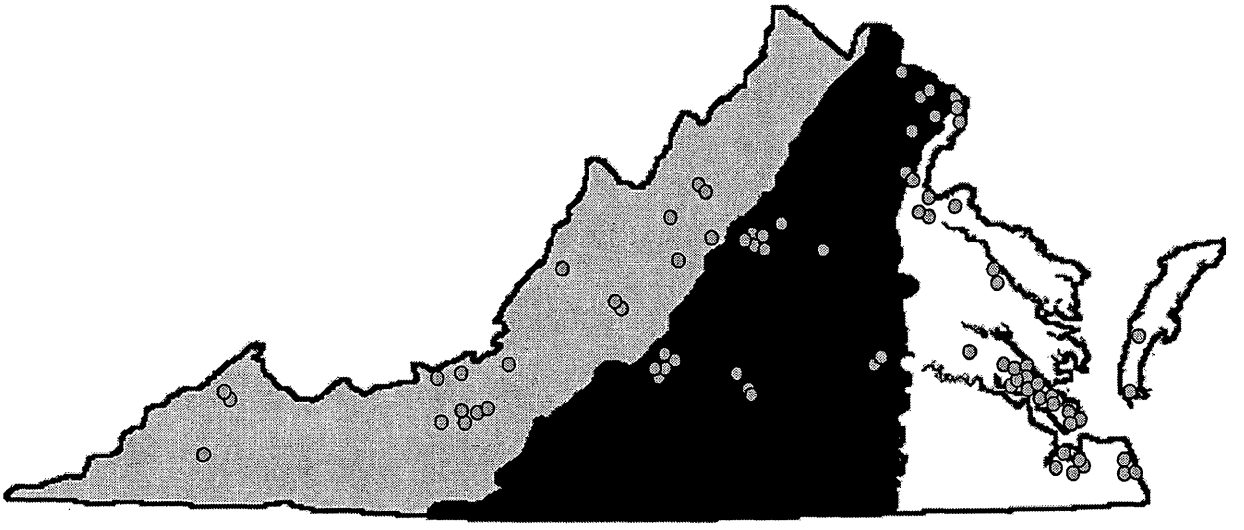
Objective 1: Relative conservation value of golf courses

Golf Course Bird Surveys

Surveys were completed on 87 of Virginia's roughly 360 (Golfcourse.com) golf courses (Figure 1; golf course locations in Appendix B). In an effort to represent the entire state, I selected golf courses within the Coastal Plain, Piedmont, and mountains (Valley and Ridge, Blue Ridge, Appalachian Plateau) physiographic provinces (Virginia Earth Science Resource Page). Observers recorded potential breeding units, rather than individual birds. Each tally of a breeding unit represented one male, one female, one breeding pair, or one family. In this manner, females were not counted in addition to a potential mate nearby, though females were counted if there were no males detected in the vicinity. This was done to avoid inflation of the population estimate through recording multiple members of the same family.

Each golf course was surveyed by two observers, one with at least 10 years of experience identifying birds. At the tee of each hole of the course, the observers conducted a three-minute (min) point count with a radius of 50 meters (m) (Verner 1985). In cases where there were multiple tees for each hole (i.e., Men's, Ladies', etc.), point counts were made from the same tee at each hole (i.e., always Men's tee). Between point counts, observers recorded all potential

FIGURE 1



mountains
n = 23

Piedmont
n = 25

Coastal Plain
n = 39

Locations of the 87 golf courses surveyed in the three physiographic provinces of Virginia.

breeding bird units detected within the boundaries of the golf course. During these fairway counts, observers walked along the fairways, not straying into unmaintained areas. Some golf courses required the use of golf carts, in which case observers drove along cart paths between point counts and stopped periodically to look and listen for birds.

Areas maintained for play (i.e., fairways and greens) as well as unmaintained areas owned and controlled by the golf course management were considered part of the golf course and, therefore, within the survey area. Birds detected on land obviously not owned by the golf course (e.g., private homes adjacent to fairways) were not recorded. Only birds using the golf course in some manner, such as perching, foraging, or breeding, were recorded. Direct evidence of breeding was noted specifically. Birds flying over the course, and presumably not using it in any way, were not recorded.

Surveys were conducted in the first two weeks of June, 2002, so all birds detected were potentially breeders, the migrants having passed through already. Surveys commenced at first light (approximately 0530) and were completed by 1000. This was done to maximize the possibility of detection, as bird activity peaks in the morning (Bibby et al. 1992). To meet this requirement, some larger golf courses were surveyed on two separate mornings. Depending upon the number of holes on the golf course, each survey consisted of 9 or 18 point counts at tees and the same number of associated fairway counts.

Surveys of Non-Golf Course Reference Habitats

To compare golf courses to other potential habitat types, surveys were conducted on 27 non-golf course reference sites. Methodology for these surveys was the same as that employed for the golf course surveys, with the following exception: observers walked a winding path through the reference habitats and stopped to conduct point counts approximately every 400 meters (length of a typical hole of golf). In this manner, each reference habitat survey consisted of 9 or 18 point counts with associated "fairway" counts in between. For each of the three physiographic provinces of Virginia (Coastal Plain, Piedmont, and mountains), I conducted surveys of three representative habitats within three categories: forest, agriculture, and developed. In the forest category, the reference habitats were early successional, fragmented mature, and intact mature. In the agriculture category, the habitats were row crops, pasture, and annually mowed grassland (i.e., hayfield). In the developed category, the reference habitats were low density suburban (housing lots ~5 ha), high density suburban (housing lots <0.5 ha), and urban downtown areas (all reference site locations in Appendix C).

Avian Community Analyses

To quantify the communities of potentially breeding birds on golf courses and reference sites, I calculated species richness, density, and diversity. I excluded from all analyses one spotted sandpiper, which is not a confirmed breeder in the area where it was reported (Trollinger and Reay 2001), and one

ring-billed gull, which does not breed within the study area. Species richness for each area surveyed was determined by counting all species observed in point counts and "fairway" counts. I calculated density in birds per ha by dividing the total number of birds reported in point counts by 0.785, the number of ha covered by each point count.

I used the Shannon-Weiner index to calculate diversity for each area surveyed. The diversity value was defined by this formula:

$$H = -\sum p \ln p,$$

where p = # individuals of a given species / total # individuals. H is species heterogeneity, or diversity, and p is the proportion each species represents of the total number of individuals. Only point count data were used in this calculation.

For all comparisons between golf course and reference habitats, I used non-parametric Kruskal-Wallis tests with *post hoc* comparisons (Siegel and Castellan 1988).

Species of conservation concern

To determine the extent to which golf courses and reference habitats support species that are not common and widely distributed, I calculated richness and density of species of conservation concern. A species was classified as of conservation concern if the Partners in Flight (2002) total breeding priority score assigned to it averaged $\geq$16 across the three physiographic provinces in which most of the study sites occurred (mid-Atlantic Coastal Plain, mid-Atlantic Piedmont, mid-Atlantic Ridge and Valley). The total breeding priority score is the

sum of scores assigned for relative abundance, breeding distribution, non-breeding distribution, breeding area importance, threats to breeding, threats to non-breeding, and breeding population trend, and it is based on Breeding Bird Survey data, published range maps, and expert opinion (Carter et al. 2000). I selected the $\geq$16 cut-off because it eliminated all non-native species and minimized the number of native species that were classified as being of conservation concern despite exhibiting moderate or significant population increases on the Breeding Bird Surveys in two or more of the physiographic provinces within the study area. Only four species with increasing populations were classified as being of concern (wood duck, wild turkey, red-headed woodpecker, fish crow) while only three species with decreasing populations were not classified as being of concern (yellow warbler, red-winged blackbird, brown-headed cowbird).

Do golf courses benefit particular ecological guilds?

To examine whether species of conservation concern in particular ecological guilds are more common on golf courses than in reference habitats, I compared densities of forest-dependent Neotropical migrants, open habitat-dependent birds, and wetland-dependent birds of conservation concern. I classified species as being forest-dependent Neotropical migrants if they require woodland with closed canopy and migrate as far as the Caribbean or Central America (Ehrlich et al. 1988). I classified species as open habitat-dependent if they were described as nesting outside of the forest canopy in two of three

standard references (Harrison 1978, Farrand 1983, Ehrlich et al. 1988). I classified species as wetland-dependent if they rely primarily on wetland for foraging (Farrand 1983).

Do golf courses and reference habitats differ in the types of species they support?

To compare the degree to which golf courses and reference habitats support particular types of species, I used ecological rank analysis (Croonquist and Brooks 1991). In this analysis, each bird species is assigned a score based on its life history traits or status within a given category. For example, in the category *wetland-dependence*, an obligate wetland species receives a high score, while a species that does not use wetlands receives a low score. Scores for all species detected at a site are totaled, giving a single score for that site. The ecological value of a site is thereby evaluated by the degree to which it is able to support particular types of species. Ecological ranks were assigned to all species for the following categories: migratory behavior, habitat specificity, wetland-dependence, and conservation priority (Appendix D). For migratory behavior, species were scored as follows: 0 = sedentary; 2 = some of the population migrates; 4 = short-distance migrant; 5 = Neotropical migrant (Farrand 1983). For habitat specificity, scoring was based on how many habitats types and subtypes a species exploits. Here, habitat types considered were forest, field, shrub, marine, freshwater, urban, and agricultural. Subtypes were more specific divisions within habitat types, such as conifer or deciduous forest. Species were scored as follows: 1 = species is found in three or more habitat

types or is found in any one habitat in addition to urban; 3 = species exploits three or more subtypes within one habitat, is found in two habitat types, or inhabits the edge between two habitat types; 5 = species is restricted to one or two subtypes within one habitat (Farrand 1983). For wetland-dependence, 0 = upland species or occasional wetland use; 1 = facultative wetland species, but wetlands not essential; 3 = facultative wetland species usually found in or near wetland; 5 = obligate wetland species (Farrand 1983, Croonquist and Brooks 1991). For conservation priority scores, I used the total breeding priority scores assigned by Partners in Flight (2002). As these scores vary by physiographic province, I scored species separately for each study site, depending on its location.

Objective 2: Effect of land cover variables on conservation value

To determine proportions of various land cover types associated with golf courses, I analyzed digital orthophoto quarter quad (DOQQ) images of each golf course using Geographic Information Systems software (ArcView 3.2, Environmental Systems Research Institute, Inc. Redlands, CA). The area within each golf course was defined by an eight-sided polygon, digitized from DOQQ images. A 250-m buffer was created around the golf course polygon to define the buffer zone, and a 1500-m buffer was created around the center point of the golf course polygon to define the large surrounding area. These three polygons (golf course, buffer zone, and large surrounding area) were used as templates to

define land cover analysis areas in the National Land Cover Data 1992 data set (National Land Cover Characterization Project).

I determined the percent cover of each of 15 land cover types, which, for clarity, can be grouped into six categories: open water, herbaceous wetland, forest (subtypes: woody wetland, deciduous forest, evergreen forest, mixed forest, transitional), row crop, grassland (subtypes: pasture/hay, urban/recreational grass), and developed (subtypes: low intensity residential, high intensity residential, commercial/industrial/transportation, bare rock/sand/clay, quarries/strip mines/gravel pits). As the land cover data were derived from satellite imagery shot in 1992, golf courses constructed or extensively redesigned later than 1992 were removed from all analyses. After these removals, 57 golf courses were included in the land cover analyses.

Exploratory analyses of land cover

I performed several exploratory analyses with the goal of determining how variations in land cover affected avian communities of the golf courses surveyed.

What land cover variables are important in determining bird use of golf courses?

To determine if any land cover variables were correlated with avian community variables, I performed linear regressions (JMP v. 3.2.1, SAS Institute Inc., Cary, NC) of proportions of all land cover categories within golf courses, buffer zones, and large surrounding areas against 1) the richness, density, and diversity of all species observed on golf courses; 2) the ecological rank scores of

each golf course based on the migratory behavior, habitat specificity, wetland-dependence, and conservation priority of species found on the course; and 3) the richness, density, and diversity of species representing four guilds: aerial insectivores, cavity nesters, species dependent on early successional habitat, and wetland-dependent species observed on golf courses (Table 1). For the purposes of this exploratory analysis, I loosely defined these guilds by starting with the list of all species found on the censuses and then restricting the list to species meeting the following requirements: aerial insectivores' diets during the breeding season consist primarily of insects caught in flight; cavity nesters nest in primary or secondary cavities; early successional species nest primarily in grassland or shrub-scrub; wetland-dependent species nest or forage primarily in wetland.

I included the "transitional" land cover type in the developed category rather than forest, as I presumed that land designated "transitional" was in the process of being developed. In analyses described later, I included "transitional" land in the forest category, as it appears to me more likely that it represents forest clear-cut (National Land Cover Characterization Project). I also recognized a seventh land cover category called "all wet", which combined open water and herbaceous wetland.

I used principal components analysis (JMP v. 3.2.1) to further reduce the number of land cover variables into a few combinations of variables that represented much of the variance in the land cover data set. I repeated the

TABLE 1

Guilds used in exploratory analyses of land cover.

Aerial insectivores	Cavity nesters	Early successional	Wetland-dependent
common nighthawk	wood duck	northern bobwhite	double-crested cormorant
chimney swift	black vulture	eastern bluebird	great blue heron
Acadian flycatcher	turkey vulture	white-eyed vireo	great egret
willow flycatcher	barn owl	chestnut-sided warbler	green heron
eastern phoebe	eastern screech-owl	prairie warbler	yellow-crowned night-heron
great-crested flycatcher	great horned owl	common yellowthroat	mute swan
eastern kingbird	barred owl	yellow-breasted chat	Canada goose
purple martin	chimney swift	indigo bunting	wood duck
tree swallow	red-headed woodpecker	chipping sparrow	American black duck
northern rough-winged swallow	red-bellied woodpecker	field sparrow	mallard
bank swallow	downy woodpecker	grasshopper sparrow	osprey
barn swallow	hairy woodpecker	eastern meadowlark	bald eagle
	northern flicker	brown-headed cowbird	red-shouldered hawk
	pileated woodpecker		killdeer
	great-crested flycatcher		laughing gull
	purple martin		herring gull
	tree swallow		royal tern
	northern rough-winged swallow		common tern
	black-capped chickadee		Forster's tern
	Carolina chickadee		least tern
	tufted titmouse		barred owl
	white-breasted nuthatch		belted kingfisher
	brown-headed nuthatch		Acadian flycatcher
	Carolina wren		eastern phoebe
	house wren		tree swallow
	eastern bluebird		prothonotary warbler
	European starling		Louisiana waterthrush
	prothonotary warbler		common yellowthroat
	house sparrow		hooded warbler
			red-winged blackbird

analysis for land cover within the golf courses, buffer areas, and large surrounding areas, and I included all principal components with eigenvalues >1.0. Principal component analysis reduced five land cover variables (all wet, forest, crop, grass, developed) to three linear combinations (hereafter "PCs") that explained >88% of the variation among the original variables for the golf courses, buffer zones, and large surrounding areas (Table 2). For the golf courses, PC1 loaded negatively on grassland and positively on forest, so I refer to it as "non-grassy/forested". PC2 loaded positively on wet habitats and developed habitats, but negatively on forest, so I refer to it as "wet/unforested/developed". PC3 loaded positively on cropland and negatively on developed habitats, so I refer to it as "cropland/undeveloped". In the buffer zone, PC1 loaded negatively on forest and positively on developed habitats, so I refer to it as "unforested/developed". PC2 loaded positively on grasslands, so I refer to it as "grassy". PC3 loaded positively on both cropland and wet habitats, so I refer to it as "cropland/wet". For the large surrounding area, PC1 loaded negatively on forest and positively on developed habitats, so I refer to it as "unforested/developed". PC2 loaded positively on cropland and wet habitats, but negatively on grassland, so I refer to it as “cropland/non-grassy/wet”. PC3 loaded positively on both grassland and cropland, so I refer to it as "grassy/cropland". In choosing these descriptors I included any original variable with an eigenvalue >0.50 or <-0.50. I performed linear regressions of these PCs against the avian community variables described above.

TABLE 2

Eigenvalues and eigenvectors for principal components of (a) golf course, (b) 250-m buffer area, and (c) 1500-m large surrounding area land cover, with land cover classified as "transitional" included in the developed, rather than forest, category. These values were used in the exploratory linear and multiple regressions.

(a) Golf Course	**PC1** (non-grassy/ forested)	**PC2** (wet/unforested/ developed)	**PC3** (cropland/ undeveloped)
Eigenvalue	1.95	1.44	1.22
Variance explained (%)	39.04	28.73	24.32
Eigenvector for:			
% all wet	0.28	**0.65**	0.24
% forest	**0.53**	**-0.53**	-0.09
% crop	0.30	0.12	**0.75**
% grassland	**-0.70**	0.08	0.15
% developed	0.24	**0.52**	**-0.59**

(b) Buffer	**PC1** (unforested/ developed)	**PC2** (grassy)	**PC3** (cropland/ wet)
Eigenvalue	1.66	1.47	1.40
Variance explained (%)	33.20	29.44	27.96
Eigenvector for:			
% all wet	0.33	-0.31	**0.59**
% forest	**-0.74**	-0.18	0.17
% crop	0.25	0.28	**0.64**
% grassland	0.17	**0.76**	-0.21
% developed	**0.50**	-0.46	-0.41

(c) Large Surrounding Area	**PC1** (unforested/ developed)	**PC2** (cropland/ non-grassy/wet)	**PC3** (grassy/ cropland)
Eigenvalue	1.79	1.37	1.26
Variance explained (%)	35.87	27.54	25.20
Eigenvector for:			
% all wet	0.46	**0.50**	0.06
% forest	**-0.65**	0.32	-0.29
% crop	0.21	**0.52**	**0.51**
% grassland	-0.12	**-0.51**	**0.68**
% developed	**0.56**	-0.34	-0.43

Are there combined effects of land cover variables?

To explore the possibility that combined effects of land cover variables were responsible for variation in avian community variables, I performed stepwise multiple regressions (JMP v. 3.2.1) using each avian community variable as a response to multiple land cover factors. As an exploratory technique in some preliminary regressions, I included all land cover categories and PCs as factors for each avian community response variable, although this approach is statistically unreliable because of the large of number of factors relative to sample size.

Does land cover predict presence/absence?

I next investigated whether land cover can determine the presence or absence of species of conservation concern on golf courses. Species of conservation concern were defined as those with Partners in Flight (2002) total breeding priority scores ≥16, but rare species seen on <20% of the 57 courses analyzed were not included. Presence was defined as having been reported on any point count or fairway count. For each of the 27 species meeting the above requirements, I performed logistic regressions (JMP v. 3.2.1) of presence/absence against golf course area and three new PCs (Table 3) for land cover on the golf course, in the buffer zone, and in the large surrounding area. In these new PCs, I used open water and herbaceous wetland as separate categories and included transitional land cover in the forest, rather than developed, category. Six land cover categories (open water, herbaceous

TABLE 3

Eigenvalues and eigenvectors for principal components of (a) golf course, (b) 250-m buffer area, and (c) 1500-m large surrounding area land cover, with "transitional" land cover included in the forest category and the all wet category separated into open water and herbaceous wetland. These values were used in the exploratory logistic regressions.

(a) Golf Course	**PC1** (non-grassy/ marsh)	**PC2** (unforested)	**PC3** (cropland/ undeveloped)
Eigenvalue	2.18	1.64	1.22
Variance explained (%)	36.33	27.30	20.27
Eigenvector for:			
% open water	0.28	0.45	0.11
% wetland	**0.51**	0.35	0.08
% forest	0.31	**-0.67**	-0.03
% crop	0.34	0.07	**0.72**
% grassland	**-0.59**	0.36	0.15
% developed	0.33	0.30	**-0.67**

(b) Buffer	**PC1** (marsh/ponds)	**PC2** (forested/ non-grassy)	**PC3** (undeveloped/ cropland/grassy)
Eigenvalue	2.05	1.59	1.45
Variance explained (%)	34.18	26.49	24.21
Eigenvector for:			
% open water	**0.54**	0.19	-0.07
% wetland	**0.61**	0.16	0.09
% forest	-0.32	**0.70**	0.01
% crop	0.39	0.02	**0.54**
% grassland	-0.20	**-0.53**	**0.52**
% developed	0.21	-0.40	**-0.64**

(c) Large Surrounding Area	**PC1** (marsh/ unforested)	**PC2** (undeveloped)	**PC3** (grassy)
Eigenvalue	2.01	1.53	1.28
Variance explained (%)	33.54	25.48	21.32
Eigenvector for:			
% open water	0.44	0.14	-0.18
% wetland	**0.52**	0.33	0.07
% forest	**-0.50**	0.48	-0.33
% crop	0.36	0.47	0.37
% grassland	-0.19	-0.27	**0.78**
% developed	0.36	**-0.59**	-0.33

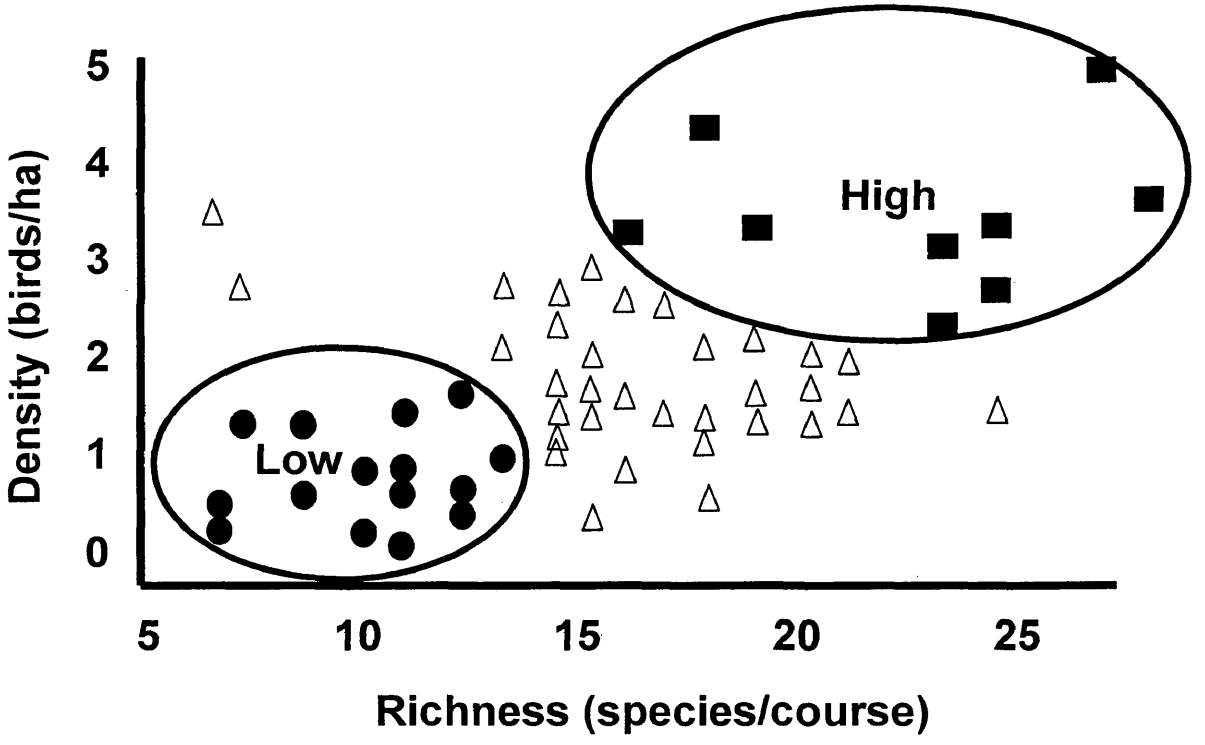
wetland, forest, cropland, grassland, and developed land) were reduced to three PCs. For the golf courses, I refer to PC1 as "non-grassy/marsh", PC2 as "unforested", and PC3 as "cropland/undeveloped". In the buffer zone, PC1 is "marsh/ponds", PC2 is "forested/non-grassy", and PC3 is "undeveloped/cropland/grassy". For the large surrounding area, PC1 is "marshy/unforested", PC2 is "undeveloped", and PC3 is "grassy".

Land cover of golf courses with high vs. low conservation value

To examine differences in land cover between golf courses that support species of conservation concern and those that don't, I used Ward's clustering method (JMP v. 3.2.1) to generate three clusters of courses based on richness and density of species of conservation concern (Figure 2). Courses of high conservation value (n = 9) comprised a cluster with high richness and density of species of conservation concern, and courses of low conservation value (n =15) comprised a cluster with low richness and density of these species. I then compared the mean proportions of each land cover category between high value and low value courses using non-parametric Kruskal-Wallis tests, as land cover proportions were not normally distributed. To be more inclusive of potentially influential land cover categories, I increased α to 0.10. For these comparisons, I included transitional land cover in the forest category.

For each land cover category that differed significantly between high and low conservation value golf courses, I used discriminant analysis (JMP v. 3.2.1) to evaluate its predictive ability to determine whether a golf course would be of

FIGURE 2



Results of cluster analysis for golf courses (n = 57) used in land cover analyses. The cluster labeled "High" had high richness and densities of species of conservation concern, and the cluster labeled "Low" had low richness and densities of these species.

high or low conservation value. In this analysis, a function is created based on proportions of land cover types, and that function is then used to classify each golf course according to its predicted conservation value. When classifying any given course, I removed that course from the function so it would not bias the prediction. If the proportion of a particular land cover type is capable of predicting the conservation value of a high percentage of golf courses, then knowing the proportion of that land cover is enough to predict whether an existing or planned golf course will have high conservation value.

RESULTS

Objective 1: Relative conservation value of golf courses

General results

A total of 125 potentially breeding species were reported in all censuses, 116 on golf courses and 108 on reference sites. Total numbers and densities of each species are reported for all golf courses and reference sites in Appendix E. Species richness, density, and diversity are reported for all golf courses and reference sites in Appendix F.

The mean number of species on golf courses was greater than that in reference habitats (Table 4), but the difference among groups was not significant ($\chi^2_3 = 4.2$, $P = 0.24$). Developed reference sites had the highest densities of birds, followed by golf courses, forest, and agriculture. There was a significant difference among groups ($\chi^2_3 = 8.5$, $P = 0.04$), and bird density in developed habitats was significantly greater than in all other habitats in *post hoc* comparisons (developed − golf course = 29.8; developed − forest = 34.3; developed − agriculture = 41.6; critical value for *post hoc* comparisons = 27.7).

TABLE 4

Avian community variables for golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. (c.c. = species of conservation concern)

	golf course mean ± S.D.	**forest mean ± S.D.**	**agriculture mean ± S.D.**	**developed mean ± S.D.**
density (all species)	7.11 ± 3.64	6.08 ± 1.67	5.70 ± 3.33	9.48 ± 1.97
density (c.c.)	2.18 ± 1.19	3.28 ± 0.80	2.90 ± 1.91	2.27 ± 0.83
density (open habitat-dependent, c.c.)	1.14 ± 0.76	1.49 ± 1.04	2.33 ± 1.55	1.03 ± 0.68
density (forest-dependent neotropical migrant, c.c.)	0.64 ± 0.70	1.79 ± 0.75	0.28 ± 0.56	0.75 ± 0.40
density (wetland-dependent, c.c.)	0.20 ± 0.26	0.46 ± 0.37	0.31 ± 0.38	0.20 ± 0.27
richness (all species)	38.38 ± 8.28	34.67 ± 10.78	35.22 ± 10.95	34.78 ± 12.04
richness (c.c.)	17.69 ± 6.04	18.89 ± 5.30	18.78 ± 7.74	13.89 ± 7.88
diversity (all species)	2.88 ± 0.32	2.93 ± 0.27	2.74 ± 0.54	2.93 ± 0.43
migratory behavior rank	91.87 ± 28.80	98.00 ± 30.46	89.00 ± 33.11	74.22 ± 33.11
habitat specificity rank	72.36 ± 22.06	84.22 ± 20.58	65.00 ± 26.79	58.56 ± 27.13
wetland-dependence rank	25.61 ± 13.71	21.44 ± 18.95	14.44 ± 5.79	15.89 ± 8.52
conservation priority rank	597.68 ± 141.24	567.44 ± 168.07	561.67 ± 185.89	526.78 ± 204.08

Species of conservation concern

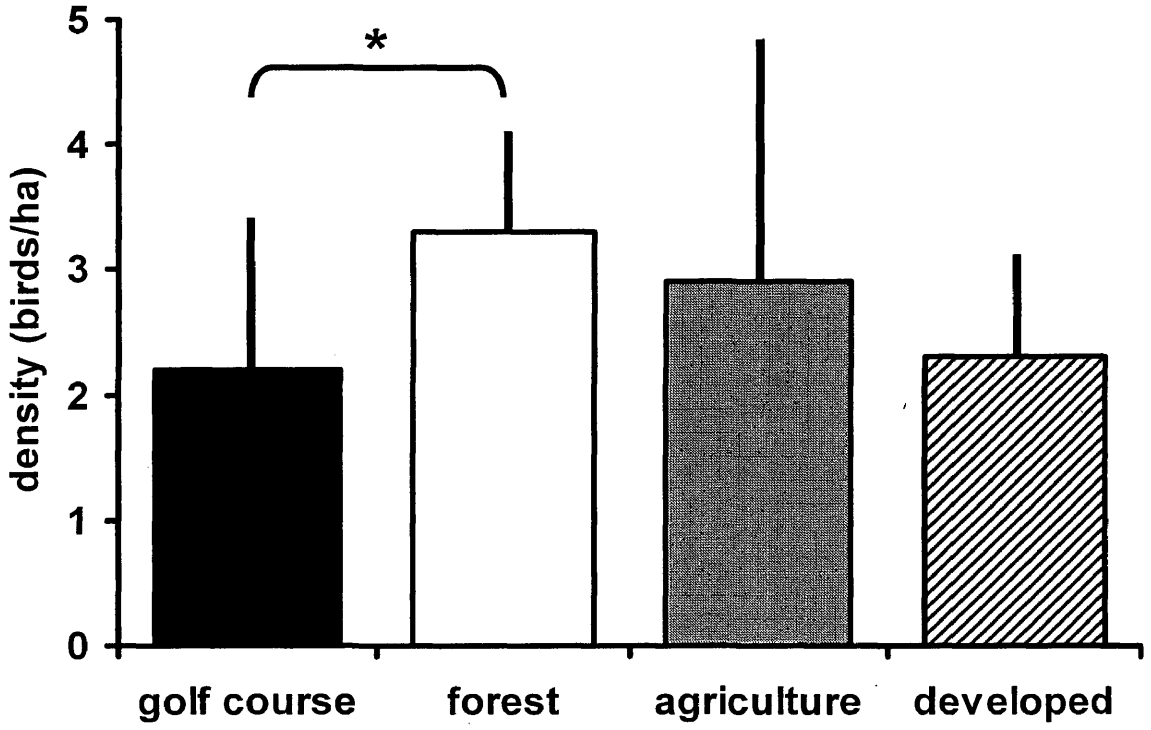
To examine the extent to which the birds on golf courses were species that may be of concern to conservationists, I restricted my analysis to those species with Partners in Flight total breeding priority scores ≥16. When restricted to species of conservation concern, richness and density fall sharply (Table 4).

Comparing golf courses to reference habitats indicated that the density of birds of conservation concern was highest on the forested reference sites and lowest on the golf courses (Figure 3). All three reference habitats had higher mean densities of birds than the golf courses. There was a significant difference among groups ($\chi^2_3 = 9.6$, $P = 0.02$), but the only reference habitat that was significantly different from golf courses in *post hoc* comparisons was forest (difference in mean ranks: forest − golf course = 34.05; agriculture − golf course = 14.28; developed − golf course = 5.16; critical value for *post hoc* comparisons = 27.7).

Do golf courses benefit particular ecological guilds?

I tested the hypothesis that golf courses may be particularly beneficial to species of conservation concern in three specific guilds: forest-dependent Neotropical migrants, open habitat-dependent birds, and wetland-dependent birds. Forest-dependent Neotropical migrants of conservation concern were found on few courses (Table 5), with only one species (chimney swift) present on more than 75% of courses, only two present on 50-75% of courses (great crested flycatcher and eastern wood-pewee), and three present on 25-50% of courses

FIGURE 3



Mean and standard deviation of density of birds of conservation concern on golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. There was a significant difference among groups ($\chi^2_3 = 9.6$, $P = 0.02$), and "*" indicates a significant difference between golf courses and forested reference sites in *post hoc* comparisons.

TABLE 5

Forest-nesting Neotropical migrants of conservation concern.

Species	Priority Score	Number seen on golf courses	% of courses detected
wood duck	16	22	9.2
broad-winged hawk	16.3	0	0
black-billed cuckoo	19	1	1.1
yellow-billed cuckoo	18.3	34	21.8
chimney swift	19	326	75.9
ruby-throated hummingbird	18	18	16.1
eastern wood-pewee	20.7	253	63.2
Acadian flycatcher	21.3	70	24.1
great crested flycatcher	17.7	164	59.8
blue-gray gnatcatcher	16.3	152	43.7
veery	17	0	0
wood thrush	24.7	77	41.4
blue-headed vireo	16	13	3.4
yellow-throated vireo	22	25	18.4
warbling vireo	17.3	8	3.4
northern parula	20.7	28	14.9
black-throated blue warbler	24	0	0
black-throated green warbler	17.7	1	1.1
yellow-throated warbler	20.3	29	9.2
pine warbler	18	148	41.4
cerulean warbler	26.3	2	2.3
black-and-white warbler	18	16	8.0
American redstart	16	6	4.6
prothonotary warbler	22	5	3.4
worm-eating warbler	23.3	0	0
ovenbird	17.3	91	24.1
Louisiana waterthrush	21.3	0	0
Kentucky warbler	24.3	2	2.3
hooded warbler	21	10	16.9
Canada warbler	21.5	0	0
summer tanager	16	52	19.5
scarlet tanager	21	34	18.4
rose-breasted grosbeak	17.3	4	1.1

(blue-gray gnatcatcher, wood thrush, pine warbler). Many more species of conservation concern dependent on open habitat were found on golf courses (Table 6). Chipping sparrow was found on more than 75% of courses; northern flicker, eastern wood-pewee, eastern kingbird, gray catbird, brown thrasher, indigo bunting, and eastern towhee were present on 50-75% of courses; killdeer, blue-gray gnatcatcher, white-eyed vireo, common yellowthroat, field sparrow, orchard oriole, and Baltimore oriole were present on 25-50% of courses. Wetland-dependent species of conservation concern were present on very few courses, with only one species (eastern phoebe) on more than 50% of courses, and three (green heron, killdeer, common yellowthroat) on 25-50% of courses (Table 7).

Comparing golf courses to reference habitats, the density of forest-dependent Neotropical migrants of conservation concern (Table 5, Appendix F) was greatest in forested reference sites, followed by developed reference sites, golf courses, and agricultural reference sites (Figure 4). There was a significant difference among groups ($\chi^2_3 = 23.7$, $P < .0001$), and forested reference sites were significantly different from golf courses in *post hoc* comparisons (difference in mean ranks: forest − golf course = 43.92; developed − golf course = 15.86; agriculture − golf course = −27.69; critical value for *post hoc* comparisons = 27.7). Golf courses provided greater conservation value for these species than agricultural reference sites, and the difference was marginally significant in *post hoc* comparisons. Restricting the analysis to species requiring open habitats (Table 6, Appendix F) resulted in agricultural reference sites providing the

TABLE 6

Open habitat-dependent species of conservation concern.

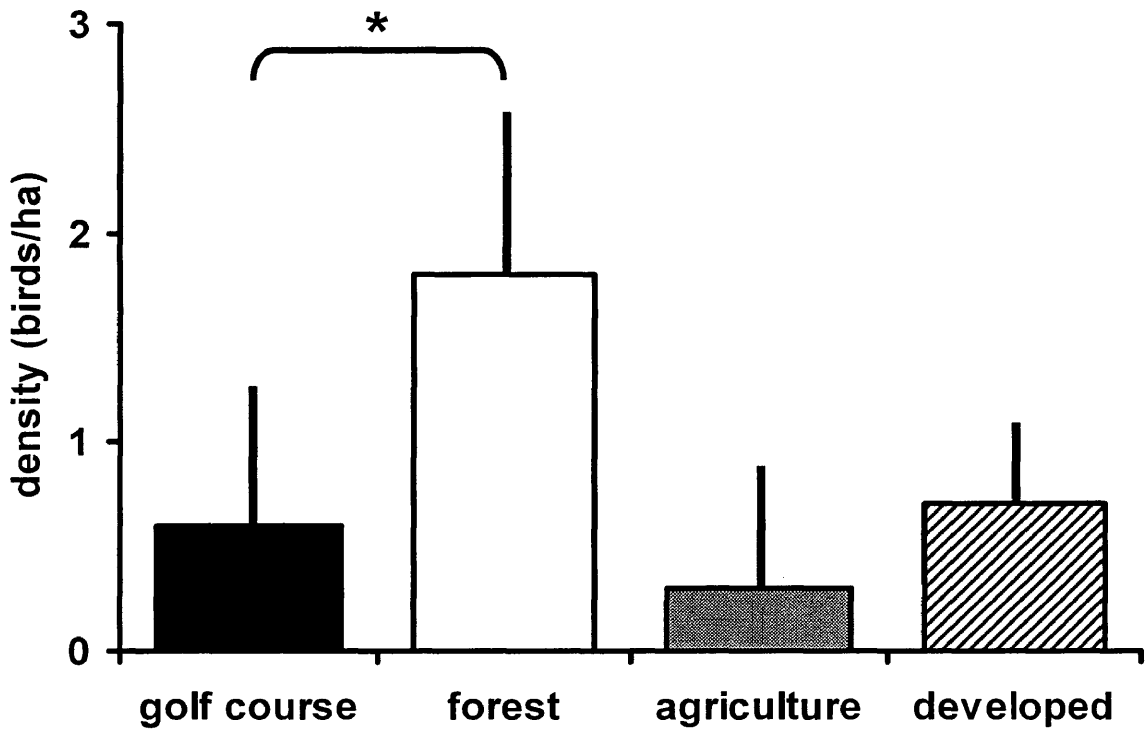
Species	Priority Score	Number seen on golf courses	% of courses detected
northern bobwhite	20	40	16.1
killdeer	16	102	44.8
yellow-billed cuckoo	18.3	34	21.8
barn owl	17.3	0	0
red-headed woodpecker	18	32	13.8
northern flicker	16	156	74.7
eastern wood-pewee	20.7	253	63.2
willow flycatcher	17.7	2	1.1
eastern kingbird	19	152	72.4
blue-gray gnatcatcher	16.3	152	43.7
gray catbird	19	168	54.0
brown thrasher	19.7	154	70.1
white-eyed vireo	19.7	48	28.7
yellow-throated vireo	22	25	18.4
warbling vireo	17.3	8	3.4
chestnut-sided warbler	19	1	1.1
prairie warbler	24	31	14.9
American redstart	16	6	4.6
common yellowthroat	17	79	33.3
yellow-breasted chat	19	27	21.8
rose-breasted grosbeak	17.3	4	1.1
blue grosbeak	17	29	14.1
indigo bunting	17.3	261	63.2
eastern towhee	20	181	58.6
chipping sparrow	16.3	700	83.9
field sparrow	22.3	76	29.9
grasshopper sparrow	19.3	9	6.9
eastern meadowlark	17.7	64	20.7
orchard oriole	18.7	63	29.9
Baltimore oriole	18.7	50	26.4

TABLE 7

Wetland-dependent species of conservation concern.

Species	Priority Score	Number seen on golf courses	% of courses detected
green heron	18	59	35.6
yellow-crowned night-heron	17	3	2.3
wood duck	16	22	9.2
American black duck	21	1	1.1
bald eagle	16.7	3	3.4
killdeer	16	102	44.8
laughing gull	16	41	5.7
royal tern	17	1	1.1
common tern	17	1	1.1
Forster's tern	19	1	1.1
least tern	18	1	1.1
belted kingfisher	17.7	22	16.1
Acadian flycatcher	21.3	70	24.1
eastern phoebe	16.3	96	57.5
prothonotary warbler	22	5	3.4
Louisiana waterthrush	21.3	0	0
common yellowthroat	17	79	33.3
hooded warbler	21	10	6.9

FIGURE 4



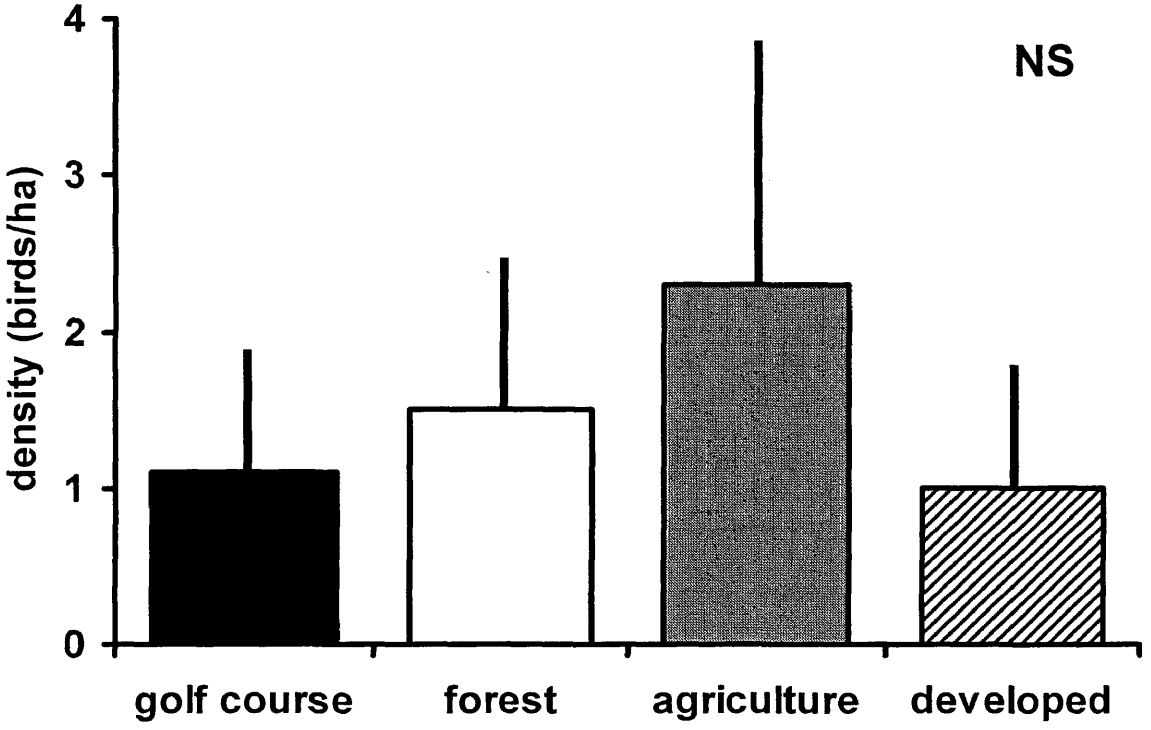
Mean and standard deviation of density of forest-dependent Neotropical migrants of conservation concern on golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. There was a significant difference among groups ($\chi^2_3 = 23.7$, $P < .0001$), and "*" indicates a significant difference between golf courses and forested reference sites in *post hoc* comparisons.

greatest conservation value, followed by forested reference sites, golf courses, and developed reference sites, though the difference among groups was not significant ($\chi^2_3 = 6.6$, $P = 0.08$) (Figure 5). Restricting the analysis to species dependent on wetlands (Table 7, Appendix F) resulted in forested sites supporting the highest mean density, followed by agricultural, golf course, and developed sites, but there was no significant difference among groups ($\chi^2_3 = 5.4$, $P = 0.15$) (Figure 6).

Do golf courses and reference habitats differ in the types of species they support?

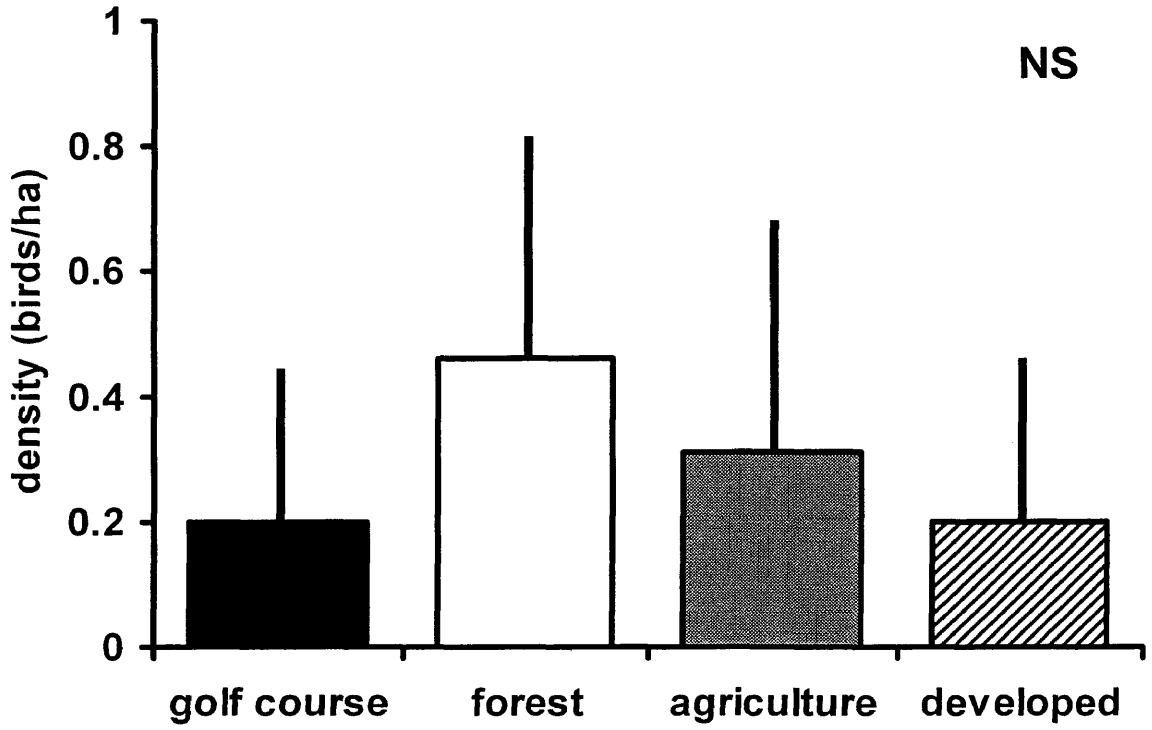
To investigate the degree to which golf courses and reference habitats were able to support various types of bird species, I compared mean total ecological rank scores of golf courses to those of reference habitats (Table 4, Appendix F). Golf courses provided the greatest support for wetland-dependent species, followed by forested, developed, and agricultural reference sites. There was a significant difference among groups ($\chi^2_3 = 11.5$, $P = .009$), but golf courses were significantly different only from agricultural reference sites in *post hoc* comparisons (difference in mean ranks: agriculture − golf course = −30.14; forest − golf course = −17.98; developed − golf course = −24.03; critical value for *post hoc* comparisons = 27.7) (Figure 7). For migratory behavior, habitat specificity, and conservation priority, there were no significant differences among groups (migratory behavior: $\chi^2_3 = 3.1$, $P = 0.37$; habitat specificity: $\chi^2_3 = 5.5$, $P = 0.14$; conservation priority: $\chi^2_3 = 2.5$, $P = 0.47$).

FIGURE 5



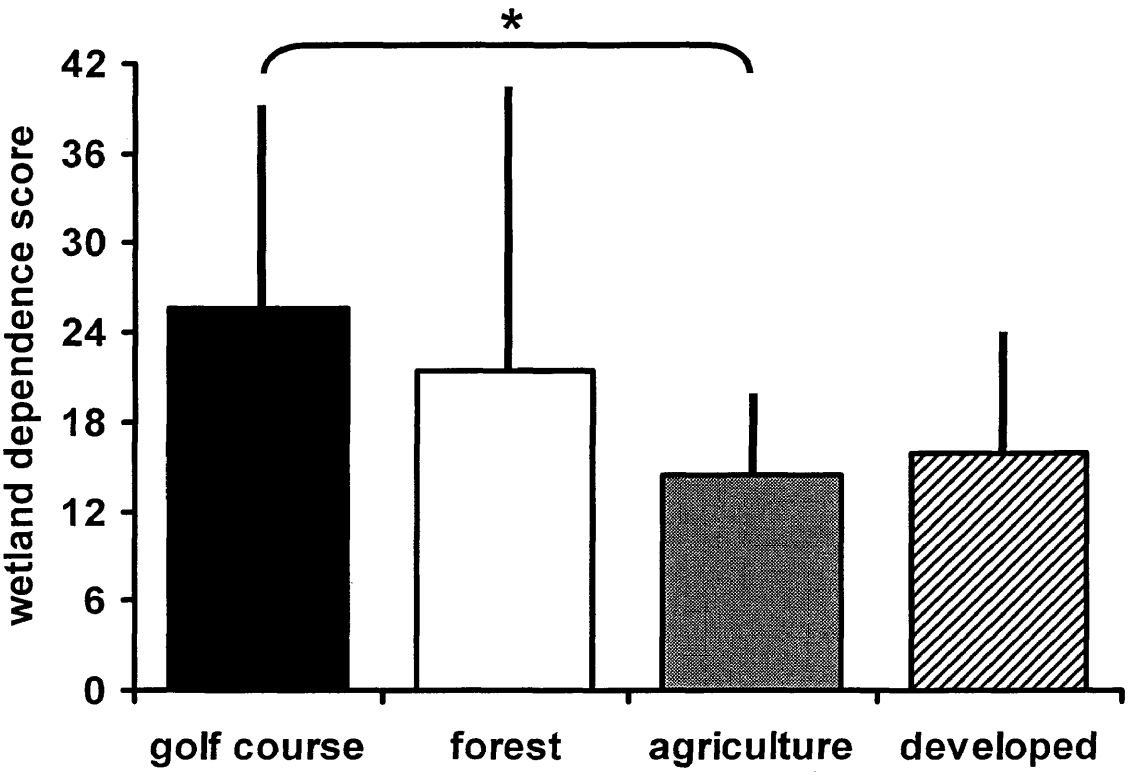
Mean and standard deviation of density of open habitat-dependent birds of conservation concern on golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. The difference among groups was not significant ($\chi^2_3 = 6.6$, $P = 0.08$).

FIGURE 6



Mean and standard deviation of density of wetland-dependent birds of conservation concern on golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. The difference among groups was not significant ($\chi^2_3 = 5.4$, $P = 0.15$).

FIGURE 7



Mean and standard deviation of wetland-dependence scores of golf courses (n = 87) and forested (n = 9), agricultural (n = 9), and developed (n = 9) reference sites. There was a significant difference among groups ($\chi^2_3 = 11.5$, $P = .009$), and "*" indicates a significant difference between golf courses and agricultural reference sites in *post hoc* comparisons.

Objective 2: Effect of land cover variables on conservation value

Proportions of all land cover types within golf courses, buffer zones, and large surrounding areas are reported in Appendix G.

Exploratory analyses of land cover

What land cover variables are important in determining bird use of golf courses?

To investigate correlations between avian community parameters and proportions of each land cover, I performed several exploratory analyses. I first performed linear regressions of each avian community variable against land cover types and PCs, separately for golf course, buffer zone, and large surrounding area. This method revealed no R^2 values higher than 0.40, indicating that no single land cover category or PC could explain more than 40% of the variation in any avian community measure (Table 8). The greatest correlations were negative ones between the proportion of developed land surrounding golf courses and diversity of the early successional guild. Early successional guild diversity was negatively correlated with development in the buffer zone (R^2 = 0.398), development in the large surrounding area (R^2 = 0.370), and the PC describing non-forested/developed land in the large surrounding area (R^2 = 0.361).

TABLE 8

Exploratory linear regressions of avian community parameters against (a) golf course (n = 57), (b) buffer zone (n = 57), and (c) large surrounding area (n = 57) land cover with $R^2 \geq 0.10$. CN = cavity nesters, ES = early successional, WD = wetland-dependent. Land cover classified as "transitional" is included in the developed, rather than forest, category.

(a) golf course

Land cover variable	**Avian community parameter**	**R^2**	**Response**
golf course area	CN guild diversity	0.11	+
% open water	WD guild richness	0.26	+
	WD guild diversity	0.17	+
	wetland-dependence rank	0.26	+
% herbaceous wetland	total diversity	0.14	-
	ES guild diversity	0.10	-
% all wet	WD guild richness	0.24	+
	WD guild diversity	0.15	+
	wetland-dependence rank	0.26	+
% forest	CN guild diversity	0.12	+
	habitat specificity rank	0.12	+
% grassland	CN guild diversity	0.14	-
% developed	ES guild diversity	0.17	-
PC1 (non-grassy/ forested)	CN guild diversity	0.11	+
	habitat specificity rank	0.11	+
	wetland-dependence rank	0.10	+
PC2 (wet/unforested/ developed)	total diversity	0.12	-
	ES guild diversity	0.11	-
	WD guild richness	0.10	+
	wetland-dependence rank	0.14	+

TABLE 8 (cont.)

(b) buffer zone

Land cover variable	Avian community parameter	R^2	Response
% open water	wetland-dependence rank	0.11	+
% herbaceous wetland	total diversity	0.12	-
% all wet	wetland-dependence rank	0.11	+
% forest	CN guild diversity	0.15	+
	ES guild diversity	0.14	+
	habitat specificity rank	0.18	+
% grassland	ES guild richness	0.12	+
% developed	CN guild density	0.14	+
	ES guild richness	0.27	-
	ES guild density	0.24	-
	ES guild diversity	0.40	-
	habitat specificity rank	0.17	-
	migratory behavior rank	0.11	-
PC1 (unforested/ developed)	total diversity	0.14	-
	CN guild diversity	0.12	-
	ES guild density	0.11	-
	ES guild diversity	0.21	-
	habitat specificity rank	0.16	-
PC2 (grassy)	CN guild density	0.12	-
	ES guild richness	0.22	+
	ES guild density	0.14	+
	ES guild diversity	0.23	+
	WD guild diversity	0.11	-

TABLE 8 (cont.)

(c) large surrounding area

Land cover variable	Avian community parameter	R^2	Response
% open water	ES guild diversity	0.11	-
% herbaceous wetland	total diversity	0.18	-
% all wet	ES guild diversity	0.12	-
% forest	ES guild richness	0.13	+
	ES guild density	0.12	+
	ES guild diversity	0.19	+
	habitat specificity rank	0.20	+
	migratory behavior rank	0.11	+
% developed	CN guild density	0.15	+
	ES guild richness	0.25	-
	ES guild density	0.21	-
	ES guild diversity	0.37	-
	habitat specificity rank	0.18	-
	migratory behavior rank	0.10	-
	conservation priority rank	0.10	-
PC1 (unforested/ developed)	total diversity	0.13	-
	ES guild richness	0.23	-
	ES guild density	0.18	-
	ES guild diversity	0.35	-
	habitat specificity rank	0.13	-
PC2 (cropland/ non-grassy/wet)	habitat specificity rank	0.13	+
PC3 (grassy/cropland)	CN guild density	0.12	-
	ES guild diversity	0.11	+

Are there combined effects of land cover variables?

Having examined individual, linear land cover variables, I sought to determine if land cover variables acting in combination could be driving avian community characteristics. To do this, I performed stepwise multiple regressions of each avian community measure with all land cover categories and PCs as factors. Regression models with $R^2 > 0.40$ were produced for richness and diversity of the early successional and wetland-dependent guilds as well as for wetland-dependence score (Table 9). Not surprisingly, models for the wetland-dependent guild and wetland-dependence score weighted heavily on water-related land cover variables. The more interesting result of this exploratory analysis was the high percentage of variation in early successional guild diversity explained by the proportion of development in the buffer areas around golf courses.

Focusing my investigation on early successional guild diversity, I performed separate multiple regression analyses for the three land cover areas (e.g., golf course, buffer, and large surrounding area). I refined the analyses by limiting the number of land cover categories for each stepwise regression model. For land cover characteristics within the golf courses, I included the percent of open water, herbaceous wetland, forest, grassland, developed land, and the area of the course. For the buffer zone, I included the percent of forest, cropland, grassland, and developed land, and I combined the percentages of open water and herbaceous wetland into one "all wet" category. I also included the golf course area as a factor, as there could be an interaction between golf course

TABLE 9

Exploratory multiple regression models of avian community parameters against golf course (n = 57), buffer zone (n = 57), and large surrounding area (n = 57) land cover variables with $R^2 > 0.40$. Land cover classified as "transitional" is included in the developed, rather than forest, category.

Avian community variable	**R^2**	**Land cover factors in model**
early successional guild richness	0.436	Buffer(developed) GC(open water) Buffer(all wet) GC(PC1: non-grassy/forested)
early successional guild diversity	0.492	Buffer(developed) Circle(all wet) GC(open water)
wetland-dependent guild richness	0.412	GC(open water) Buffer(crop) Buffer(PC3: cropland/wet)
wetland-dependent guild diversity	0.454	GC(open water) Buffer(crop) GC(crop) Circle(open water) GC Area
wetland-dependence rank	0.434	GC(all wet) Buffer(crop) Buffer(PC3: cropland/wet)

area and buffer characteristics. For example, effects of the buffer might be more pronounced on smaller courses because there is a larger ratio of buffer area to course area. For the large surrounding area, I included the percent of "all wet", forest, cropland, grassland, and developed land. The resulting models are shown in Table 10. The percent of developed land is a significant factor in each model, and in the buffer zone and large surrounding area it explains much of the variation in early successional guild diversity (44.0% and 44.8%, respectively).

Does land cover predict presence/absence?

There was a great deal of variation in the number of species of conservation concern supported by golf courses (range: 7 to 31 species) (Appendix F). To examine how the presence or absence of these species was influenced by land cover on and around the courses, I performed logistic regressions of presence/absence data against land cover PCs and golf course area. This analysis indicated that only one species responded significantly to land cover: orchard orioles were less likely to be present on golf courses with high amounts of cropland, grass, and development in the buffer zone (n = 57; whole model: $P = 0.04$; effect test for buffer PC3: $P = 0.03$). In addition, wood thrushes were more likely to be present on larger golf courses (n = 57; whole model: $P = 0.02$; effect test for golf course area: $P = 0.01$). The lack of significant results for more species suggests that 1) the presence/absence of species may be due to factors other than land cover and golf course area, and 2) the land cover PCs used in this analysis may not reflect biologically significant habitat

TABLE 10

Exploratory stepwise multiple regression models of early successional guild diversity against (a) golf course (n = 57), (b) buffer zone (n = 57), and (c) large surrounding area (n = 57) land cover. Land cover classified as "transitional" is included in the developed, rather than forest, category.

(a) golf course

Input variables	**Total adjusted R^2**	**Model**	**R^2**	***P***
golf course area % open water % herb. wetland % forest % grassland % developed	0.219	% developed golf course area % herb. wetland % open water	0.166 0.063 0.021 0.025	0.011 0.051 0.121 0.195

(b) buffer zone

Input variables	**Total adjusted R^2**	**Model**	**R^2**	***P***
% all wet % forest % cropland % grassland % developed golf course area	0.440	% developed % all wet	0.398 0.062	<0.001 0.016

(c) large surrounding area

Input variables	**Total Adjusted R^2**	**Model**	**R^2**	***P***
% all wet % forest % cropland % grassland % developed	0.448	% developed % all wet % cropland	0.370 0.093 0.015	<0.001 <0.002 0.223

variables. The absence of particular species on some golf courses could also be the result of observer error, as species present in lower numbers are more likely to be missed.

Land cover of golf courses with high vs. low conservation value

I examined differences in land cover between golf courses that support species of conservation concern and those that don't by creating clusters of courses with high conservation value (n = 9) and low conservation value (n = 15) (Figure 2). Non-parametric comparisons of land cover of high and low conservation value golf courses revealed that they differ significantly in the proportion of developed land within the buffer area and in the proportion of forested land within the golf course, buffer area, and large surrounding area (Table 11). Courses surrounded by developed land were of low conservation value, while those containing and surrounded by forest were of high conservation value.

To evaluate the predictive ability of these land cover variables, I conducted a discriminant analysis which used the land cover information to attempt to classify each golf course as being of high or low conservation value. Using proportions of four forest types (deciduous, evergreen, mixed forest, and transitional) within the golf course, the discriminant function correctly classified 75.0% of the 24 golf courses as being of high or low conservation value. Using the same forest types within the large surrounding area, the discriminant function correctly classified 83.3% of the courses. The discriminant function was not as

TABLE 11

Proportions of land cover categories for high (n = 9) and low (n = 15) conservation value golf courses. (Kruskal-Wallis tests, α = 0.1)

	Low value mean ± SD	**High value mean ± SD**	***Z***	***P***
golf course				
Open water	2.0 ± 2.1	3.0 ± 3.1	0.78	0.44
Wetland	1.0 ± 1.8	0.2 ± 0.4	0.25	0.80
Forest	18.4 ± 14.7	35.5 ± 23.8	1.85	0.06**
Grassland	57.7 ± 25.0	47.2 ± 24.2	0.78	0.44
Developed	15.4 ± 17.0	11.5 ±11.2	0.42	0.68
buffer area (250 m)				
Open water	4.5 ± 5.5	4.4 ± 5.2	0.33	0.74
Wetland	2.5 ± 4.1	0.7 ± 0.9	0.24	0.81
Forest	34.5 ± 17.9	55.5 ± 25.4	1.91	0.06**
Row crop	5.4 ± 6.2	2.7 ± 2.9	0.57	0.57
Grassland	23.4 ± 19.6	24.7 ± 25.7	0.42	0.68
Developed	28.5 ± 20.8	11.6 ± 11.0	2.03	0.04**
large surrounding area (1500 m)				
Open water	4.7 ± 6.3	4.8 ± 3.8	0.66	0.51
Wetland	2.9 ± 4.4	0.6 ± 0.7	1.01	0.31
Forest	35.6 ± 22.6	59.4 ± 16.8	2.03	0.04**
Row crop	6.22 ± 8.2	3.8 ± 3.15	0.06	0.95
Grassland	23.1 ± 17.4	20.34 ± 18.73	0.78	0.44
Developed	27.5 ± 22.4	11.1 ± 7.8	1.37	0.17

accurate in classifying courses based on proportion of forest in the buffer area. Even adding the proportion of woody wetland to the above forest types in the buffer area resulted in only 66.7% correctly classified. Developed land in the buffer area was also a poor predictor of golf course conservation value. Using the proportions of low intensity residential, high intensity residential, commercial/industrial/transportation, and quarries/strip mines/gravel, the discriminant function correctly classified only 58.3% of the courses.

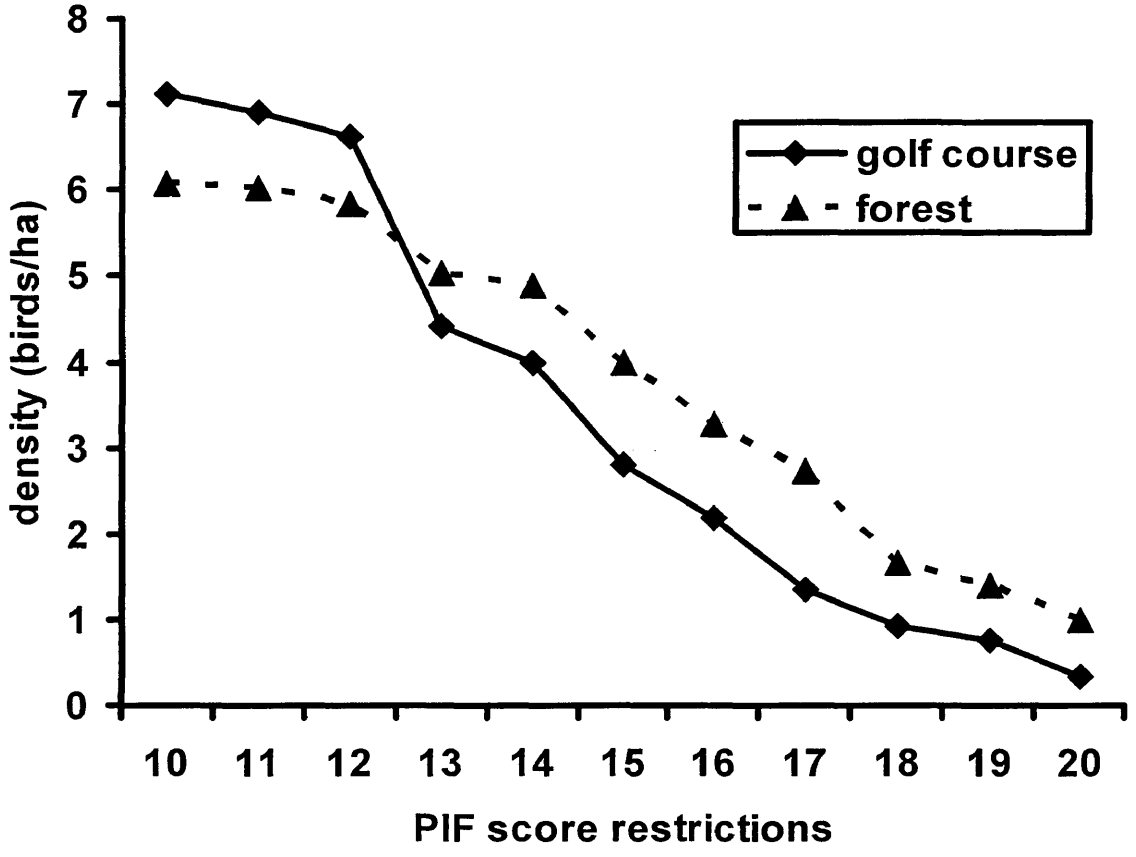
DISCUSSION

Objective 1: Relative conservation value of golf courses

Golf courses supported a high number of individual birds and the highest mean number of species of all habitats surveyed. Considering only species of conservation concern, however, density and species richness on golf courses dropped sharply. I defined "conservation concern" liberally, even including some species with stable or increasing populations. When a more stringent definition of conservation concern is applied, golf courses provide very little habitat. For example, only three species with Partners in Flight (2002) breeding priority scores >24 were reported on golf courses, and of those, only one (wood thrush) was found on more than one course.

Forested reference habitat exhibited a similar drop in bird density when only species of conservation concern were considered, but the drop was less severe (Figure 8). Forested habitats supported significantly greater densities of these vulnerable birds than did golf courses, and golf courses were not statistically different from agricultural or developed land. Even species of conservation concern that might be expected to thrive on golf courses, forest-dependent Neotropical migrants, open habitat birds, and wetland-dependent birds, were no more common on golf courses than on forested or developed land.

FIGURE 8



Mean density of birds on golf courses (n = 87) and forested reference sites (n = 9) meeting Partners in Flight total breeding priority score restrictions.

Golf courses had higher ecological rank scores for wetland-dependence than reference habitats, but this was likely due to inflation from a few common species. For example, Canada geese (Partners in Flight score = 12) were reported on over 39% of golf courses, but were not reported on any reference habitats.

Thus, although golf courses support large numbers of birds, they do not appear to make a significant contribution to bird conservation by supporting species declining or at-risk in the region. Golf courses should not be expected to replace the ecological functions of native habitat, nor should they be considered preferable, in terms of bird conservation, to other forms of development or agriculture.

Objective 2: Effect of land cover variables on conservation value

The golf course censuses revealed a great deal of variation in bird use of golf courses, with some courses supporting very high numbers of individual birds and species of conservation concern (range for species with Partners in Flight score ≥16: 0.4 to 5.7 birds/ha, 7 to 31 species/course). These courses of high conservation value were characterized by high proportions of forested land within the course proper, in a 250-m buffer zone, and within a 1.5-km radius of the center of the course. They also had less development in the buffer zone.

Proportions of forested land within and immediately surrounding the golf course were not reliable predictors of conservation value. This is possibly due to the low resolution of the land cover data. The National Land Cover Data 1992

(National Land Cover Characterization Project) has a resolution of 30 m, so fine distinction of land cover features at the scale of a golf course and its immediate surroundings is not possible. Microhabitat variables, such as proportion of edge or vegetative complexity, which are important predictors of bird use (Lichstein et al. 2002), were not measured.

The proportion of forested land in the larger surrounding area was a better predictor of a golf course's conservation value. Courses in heavily forested areas can be expected to harbor more species of conservation concern than those in unforested areas. This does not mean, however, that golf courses in forested areas are necessarily contributing to regional bird conservation. Based on this study, it is likely that the forested land destroyed by the golf course supported more birds of conservation concern than even the best golf course would.

The amount of development, including housing, immediately surrounding the golf course was a poor predictor of the course's conservation value. Again, it is possible that the land cover data lacked the resolution necessary to discern important microhabitat variables. Interestingly, based on development in the buffer zone, it was more likely for courses of low conservation value to be misclassified as high value than for high value courses to be misclassified as low value. This suggests that increased development adjacent to golf courses may be a reliable predictor of lower conservation value, but other factors, even in the absence of development, can have the same effect. Thus, even if a course is protected from surrounding development, other factors inherent to course design

or the larger surrounding area may predestine the course to low conservation value.

Overall implications

Regardless of conservation value, golf course construction is driven by a consumer demand that is likely to continue for the foreseeable future (O'Hara and Beckwith 2002). As new courses are built, consideration of the amount of forest left in the design as well as minimizing adjacent development could increase their value to breeding birds. There are reasons to be cautious, however, about luring birds onto golf courses. Pesticides used to maintain the aesthetic and functional qualities of courses can be deadly for birds if misapplied (Stone and Knoch 1982, Rainwater et al. 1995), and golf courses are subject to high levels of human disturbance. Studies have demonstrated subtle decreases in productivity in birds breeding on golf courses compared to birds breeding elsewhere, although more data of this type are necessary before it can be concluded that golf courses are not good places for bird reproduction (Stanback personal communication, LeClerc et al. unpublished data).

For these reasons, it is important to consider golf courses in their regional contexts. A golf course in a relatively undisturbed region may be a population sink for some species, where birds dependent on native habitat are unable to maintain viable populations without the immigration of individuals from habitat outside the golf course. That same golf course could support a source

population of more suburban-adaptable species (Blair 1996) which emigrate from the course and compete against the native species in surrounding areas. In this case, regional conservation efforts might benefit from making the golf course less attractive to birds. Conversely, in areas of intense urban development, golf courses may provide the only habitat for birds that would otherwise be absent. Careful study of the meta-population dynamics of the region should precede any judgments about a golf course's relative ecological value. Future studies should also examine the potential role of golf courses as winter habitat and stop-over sites for migratory birds, something not addressed in this study.

My conclusion is that, until further evidence is available, it should not be assumed that a golf course is a better alternative for birds than other types of land use. Golf courses should not be treated by municipalities as green spaces with conservation value unless they are carefully designed with wildlife in mind and developers can demonstrate that they will likely support source populations for native birds of conservation concern.

APPENDIX A

Scientific names and abbreviations of bird species.

double-crested cormorant	*Phalacrocorax auritus*	DCCO
great blue heron	*Ardea herodias*	GTBH
great egret	*Ardea alba*	GREG
green heron	*Butorides virescens*	GNHE
yellow-crowned night-heron	*Nyctanassa violacea*	YCNH
black vulture	*Coragyps atratus*	BLVU
turkey vulture	*Cathartes aura*	TUVU
Canada goose	*Branta canadensis*	CAGO
mute swan	*Cygnus olor*	MUSW
wood duck	*Aix sponsa*	WODU
American black duck	*Anas rubripes*	AMDU
mallard	*Anas platyrhynchos*	MALL
osprey	*Pandion haliaetus*	OSPR
bald eagle	*Haliaeetus leucocephalus*	BAEA
sharp-shinned hawk	*Accipiter striatus*	SSHA
cooper's hawk	*Accipiter cooperii*	COHA
red-shouldered hawk	*Buteo lineatus*	RSHA
broad-winged hawk	*Buteo platypterus*	BWHA
red-tailed hawk	*Buteo jamaicensis*	RTHA
ruffed grouse	*Bonasa umbellus*	RUGR
wild turkey	*Meleagris gallopavo*	WITU
northern bobwhite	*Colinus virginianus*	NOBO
killdeer	*Charadrius vociferus*	KILL
spotted sandpiper	*Actitis macularia*	SPSA
laughing gull	*Larus atricilla*	LAGU
ring-billed gull	*Larus delawarensis*	RBGU
herring gull	*Larus argentatus*	HERG
royal tern	*Sterna maxima*	ROTE
common tern	*Sterna hirundo*	COTE
Forster's tern	*Sterna forsteri*	FOTE
least tern	*Sterna antillarum*	LETE
rock dove	*Columba livia*	RODO
mourning dove	*Zenaida macroura*	MODO
black-billed cuckoo	*Coccyzus erythropthalmus*	BBCU
yellow-billed cuckoo	*Coccyzus americanus*	YBCU
barn owl	*Tyto alba*	BNOW
eastern screech-owl	*Otus asio*	EASO
great horned owl	*Bubo virginianus*	GHOW
barred owl	*Strix varia*	BAOW
common nighthawk	*Chordeiles minor*	CONI
chimney swift	*Chaetura pelagica*	CHSW
ruby-throated hummingbird	*Archilochus colubris*	RTHU
belted kingfisher	*Ceryle alcyon*	BEKI

APPENDIX A (cont.)

red-headed woodpecker	*Melanerpes erythrocephalus*	RHWO
red-bellied woodpecker	*Melanerpes carolinus*	RBWO
downy woodpecker	*Picoides pubescens*	DOWO
hairy woodpecker	*Picoides villosus*	HAWO
northern flicker	*Colaptes auratus*	NOFL
pileated woodpecker	*Dryocopus pileatus*	PIWO
eastern wood-pewee	*Contopus virens*	EAWP
Acadian flycatcher	*Empidonax virescens*	ACFL
willow flycatcher	*Empidonax traillii*	WIFL
eastern phoebe	*Sayornis phoebe*	EAPH
great crested flycatcher	*Myiarchus crinitus*	GCFL
eastern kingbird	*Tyrannus tyrannus*	EAKI
white-eyed vireo	*Vireo griseus*	WEVI
blue-headed vireo	*Vireo solitarius*	BHVI
yellow-throated vireo	*Vireo flavifrons*	YTVI
warbling vireo	*Vireo gilvus*	WAVI
red-eyed vireo	*Vireo olivaceus*	REVI
blue jay	*Cyanocitta cristata*	BLJA
American crow	*Corvus brachyrhynchos*	AMCR
fish crow	*Corvus ossifragus*	FICR
common raven	*Corvus corax*	CORA
purple martin	*Progne subis*	PUMA
tree swallow	*Tachycineta bicolor*	TRES
northern rough-winged swallow	*Stelgidopteryx serripennis*	NRWS
bank swallow	*Riparia riparia*	BANS
barn swallow	*Hirundo rustica*	BARS
Carolina chickadee	*Poecile carolinensis*	CACH
black-capped chickadee	*Poecile atricapillus*	BCCH
tufted titmouse	*Baeolophus bicolor*	TUTI
white-breasted nuthatch	*Sitta carolinensis*	WBNU
brown-headed nuthatch	*Sitta pusilla*	BHNU
Carolina wren	*Thryothorus ludovicianus*	CARW
house wren	*Troglodytes aedon*	HOWR
blue-gray gnatcatcher	*Polioptila caerulea*	BGGN
eastern bluebird	*Sialia sialis*	EABL
veery	*Catharus fuscescens*	VEER
wood thrush	*Catharus mustelinus*	WOTH
American robin	*Turdus migratorius*	AMRO
gray catbird	*Dumetella carolinensis*	GRCA
northern mockingbird	*Mimus polyglottos*	NOMO
brown thrasher	*Toxostoma rufum*	BRTH
European starling	*Sturnus vulgaris*	EUST
cedar waxwing	*Bombycilla cedrorum*	CEDW
northern parula	*Parula americana*	NOPA
yellow warbler	*Dendroica petechia*	YWAR
chestnut-sided warbler	*Dendroica pensylvanica*	CSWA
black-throated blue warbler	*Dendroica caerulescens*	BTBW
black-throated green warbler	*Dendroica virens*	BTNW
yellow-throated warbler	*Dendroica dominica*	YTWA
pine warbler	*Dendroica pinus*	PIWA
prairie warbler	*Dendroica discolor*	PRAW

APPENDIX A (cont.)

cerulean warbler	*Dendroica cerulea*	CERW
black-and-white warbler	*Mniotilta varia*	BAWW
American redstart	*Setophaga ruticilla*	AMRE
prothonotary warbler	*Protonotaria citrea*	PROW
worm-eating warbler	*Helmitheros vermivorus*	WEWA
ovenbird	*Seiurus aurocapillus*	OVEN
Louisiana waterthrush	*Seiurus motacilla*	LOWA
Kentucky warbler	*Oporornis formosus*	KEWA
common yellowthroat	*Geothlypis trichas*	COYE
hooded warbler	*Wilsonia citrina*	HOWA
Canada warbler	*Wilsonia canadensis*	CAWA
yellow-breasted chat	*Icteria virens*	YBCH
summer tanager	*Piranga rubra*	SUTA
scarlet tanager	*Piranga olivacea*	SCTA
eastern towhee	*Pipilo erythrophthalmus*	EATO
chipping sparrow	*Spizella passerina*	CHSP
field sparrow	*Spizella pusilla*	FISP
grasshopper sparrow	*Ammodramus savannarum*	GRSP
song sparrow	*Melospiza melodia*	SOSP
dark-eyed junco	*Junco hyemalis*	DEJU
northern cardinal	*Cardinalis cardinalis*	NOCA
rose-breasted grosbeak	*Pheucticus ludovicianus*	RBGR
blue grosbeak	*Guiraca caerulea*	BLGR
indigo bunting	*Passerina cyanea*	INBU
red-winged blackbird	*Agelaius phoeniceus*	RWBL
eastern meadowlark	*Sturnella magna*	EAME
common grackle	*Quiscalus quiscula*	COGR
brown-headed cowbird	*Molothrus ater*	BHCO
orchard oriole	*Icterus spurius*	OROR
Baltimore oriole	*Icterus galbula*	BAOR
house finch	*Carpodacus mexicanus*	HOFI
American goldfinch	*Carduelis tristis*	AMGO
house sparrow	*Passer domesticus*	HOSP

APPENDIX B

Censused golf course names and locations in Virginia.

Aquia Harbour Golf and Country Club, Stafford
Army Navy Country Club, Arlington
Augustine Golf Club, Stafford
Bay Creek Golf Club, Cape Charles
Belle Haven Country Club, Alexandria
Bide-a-wee Golf Club, Portsmouth
Birdwood Golf Course, Charlottesville
Birkdale Golf Club, Chesterfield
Blacksburg Country Club, Blacksburg
Boonsboro Country Club, Lynchburg
Brambleton Regional Park Golf Course, Ashburn
Castle Rock Golf Course, Pembroke
Chesapeake Golf Club, Chesapeake
Colonial Golf Course, Williamsburg
Colonial Hills Golf Course, Forest
Devil's Knob Golf Course at Wintergreen Resort, Wintergreen
Eaglewood Golf Course, Langley AFB
Eastern Shore Yacht and Country Club, Melfa
Elizabeth Manor Golf and Country Club, Portsmouth
Fairfax National Golf Club, Centreville
Falling River Country Club, Appomattox
Farmington Country Club, Charlottesville
Fawn Lake Country Club, Spotsylvania
Ford's Colony, Williamsburg
Four Winds Golf Course, Rappahannock
Fredericksburg Country Club, Fredericksburg
Glenmore Country Club, Keswick
Golden Horseshoe Golf Club, Williamsburg
Gypsy Hill Golf Club, Staunton
Hamptons Golf Course, Hampton
Hanging Rock Golf Club, Salem
Heartland Golf Club, Farmville
Hell's Point Golf Club, Virginia Beach
Heritage Oaks Golf Course, Harrisonburg
Hobbs Hole Golf Club, Tappahannock
Ivy Hill Golf Club, Forest
Jefferson District Golf Course, Falls Church
Keswick Club, Keswick
Kiln Creek Golf and Country Club, Newport News
Kingsmill Resort, Williamsburg
Kiskiack Golf Club, Williamsburg
Lake Bonaventure Country Club, Castlewood
Lake Chesdin Golf Club, Chesterfield

APPENDIX B (cont.)

Lakeview Golf Course, Harrisonburg
Lee's Hill Golfers' Club, Fredericksburg
Lexington Golf and Country Club, Lexington
London Downs Golf Club, Forest
Longwood Golf Course, Farmville
Lower Cascades at the Homestead, Hot Springs
Meadowcreek Golf Course at Pen Park, Charlottesville
Mountain Top Golf Course, Grundy
Needle's Eye Golf Course, Monterey
Newport News Golf Club at Deer Run, Newport News
Oak Marr Golf Course, Oakton
Oakwood Country Club, Lynchburg
Ole Monterey Golf Club, Roanoke
Pohick Bay Regional Park Golf Course, Lorton
Princess Anne Country Club, Virginia Beach
Red Wing Lake Golf Club, Virginia Beach
River Course, Radford
Riverfront Golf Club, Suffolk
Round Meadows Country Club, Christiansburg
Royal New Kent Golf Club, Providence Forge
Shenandoah Crossing Country Club, Gordonsville
Stonehouse Golf Club, Toano
Stoney Creek Golf Course at Wintergreen Resort, Nellysford
Suffolk Golf Association, Suffolk
Tanyard Country Club, Louisa
Two Rivers Country Club, Williamsburg
Virginia Tech Golf Course, Blacksburg
Washington Golf and Country Club, Arlington
Waynesboro Country Club, Waynesboro
Williamsburg Country Club, Williamsburg
Williamsburg National Golf Club, Williamsburg
Willowbrook Country Club, Grundy
Woodlands Golf Course, Hampton
Woodside Country Club, Tappahannock

APPENDIX C

Reference site locations in Virginia.

Intact mature forest – Coastal Plain	Lake Matoaka Woods (Williamsburg)
Intact mature forest – Piedmont	Wildcat Mountain Natural Area (Fauquier Co.)
Intact mature forest – mountain	War Spur Loop Trail, Mountain Lake Scenic Area (Giles Co.)
Early successional – Coastal Plain	College of William and Mary Woods (Williamsburg)
Early successional – Piedmont	C. F. Phelps Wildlife Management Area (Fauquier Co.)
Early successional – mountain	Mountain Lake Scenic Area (Giles Co.)
Fragmented forest – Coastal Plain	Greensprings Farm (James City Co.), Lake Matoaka Woods (Williamsburg)
Fragmented forest – Piedmont	Charlottesville
Fragmented forest – mountain	Pandapas Pond, Blacksburg (Montgomery Co.)
Row crops – Coastal Plain	Mt. Clear, Auburn Hill, Miller Farms (Caroline Co.)
Row crops – Piedmont	Huntlee Farm (Fauquier Co.)
Row crops – mountain	Virginia Tech Fields, Blacksburg (Montgomery Co.)
Pasture – Coastal Plain	Mainland, Gospel Spreading, War Hill Farms, Toano Stables (James City Co.)
Pasture – Piedmont	Prince Edward Co.
Pasture – mountain	Virginia Tech Pastures, Blacksburg (Montgomery Co.)
Grassland/hay field – Coastal Plain	West Point Airfield (King William Co.), Fort Lee (Prince George Co.)
Grassland/hay field – Piedmont	James River State Park (Buckingham Co.)
Grassland/hay field – mountain	Caldwell Fields (Montgomery Co.)
Low-density suburban – Coastal Plain	Vineyards subdivision (James City Co.)
Low-density suburban – Piedmont	Campbell Co.
Low-density suburban – mountain	Blacksburg Country Club Estates (Montgomery Co.)
High-density suburban – Coastal Plain	Rolling Woods subdivision (James City Co.)
High-density suburban – Piedmont	Suburban Lynchburg
High-density suburban – mountain	Suburban Blacksburg (Montgomery Co.)
Urban – Coastal Plain	Downtown Hampton
Urban – Piedmont	Downtown Farmville (Prince Edward Co.)
Urban – mountain	Downtown Blacksburg (Montgomery Co.)

APPENDIX D

Ecological rank scores for migratory behavior, habitat specificity, wetland-dependence, and conservation priority.

Species	Migratory behavior	Habitat specificity	Wetland-dependence	Conservation priority
DCCO	2	3	5	13
GTBH	2	3	5	14.7
GREG	2	3	5	13
GNHE	4	1	5	18
YCNH	5	3	5	17
MUSW	0	3	5	12
CAGO	0	1	5	12
WODU	4	3	5	16
ABDU	2	5	5	21
MALL	2	1	5	12
BLVU	2	1	0	12.3
TUVU	2	1	0	12.3
OSPR	5	5	5	15.7
BAEA	2	5	3	16.7
SSHA	4	3	0	17.7
COHA	2	3	0	16.7
RSHA	0	5	3	15.7
BWHA	5	3	0	16.3
RTHA	2	1	0	11.7
RUGR	0	5	0	17.5
WITU	0	3	0	17.7
NOBO	0	3	0	20
KILL	2	3	3	16
LAGU	4	1	5	16
HERG	2	1	3	12
ROYT	4	5	5	17
COTE	5	5	5	17
FOTE	4	3	5	19
LETE	5	1	5	18
RODO	0	1	0	13
MODO	2	1	0	10.3
BBCU	5	3	0	19
YBCU	5	3	0	18.3
BNOW	0	1	1	17.3
EASO	0	1	0	19.3
GHOW	0	1	0	12.7
BAOW	0	5	3	14
CONI	5	1	0	15
CHSW	5	1	0	19
RTHU	5	1	0	18
BEKI	2	3	5	17.7

APPENDIX D (cont.)

Species	Migratory behavior	Habitat specificity	Wetland-dependence	Conservation priority
RHWO	2	3	1	18
RBWO	0	1	1	16.3
DOWO	0	1	0	15.7
HAWO	0	3	0	15
NOFL	2	1	0	16
PIWO	0	1	0	14.7
EAWP	5	3	0	20.7
ACFL	5	5	3	21.3
WIFL	5	1	0	17.7
EAPH	4	5	3	16.3
GCFL	5	1	0	17.7
EAKI	5	3	1	19
PUMA	5	1	0	15
TRES	4	3	3	12.7
NRWS	5	1	1	17.7
BANS	5	3	1	14
BARS	5	1	0	16.3
BLJA	2	1	0	14.3
AMCR	2	1	0	11.7
FICR	4	1	1	16.3
CORA	0	1	0	12
BCCH	0	3	0	13.7
CACH	0	3	0	17.3
TUTI	0	3	0	14.3
WBNU	0	5	0	14.7
BHNU	0	5	1	22.5
CARW	0	3	0	15
HOWR	4	1	0	13
BGGN	4	3	0	16.3
EABL	2	3	0	15
VEER	5	5	1	17
WOTH	5	3	0	24.7
AMRO	2	1	0	12
GRCA	4	1	0	19
NOMO	0	1	0	12.3
BRTH	0	1	0	19.7
CEDW	2	1	0	14.3
EUST	0	1	0	12.7
WEVI	5	3	0	19.7
BHVI	5	5	0	16
YTVI	5	5	0	22
WAVI	5	3	0	17.3
REVI	5	3	0	15.7
NOPA	5	3	1	20.7
YWAR	5	1	1	14.7
CSWA	5	5	0	19
BTBW	5	5	0	24
BTNW	5	3	0	17.7
YTWA	5	3	1	20.3
PIWA	4	3	0	18

APPENDIX D (cont.)

Species	Migratory behavior	Habitat specificity	Wetland-dependence	Conservation priority
PRAW	5	3	0	24
CERW	5	5	1	26.3
BAWW	5	5	0	18
AMRE	5	5	0	16
PROW	5	5	5	22
WEWA	5	5	0	23.3
OVEN	5	5	1	17.3
LOWA	5	5	5	21.3
KEWA	5	3	1	24.3
COYE	4	1	3	17
HOWA	5	5	3	21
CAWA	5	5	1	21.5
YBCH	5	3	0	19
SUTA	5	3	0	16
SCTA	5	3	0	21
NOCA	0	1	0	12
RBGR	5	1	0	17.3
BLGR	5	1	0	17
INBU	5	3	0	17.3
EATO	2	1	0	20
CHSP	2	1	0	16.3
FISP	2	3	0	22.3
GRSP	4	3	0	19.3
SOSP	2	1	0	12.7
DEJU	0	3	0	11.5
RWBL	2	1	3	12
EAME	2	3	0	17.7
COGR	2	1	1	14
BHCO	2	1	0	12.3
OROR	5	1	0	18.7
NOOR	5	1	0	18.7
HOFI	2	1	0	10.7
AMGO	2	1	0	13.3
HOSP	0	1	0	13.7

APPENDIX E

Total number of individuals and density (birds/ha) of each species reported at reference sites (Appendix E1) and on golf courses in the Coastal Plain (Appendix E2), Piedmont (Appendix E3), and mountains (Appendix E4). The total number of individuals includes birds recorded during point counts and during "fairway" counts between point counts. Density (in parentheses) is calculated from point count data only. As some surveys consisted of only 9, rather than 18, point counts and "fairway" counts, the number of counts per survey is noted. (CP = Coastal Plain, P = Piedmont, M = mountains)

APPENDIX E1 – Reference Sites

Reference Habitat	Province	# Counts	Habitat Group	DCCO	GTBH	GREG	GNHE
Intact Mature Forest	CP	18	forest	-	-	-	-
Intact Mature Forest	P	18	forest	-	-	-	-
Intact Mature Forest	M	18	forest	-	-	-	-
Early Successional	CP	18	forest	-	-	-	-
Early Successional	P	18	forest	-	-	-	-
Early Successional	M	18	forest	-	-	-	-
Fragmented Forest	CP	18	forest	-	5	5	10 (0.28)
Fragmented Forest	P	18	forest	-	-	-	-
Fragmented Forest	M	18	forest	-	-	-	-
Row Crops	CP	18	agriculture	-	-	-	-
Row Crops	P	18	agriculture	-	-	-	-
Row Crops	M	18	agriculture	-	-	-	-
Pasture	CP	18	agriculture	-	-	-	-
Pasture	P	9	agriculture	-	1	-	-
Pasture	M	18	agriculture	-	-	-	-
Grassland/Hay Field	CP	18	agriculture	-	-	-	-
Grassland/Hay Field	P	18	agriculture	-	-	-	-
Grassland/Hay Field	M	18	agriculture	-	-	-	-
Low-density Suburban	CP	18	developed	-	2	-	-
Low-density Suburban	P	18	developed	-	-	-	-
Low-density Suburban	M	18	developed	-	-	-	1
High-density Suburban	CP	18	developed	-	-	-	1 (0.07)
High-density Suburban	P	18	developed	-	-	-	1
High-density Suburban	M	18	developed	-	-	-	-
Urban	CP	18	developed	-	1 (0.07)	-	-
Urban	P	9	developed	-	-	-	-
Urban	M	18	developed	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	YCNH	MUSW	CAGO	WODU	ABDU	MALL	BLVU
Intact Mature Forest	CP	-	-	1	1 (0.07)	-	-	-
Intact Mature Forest	P	-	-	-	-	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	-
Early Successional	CP	-	-	-	-	-	-	-
Early Successional	P	-	-	-	-	-	-	-
Early Successional	M	-	-	-	-	-	-	-
Fragmented Forest	CP	-	-	6	1	-	1	-
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	-	-	-	1	-	-	-
Row Crops	CP	-	-	-	-	-	-	-
Row Crops	P	-	-	-	-	-	-	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	-	-	1	1	-	-	1 (0.07)
Pasture	P	-	-	-	-	-	-	-
Pasture	M	-	-	-	-	-	2	-
Grassland/Hay Field	CP	-	-	-	-	-	-	-
Grassland/Hay Field	P	-	-	-	-	-	-	-
Grassland/Hay Field	M	-	-	-	-	-	-	-
Low-density Suburban	CP	-	-	-	-	-	-	1
Low-density Suburban	P	-	-	-	-	-	1 (0.07)	-
Low-density Suburban	M	-	-	-	-	-	-	1
High-density Suburban	CP	-	-	2	-	-	-	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	2	-	-	-	-	3 (0.07)	-
Urban	P	-	-	32	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	TUVU	OSPR	BAEA	SSHA	COHA	RSHA	BWHA
Intact Mature Forest	CP	-	-	-	-	-	-	-
Intact Mature Forest	P	-	-	-	-	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	-
Early Successional	CP	-	-	-	-	-	1 (0.07)	-
Early Successional	P	1	-	-	-	-	-	-
Early Successional	M	-	-	-	-	-	1	-
Fragmented Forest	CP	-	7 (0.21)	-	-	-	-	-
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	1	1	-	-	1	1 (0.07)	-
Row Crops	CP	-	-	-	-	-	-	-
Row Crops	P	-	-	-	-	-	-	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	1 (0.07)	-	-	-	1 (0.07)	-	-
Pasture	P	-	-	-	-	-	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	-	-	-	-	-	-	-
Grassland/Hay Field	P	-	-	-	-	-	-	-
Grassland/Hay Field	M	3 (0.14)	-	-	-	-	-	-
Low-density Suburban	CP	4 (0.21)	3	-	1	1	1	-
Low-density Suburban	P	-	-	-	-	-	-	-
Low-density Suburban	M	3 (0.14)	-	-	-	-	-	1
High-density Suburban	CP	2	-	-	-	-	2 (0.07)	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	-	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	RTHA	RUGR	WITU	NOBO	KILL	LAGU	HERG
Intact Mature Forest	CP	-	-	-	-	-	-	-
Intact Mature Forest	P	-	-	-	-	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	-
Early Successional	CP	1 (0.07)	-	1	-	-	-	-
Early Successional	P	-	-	-	-	-	-	-
Early Successional	M	-	3 (0.07)	-	-	-	-	-
Fragmented Forest	CP	-	-	-	-	2 (0.07)	-	-
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	-	-	-	-	-	-	-
Row Crops	CP	1 (0.07)	-	2 (0.14)	18 (0.92)	-	-	-
Row Crops	P	-	-	-	2	-	-	-
Row Crops	M	-	-	-	-	1 (0.07)	-	-
Pasture	CP	1 (0.07)	-	-	5 (0.21)	2 (0.14)	-	-
Pasture	P	-	-	-	5	2	-	-
Pasture	M	-	-	-	-	3 (0.14)	-	-
Grassland/Hay Field	CP	1	-	-	3 (0.14)	6 (0.28)	-	-
Grassland/Hay Field	P	-	-	-	9 (0.42)	1 (0.07)	-	-
Grassland/Hay Field	M	-	-	1	-	-	-	-
Low-density Suburban	CP	-	-	-	4 (0.07)	-	-	-
Low-density Suburban	P	-	-	-	-	-	-	-
Low-density Suburban	M	-	-	-	-	2 (0.07)	-	-
High-density Suburban	CP	-	-	-	-	-	-	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	-	-	-	-	-	15 (0.85)	-
Urban	P	-	-	-	-	1 (0.14)	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	ROYT	COTE	FOTE	LETE	RODO	MODO	BBCU
Intact Mature Forest	CP	-	-	-	-	-	1	-
Intact Mature Forest	P	-	-	-	-	-	1 (0.07)	1
Intact Mature Forest	M	-	-	-	-	-	-	-
Early Successional	CP	-	-	-	-	-	1	-
Early Successional	P	-	-	-	-	-	-	-
Early Successional	M	-	-	-	-	-	-	-
Fragmented Forest	CP	-	-	-	-	-	13 (0.21)	-
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	-	-	-	-	-	-	-
Row Crops	CP	-	-	-	-	-	8 (0.50)	-
Row Crops	P	-	-	-	-	3 (0.07)	11 (0.42)	-
Row Crops	M	-	-	-	-	1 (0.07)	4 (0.14)	-
Pasture	CP	-	-	-	-	2 (0.14)	15 (0.35)	-
Pasture	P	-	-	-	-	1	5	-
Pasture	M	-	-	-	-	-	5 (0.28)	-
Grassland/Hay Field	CP	-	-	-	-	-	1	-
Grassland/Hay Field	P	-	-	-	-	-	6 (0.21)	-
Grassland/Hay Field	M	-	-	-	-	-	1	-
Low-density Suburban	CP	-	-	-	-	1	18 (0.50)	-
Low-density Suburban	P	-	-	-	-	-	3 (0.07)	-
Low-density Suburban	M	-	-	-	-	-	13 (0.35)	-
High-density Suburban	CP	-	-	-	-	14 (0.21)	7 (0.35)	-
High-density Suburban	P	-	-	-	-	3 (0.07)	40 (1.06)	-
High-density Suburban	M	-	-	-	-	-	17 (0.71)	-
Urban	CP	-	-	-	-	50 (1.77)	12 (0.42)	-
Urban	P	-	-	-	-	2	2	-
Urban	M	-	-	-	-	2	16 (0.57)	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	YBCU	BNOW	EASO	GHOW	BAOW	CONI	CHSW
Intact Mature Forest	CP	1	-	-	-	1	-	1
Intact Mature Forest	P	4 (0.14)	-	1	-	2	-	-
Intact Mature Forest	M	-	-	-	-	-	-	2 (0.14)
Early Successional	CP	-	-	-	-	-	-	-
Early Successional	P	1 (0.07)	-	-	-	-	-	-
Early Successional	M	-	-	1 (0.07)	-	-	-	-
Fragmented Forest	CP	-	-	-	-	-	-	4 (0.07)
Fragmented Forest	P	1 (0.07)	-	-	-	-	-	1 (0.07)
Fragmented Forest	M	1 (0.07)	-	-	-	-	-	-
Row Crops	CP	1 (0.07)	1 (0.07)	-	-	-	-	9 (0.07)
Row Crops	P	1	-	1 (0.07)	-	-	-	3 (0.14)
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	-	-	-	-	-	-	4 (0.14)
Pasture	P	-	-	-	-	-	-	1
Pasture	M	-	-	-	-	-	-	4 (0.21)
Grassland/Hay Field	CP	-	-	-	-	-	-	-
Grassland/Hay Field	P	-	-	-	-	-	-	1 (0.07)
Grassland/Hay Field	M	-	-	-	-	-	-	1
Low-density Suburban	CP	-	-	-	-	-	-	9 (0.28)
Low-density Suburban	P	-	-	-	-	-	-	1
Low-density Suburban	M	-	-	-	-	-	-	5 (0.21)
High-density Suburban	CP	-	-	-	-	1	-	7 (0.14)
High-density Suburban	P	-	-	-	-	-	-	12 (0.42)
High-density Suburban	M	-	-	-	-	-	-	10 (0.50)
Urban	CP	-	-	-	-	-	-	19 (0.78)
Urban	P	-	-	-	-	-	-	24 (1.27)
Urban	M	-	-	-	-	-	-	17 (0.57)

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	RTHU	BEKI	RHWO	RBWO	DOWO	HAWO	NOFL
Intact Mature Forest	CP	2 (0.07)	-	-	13 (0.21)	6 (0.14)	-	3
Intact Mature Forest	P	-	-	-	5 (0.07)	5 (0.28)	2 (0.14)	1
Intact Mature Forest	M	-	-	-	-	4 (0.07)	-	-
Early Successional	CP	-	-	-	5 (0.21)	3 (0.21)	-	3 (0.14)
Early Successional	P	-	-	1	-	4 (0.07)	-	1 (0.07)
Early Successional	M	1	-	-	-	-	1	-
Fragmented Forest	CP	-	-	2 (0.07)	6 (0.21)	2	-	2 (0.07)
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	-	-	-	-	7 (0.28)	-	1 (0.07)
Row Crops	CP	1	-	-	5 (0.21)	1 (0.07)	-	2 (0.07)
Row Crops	P	-	-	-	2 (0.07)	3 (0.07)	-	4
Row Crops	M	1	-	-	-	-	-	-
Pasture	CP	-	-	-	2 (0.07)	3 (0.07)	-	-
Pasture	P	-	-	-	5	2	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	1	-	-	-	-	-	2 (0.07)
Grassland/Hay Field	P	-	-	-	-	-	-	-
Grassland/Hay Field	M	-	-	-	-	1	-	2
Low-density Suburban	CP	3 (0.07)	-	-	11 (0.28)	2 (0.07)	-	2
Low-density Suburban	P	-	-	-	3 (0.07)	1	-	1 (0.07)
Low-density Suburban	M	-	-	-	2 (0.07)	-	-	-
High-density Suburban	CP	2 (0.07)	-	-	16 (0.35)	7 (0.28)	-	1 (0.07)
High-density Suburban	P	-	-	-	5 (0.14)	4 (0.14)	-	3
High-density Suburban	M	-	-	-	2 (0.14)	-	-	1
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	-	1 (0.14)	-	-	-
Urban	M	-	-	-	2 (0.07)	2 (0.07)	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	PIWO	EAWP	ACFL	WIFL	EAPH	GCFL	EAKI
Intact Mature Forest	CP	3	17 (0.42)	20 (0.78)	-	-	11 (0.28)	-
Intact Mature Forest	P	4 (0.07)	8 (0.14)	7 (0.28)	-	2 (0.07)	8 (0.42)	-
Intact Mature Forest	M	1 (0.07)	1	1 (0.07)	-	1	5 (0.28)	-
Early Successional	CP	1 (0.07)	3 (0.07)	10 (0.57)	-	-	8 (0.57)	-
Early Successional	P	-	3 (0.14)	2 (0.07)	-	-	-	-
Early Successional	M	-	1	-	-	1	-	-
Fragmented Forest	CP	2	2	18 (0.14)	-	5 (0.14)	6 (0.14)	-
Fragmented Forest	P	-	-	2 (0.14)	-	-	-	-
Fragmented Forest	M	-	9 (0.28)	2 (0.07)	-	4 (0.14)	3 (0.14)	-
Row Crops	CP	1 (0.07)	4 (0.14)	7 (0.28)	-	2 (0.07)	1 (0.07)	-
Row Crops	P	-	-	-	2 (0.07)	2 (0.14)	4	3 (0.14)
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	1	1	-	-	5 (0.07)	1	1
Pasture	P	1	4	-	-	-	1	-
Pasture	M	-	-	-	-	-	-	1 (0.07)
Grassland/Hay Field	CP	-	2	-	-	-	-	-
Grassland/Hay Field	P	-	-	-	-	2 (0.14)	-	2 (0.07)
Grassland/Hay Field	M	-	-	-	-	1	-	2
Low-density Suburban	CP	1	1 (0.07)	3 (0.21)	-	1 (0.07)	7 (0.14)	1 (0.07)
Low-density Suburban	P	2 (0.14)	2 (0.07)	-	-	2 (0.07)	1 (0.07)	-
Low-density Suburban	M	-	-	-	-	2 (0.14)	-	1 (0.07)
High-density Suburban	CP	2 (0.07)	5 (0.07)	-	-	-	11 (0.50)	-
High-density Suburban	P	-	1 (0.07)	-	-	-	-	-
High-density Suburban	M	-	-	-	-	1	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	1	2 (0.14)	-	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	PUMA	TRES	NRWS	BANS	BARS	BLJA	AMCR
Intact Mature Forest	CP	-	-	-	-	-	9 (0.35)	7
Intact Mature Forest	P	-	-	-	-	-	9 (0.35)	9 (0.14)
Intact Mature Forest	M	-	-	-	-	-	1 (0.07)	1 (0.07)
Early Successional	CP	-	-	-	-	-	1	5 (0.21)
Early Successional	P	-	-	2 (0.07)	-	-	1 (0.07)	1 (0.07)
Early Successional	M	-	-	-	-	-	3 (0.07)	2
Fragmented Forest	CP	5	1	1 (0.07)	-	-	2 (0.07)	15 (0.14)
Fragmented Forest	P	-	1 (0.07)	-	-	-	1 (0.07)	3 (0.14)
Fragmented Forest	M	-	-	-	-	-	4 (0.28)	7 (0.21)
Row Crops	CP	-	-	-	-	1 (0.07)	-	10 (0.28)
Row Crops	P	-	-	2 (0.07)	-	7 (0.28)	1 (0.07)	6 (0.21)
Row Crops	M	-	-	1 (0.07)	-	-	2	2 (0.07)
Pasture	CP	2	-	2 (0.07)	-	14 (0.57)	5 (0.07)	9 (0.21)
Pasture	P	-	-	-	-	3	5	9 (0.14)
Pasture	M	-	-	1 (0.07)	-	7 (0.35)	3 (0.07)	2 (0.07)
Grassland/Hay Field	CP	1	-	1	-	1	2	1
Grassland/Hay Field	P	-	2 (0.14)	2 (0.14)	-	2 (0.07)	1 (0.07)	16 (0.64)
Grassland/Hay Field	M	-	-	-	-	-	-	4
Low-density Suburban	CP	-	-	-	-	13 (0.42)	5 (0.14)	11 (0.35)
Low-density Suburban	P	-	-	1 (0.07)	-	-	5 (0.14)	8 (0.21)
Low-density Suburban	M	-	3 (0.14)	-	-	-	3 (0.14)	12 (0.50)
High-density Suburban	CP	7	-	-	-	2 (0.07)	10 (0.28)	10 (0.14)
High-density Suburban	P	9 (0.57)	-	-	-	-	15 (0.14)	3
High-density Suburban	M	-	6 (0.21)	2 (0.07)	-	2 (0.07)	7 (0.14)	6 (0.21)
Urban	CP	-	-	-	-	-	2	14 (0.64)
Urban	P	-	-	-	-	4 (0.14)	4 (0.14)	10 (0.57)
Urban	M	-	-	-	-	1 (0.07)	24 (0.35)	18 (0.50)

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	FICR	CORA	BCCH	CACH	TUTI	WBNU	BHNU
Intact Mature Forest	CP	-	-	-	11 (0.21)	19 (0.85)	13 (0.14)	-
Intact Mature Forest	P	-	1	-	16 (0.92)	8 (0.35)	8 (0.35)	-
Intact Mature Forest	M	-	-	-	1	3 (0.21)	3 (0.14)	-
Early Successional	CP	3 (0.07)	-	-	6 (0.21)	11 (0.57)	2	-
Early Successional	P	-	-	-	-	2 (0.07)	1 (0.07)	-
Early Successional	M	-	2 (0.07)	1 (0.07)	-	1	-	-
Fragmented Forest	CP	4 (0.07)	-	-	11 (0.14)	18 (0.50)	6 (0.14)	-
Fragmented Forest	P	-	-	-	7 (0.50)	8 (0.42)	-	-
Fragmented Forest	M	-	-	-	6 (0.35)	13 (0.57)	6 (0.21)	-
Row Crops	CP	-	-	-	3 (0.14)	6 (0.28)	2 (0.14)	-
Row Crops	P	1 (0.07)	-	-	1 (0.07)	2	1	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	4 (0.07)	-	-	-	2 (0.07)	-	-
Pasture	P	-	-	-	2	-	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	2 (0.14)	-	-	-	1	-	-
Grassland/Hay Field	P	-	-	-	-	1	-	-
Grassland/Hay Field	M	-	-	-	6 (0.07)	2	1 (0.07)	-
Low-density Suburban	CP	4 (0.07)	-	-	9 (0.14)	9 (0.21)	3	-
Low-density Suburban	P	-	-	-	4 (0.28)	4 (0.21)	2 (0.07)	-
Low-density Suburban	M	-	-	-	10 (0.35)	1 (0.07)	2 (0.07)	-
High-density Suburban	CP	4 (0.07)	-	-	9 (0.28)	10 (0.35)	6 (0.21)	-
High-density Suburban	P	-	-	-	9 (0.07)	4 (0.07)	1 (0.07)	-
High-density Suburban	M	-	-	-	-	1	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	2 (0.14)	-	-	1	1	-	-
Urban	M	-	-	-	9 (0.28)	8 (0.14)	1	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	CARW	HOWR	BGGN	EABL	VEER	WOTH	AMRO
Intact Mature Forest	CP	12 (0.42)	-	9 (0.21)	1	-	17 (0.50)	15 (0.42)
Intact Mature Forest	P	11 (0.64)	-	5 (0.07)	-	-	13 (0.50)	-
Intact Mature Forest	M	-	-	-	-	3 (0.21)	2 (0.14)	2 (0.14)
Early Successional	CP	8 (0.28)	1 (0.07)	10 (0.42)	-	-	3 (0.14)	4 (0.14)
Early Successional	P	2 (0.14)	-	8 (0.28)	-	-	3 (0.14)	-
Early Successional	M	-	-	-	-	11 (0.42)	-	-
Fragmented Forest	CP	15 (0.35)	1	17 (0.57)	2	-	1	24 (0.71)
Fragmented Forest	P	8 (0.21)	-	6 (0.35)	-	-	1	-
Fragmented Forest	M	2 (0.07)	-	20 (0.57)	-	-	-	10 (0.14)
Row Crops	CP	11 (0.71)	-	7 (0.35)	3 (0.14)	-	3 (0.07)	-
Row Crops	P	3 (0.14)	-	1 (0.07)	10 (0.21)	-	-	10 (0.14)
Row Crops	M	-	-	-	-	-	-	5 (0.28)
Pasture	CP	2 (0.07)	-	-	9 (0.28)	-	-	13 (0.50)
Pasture	P	4 (0.14)	-	1	3	-	-	1
Pasture	M	-	-	-	-	-	-	19 (0.50)
Grassland/Hay Field	CP	1	-	-	1 (0.07)	-	-	3
Grassland/Hay Field	P	3 (0.21)	-	-	4 (0.14)	-	-	2 (0.14)
Grassland/Hay Field	M	2	-	1 (0.07)	-	-	-	1
Low-density Suburban	CP	7 (0.28)	1	6 (0.14)	16 (0.28)	-	-	23 (0.78)
Low-density Suburban	P	7 (0.35)	-	-	2 (0.14)	-	3 (0.21)	5 (0.28)
Low-density Suburban	M	3 (0.21)	6 (0.21)	-	12 (0.21)	-	-	22 (0.85)
High-density Suburban	CP	11 (0.35)	8 (0.21)	2 (0.07)	10 (0.28)	-	2 (0.07)	42 (0.92)
High-density Suburban	P	8 (0.28)	5 (0.14)	-	1	-	2 (0.07)	53 (1.56)
High-density Suburban	M	1	3	-	4 (0.14)	-	-	46 (1.34)
Urban	CP	-	-	-	-	-	-	17 (0.78)
Urban	P	-	-	-	-	-	-	9 (0.42)
Urban	M	5 (0.28)	7 (0.42)	-	2 (0.14)	-	-	50 (1.34)

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	GRCA	NOMO	BRTH	CEDW	EUST	WEVI	BHVI
Intact Mature Forest	CP	1	-	1 (0.07)	-	1 (0.07)	-	-
Intact Mature Forest	P	-	-	-	-	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	1
Early Successional	CP	-	-	-	-	-	5 (0.35)	-
Early Successional	P	-	-	1	1 (0.07)	-	11 (0.28)	-
Early Successional	M	3 (0.07)	-	-	2 (0.14)	-	1 (0.07)	2 (0.07)
Fragmented Forest	CP	7 (0.21)	2	-	-	8 (0.14)	2 (0.07)	-
Fragmented Forest	P	1 (0.07)	-	-	-	-	-	-
Fragmented Forest	M	-	-	-	-	-	-	-
Row Crops	CP	-	1 (0.07)	-	5 (0.21)	-	4 (0.14)	-
Row Crops	P	12 (0.42)	2 (0.07)	-	2	17 (0.71)	-	-
Row Crops	M	1 (0.07)	-	2 (0.07)	-	7 (0.28)	-	-
Pasture	CP	-	18 (0.50)	2 (0.07)	1	33 (1.06)	1 (0.07)	-
Pasture	P	-	6	-	-	1	-	-
Pasture	M	1 (0.07)	4 (0.14)	-	-	1	-	-
Grassland/Hay Field	CP	4 (0.21)	-	3 (0.07)	-	-	-	-
Grassland/Hay Field	P	2 (0.14)	2 (0.14)	2 (0.14)	-	10 (0.71)	-	-
Grassland/Hay Field	M	-	-	-	-	-	-	-
Low-density Suburban	CP	2 (0.07)	16 (0.42)	8 (0.07)	2 (0.07)	14 (0.57)	-	-
Low-density Suburban	P	-	9 (0.21)	4 (0.28)	-	-	-	-
Low-density Suburban	M	5 (0.14)	11 (0.50)	1 (0.07)	5 (0.21)	7 (0.28)	-	-
High-density Suburban	CP	12 (0.14)	14 (0.35)	6 (0.14)	1	9 (0.35)	-	-
High-density Suburban	P	18 (0.71)	26 (0.57)	2 (0.14)	1	24 (0.92)	-	-
High-density Suburban	M	6 (0.28)	33 (1.27)	2 (0.07)	-	24 (0.92)	-	-
Urban	CP	-	14 (0.50)	-	-	131 (2.33)	-	-
Urban	P	4 (0.28)	14 (0.71)	-	-	24 (1.13)	-	-
Urban	M	7 (0.28)	16 (0.35)	-	-	86 (2.48)	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	YTVI	WAVI	REVI	NOPA	YWAR	CSWA	BTBW
Intact Mature Forest	CP	-	-	17 (0.28)	-	-	-	-
Intact Mature Forest	P	-	-	13 (0.28)	-	-	-	-
Intact Mature Forest	M	-	-	18 (0.50)	-	-	-	1 (0.07)
Early Successional	CP	-	-	1 (0.07)	1 (0.07)	-	-	-
Early Successional	P	1 (0.07)	-	5 (0.28)	-	1	-	-
Early Successional	M	-	-	20 (0.57)	-	-	38 (1.34)	-
Fragmented Forest	CP	-	-	12 (0.14)	-	-	-	-
Fragmented Forest	P	-	-	5 (0.14)	-	-	-	-
Fragmented Forest	M	-	-	14 (0.57)	-	-	-	-
Row Crops	CP	-	-	8 (0.28)	1 (0.07)	-	-	-
Row Crops	P	-	-	1	-	-	-	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	-	-	1 (0.07)	1	-	-	-
Pasture	P	-	-	4 (0.14)	-	-	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	-	-	-	-	-	-	-
Grassland/Hay Field	P	1 (0.07)	-	-	-	-	-	-
Grassland/Hay Field	M	-	-	4	-	-	-	-
Low-density Suburban	CP	-	-	2 (0.07)	-	-	-	-
Low-density Suburban	P	-	-	2 (0.07)	-	-	-	-
Low-density Suburban	M	-	-	1	-	-	-	-
High-density Suburban	CP	-	-	-	1 (0.07)	-	-	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	-	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	BTNW	YTWA	PIWA	PRAW	CERW	BAWW	AMRE
Intact Mature Forest	CP	-	-	3 (0.14)	-	-	-	-
Intact Mature Forest	P	-	-	1 (0.07)	-	-	-	-
Intact Mature Forest	M	1 (0.07)	-	1 (0.07)	-	-	5 (0.21)	-
Early Successional	CP	-	-	-	-	-	-	-
Early Successional	P	-	-	-	13 (0.50)	-	2 (0.07)	-
Early Successional	M	-	-	-	-	-	-	1 (0.07)
Fragmented Forest	CP	-	1	7 (0.21)	-	-	-	-
Fragmented Forest	P	-	-	-	-	-	-	-
Fragmented Forest	M	-	-	10 (0.57)	-	-	2 (0.07)	-
Row Crops	CP	-	-	5 (0.14)	10 (0.42)	-	1 (0.07)	-
Row Crops	P	-	-	-	-	-	-	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	-	-	-	-	-	-	-
Pasture	P	-	-	-	2	-	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	-	-	-	6 (0.07)	-	-	-
Grassland/Hay Field	P	-	-	-	1 (0.07)	-	-	-
Grassland/Hay Field	M	-	-	2	-	-	-	-
Low-density Suburban	CP	-	-	3 (0.14)	1	-	-	-
Low-density Suburban	P	-	-	1 (0.07)	3 (0.21)	-	-	-
Low-density Suburban	M	-	-	-	-	-	-	-
High-density Suburban	CP	-	-	4 (0.21)	-	-	-	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	-	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	PROW	WEWA	OVEN	LOWA	KEWA	COYE	HOWA
Intact Mature Forest	CP	-	-	10 (0.14)	4	-	-	-
Intact Mature Forest	P	-	13 (0.64)	8 (0.14)	-	-	-	1 (0.07)
Intact Mature Forest	M	-	-	18 (0.57)	-	-	-	-
Early Successional	CP	-	-	1 (0.07)	-	-	2 (0.14)	-
Early Successional	P	-	-	6 (0.28)	-	-	6 (0.28)	4 (0.28)
Early Successional	M	-	-	-	-	-	-	-
Fragmented Forest	CP	3 (0.14)	-	5 (0.07)	2 (0.07)	-	9 (0.21)	-
Fragmented Forest	P	-	-	-	1 (0.07)	-	2	-
Fragmented Forest	M	-	4 (0.28)	9 (0.50)	-	-	-	-
Row Crops	CP	-	-	6 (0.21)	-	-	3 (0.14)	-
Row Crops	P	-	-	-	-	-	2	-
Row Crops	M	-	-	-	-	-	-	-
Pasture	CP	-	-	-	-	-	1 (0.07)	-
Pasture	P	-	-	-	-	-	-	-
Pasture	M	-	-	-	-	-	-	-
Grassland/Hay Field	CP	-	-	-	-	-	28 (0.92)	-
Grassland/Hay Field	P	-	-	-	-	-	6 (0.21)	-
Grassland/Hay Field	M	-	-	2	1	-	-	-
Low-density Suburban	CP	-	-	-	-	-	2 (0.07)	-
Low-density Suburban	P	-	-	1	-	-	1 (0.07)	-
Low-density Suburban	M	-	-	-	-	-	-	-
High-density Suburban	CP	-	-	-	-	-	-	-
High-density Suburban	P	-	-	-	-	-	-	-
High-density Suburban	M	-	-	-	-	-	-	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	-	-	-	-	-
Urban	M	-	-	-	-	-	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	CAWA	YBCH	SUTA	SCTA	NOCA	RBGR	BLGR
Intact Mature Forest	CP	-	-	2 (0.07)	4	11 (0.42)	-	-
Intact Mature Forest	P	-	-	-	3	13 (0.50)	-	-
Intact Mature Forest	M	1 (0.07)	-	-	-	-	1 (0.07)	-
Early Successional	CP	-	-	2 (0.14)	-	25 (1.20)	-	-
Early Successional	P	-	17 (0.57)	-	1	7 (0.28)	-	-
Early Successional	M	-	-	-	3 (0.21)	-	-	-
Fragmented Forest	CP	-	1	2	1	28 (0.78)	-	3 (0.14)
Fragmented Forest	P	-	3 (0.14)	-	-	18 (0.78)	-	-
Fragmented Forest	M	-	-	-	2 (0.07)	3 (0.07)	-	-
Row Crops	CP	-	3 (0.14)	1 (0.07)	3 (0.14)	11 (0.50)	-	3 (0.07)
Row Crops	P	-	-	-	-	7 (0.21)	-	1 (0.07)
Row Crops	M	-	-	-	-	2	-	-
Pasture	CP	-	5 (0.28)	-	-	6 (0.28)	-	5 (0.14)
Pasture	P	-	1	-	-	2	-	-
Pasture	M	-	-	-	-	4 (0.07)	-	-
Grassland/Hay Field	CP	-	-	-	-	-	-	1
Grassland/Hay Field	P	-	4 (0.21)	-	-	2 (0.14)	-	6 (0.28)
Grassland/Hay Field	M	-	-	-	-	4 (0.07)	-	1
Low-density Suburban	CP	-	2 (0.07)	-	-	14 (0.57)	-	1
Low-density Suburban	P	-	1 (0.07)	-	-	6 (0.35)	-	-
Low-density Suburban	M	-	-	-	-	15 (0.57)	-	-
High-density Suburban	CP	-	-	-	-	28 (0.71)	-	-
High-density Suburban	P	-	1	-	-	19 (0.35)	-	-
High-density Suburban	M	-	-	-	-	9 (0.21)	-	-
Urban	CP	-	1	-	-	2 (0.07)	-	-
Urban	P	-	-	-	-	1	-	-
Urban	M	-	-	-	-	20 (0.64)	-	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	INBU	EATO	CHSP	FISP	GRSP	SOSP	DEJU
Intact Mature Forest	CP	-	2 (0.07)	-	-	-	-	-
Intact Mature Forest	P	2 (0.14)	2	-	1	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	5 (0.21)
Early Successional	CP	7 (0.35)	-	-	-	-	-	-
Early Successional	P	9 (0.21)	11 (0.50)	-	7 (0.14)	-	-	-
Early Successional	M	20 (0.64)	24 (0.78)	-	-	-	-	16 (0.35)
Fragmented Forest	CP	3	2 (0.07)	6 (0.28)	-	-	4 (0.07)	-
Fragmented Forest	P	7 (0.28)	1 (0.07)	-	-	-	1 (0.07)	-
Fragmented Forest	M	7 (0.35)	1 (0.07)	2 (0.14)	-	-	1 (0.07)	-
Row Crops	CP	15 (1.06)	1 (0.07)	15 (0.78)	1 (0.07)	1	-	-
Row Crops	P	19 (0.64)	-	4 (0.14)	-	8 (0.21)	14 (0.50)	-
Row Crops	M	4 (0.07)	1 (0.07)	-	-	-	-	-
Pasture	CP	8	-	20 (0.71)	1	2 (0.07)	3 (0.07)	-
Pasture	P	7	2	3 (0.14)	3 (0.14)	3 (0.14)	-	-
Pasture	M	-	1 (0.07)	-	1	-	1 (0.07)	-
Grassland/Hay Field	CP	17 (0.64)	1 (0.07)	-	9 (0.42)	26 (0.92)	-	-
Grassland/Hay Field	P	15 (0.85)	2 (0.14)	5 (0.21)	7 (0.35)	2 (0.14)	2	-
Grassland/Hay Field	M	21 (1.20)	5 (0.14)	5 (0.21)	8 (0.28)	-	1 (0.07)	-
Low-density Suburban	CP	6 (0.14)	7 (0.07)	13 (0.42)	6 (0.28)	-	15 (0.35)	-
Low-density Suburban	P	8 (0.50)	8 (0.42)	1 (0.07)	4 (0.14)	-	-	-
Low-density Suburban	M	2	8 (0.21)	16 (0.64)	2 (0.07)	-	17 (0.57)	-
High-density Suburban	CP	-	4	4 (0.07)	-	-	12 (0.35)	-
High-density Suburban	P	-	-	-	1	-	31 (0.85)	-
High-density Suburban	M	-	6 (0.21)	1 (0.07)	-	-	31 (1.06)	-
Urban	CP	-	-	-	-	-	-	-
Urban	P	-	-	13 (0.71)	3 (0.42)	-	1	-
Urban	M	-	-	-	-	-	32 (0.78)	-

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	RWBL	EAME	COGR	BHCO	OROR	NOOR	HOFI
Intact Mature Forest	CP	-	-	2	10 (0.35)	-	-	2 (0.07)
Intact Mature Forest	P	-	-	-	4 (0.14)	-	-	-
Intact Mature Forest	M	-	-	-	-	-	-	-
Early Successional	CP	5 (0.07)	-	4 (0.14)	-	1 (0.07)	-	2
Early Successional	P	-	-	1	2 (0.14)	-	-	-
Early Successional	M	-	-	-	-	-	-	-
Fragmented Forest	CP	8 (0.07)	-	29 (1.27)	7 (0.14)	-	-	3 (0.07)
Fragmented Forest	P	1	-	2 (0.14)	4 (0.21)	1 (0.07)	-	1
Fragmented Forest	M	-	-	-	-	-	-	-
Row Crops	CP	-	-	-	3 (0.14)	-	-	-
Row Crops	P	6 (0.28)	2	29 (0.99)	9 (0.28)	-	2 (0.07)	-
Row Crops	M	1	-	9 (0.21)	2 (0.07)	-	-	-
Pasture	CP	9 (0.21)	2 (0.14)	20 (0.71)	4 (0.14)	6 (0.28)	-	14 (0.28)
Pasture	P	1	8 (0.14)	1 (0.14)	-	2 (0.14)	-	-
Pasture	M	14 (0.71)	15 (0.85)	16 (0.64)	-	-	-	1
Grassland/Hay Field	CP	2	24 (0.57)	4	2 (0.07)	-	-	-
Grassland/Hay Field	P	7 (0.35)	4 (0.28)	8 (0.57)	3 (0.21)	1 (0.07)	-	-
Grassland/Hay Field	M	-	1 (0.07)	-	-	-	-	-
Low-density Suburban	CP	2	2	30 (0.57)	17 (0.35)	3 (0.07)	-	37 (0.85)
Low-density Suburban	P	2 (0.07)	-	3 (0.07)	-	1 (0.07)	-	1
Low-density Suburban	M	2 (0.07)	4 (0.07)	14 (0.50)	1	-	-	12 (0.64)
High-density Suburban	CP	1 (0.07)	-	31 (0.85)	2 (0.07)	1 (0.07)	-	34 (0.64)
High-density Suburban	P	-	-	25 (0.64)	7 (0.14)	3 (0.07)	-	39 (1.41)
High-density Suburban	M	3 (0.21)	2 (0.07)	57 (1.56)	17 (0.57)	-	-	18 (0.50)
Urban	CP	-	-	28 (1.13)	-	-	-	4
Urban	P	-	-	1 (0.14)	1 (0.14)	-	-	1
Urban	M	-	-	24 (0.57)	2	-	-	10 (0.07)

APPENDIX E1 – Reference Sites (cont.)

Reference Habitat	Province	AMGO	HOSP
Intact Mature Forest	CP	8 (0.42)	-
Intact Mature Forest	P	2 (0.14)	-
Intact Mature Forest	M	-	-
Early Successional	CP	1	-
Early Successional	P	5 (0.07)	-
Early Successional	M	2 (0.07)	-
Fragmented Forest	CP	10 (0.28)	1 (0.07)
Fragmented Forest	P	4 (0.21)	-
Fragmented Forest	M	5 (0.07)	-
Row Crops	CP	13 (0.92)	-
Row Crops	P	20 (0.92)	-
Row Crops	M	3 (0.14)	12 (0.28)
Pasture	CP	4 (0.14)	4 (0.14)
Pasture	P	2 (0.14)	1
Pasture	M	2 (0.07)	1
Grassland/Hay Field	CP	8 (0.14)	1
Grassland/Hay Field	P	5 (0.21)	-
Grassland/Hay Field	M	10 (0.50)	-
Low-density Suburban	CP	16 (0.42)	5 (0.14)
Low-density Suburban	P	2 (0.07)	-
Low-density Suburban	M	14 (0.57)	-
High-density Suburban	CP	15 (0.42)	12 (0.21)
High-density Suburban	P	2	9 (0.35)
High-density Suburban	M	11 (0.35)	4
Urban	CP	-	15 (0.42)
Urban	P	1 (0.14)	10 (0.42)
Urban	M	5	22 (0.71)

APPENDIX E2 – Golf Courses in Coastal Plain

Golf Course	# Counts	DCCO	GTBH	GREG	GNHE	YCNH	MUSW	CAGO
Aquia Harbour	9	-	-	-	-	-	-	-
Augustine	18	-	1 (0.07)	-	-	-	-	21 (0.92)
Bay Creek	18	2	2 (0.07)	2 (0.07)	2 (0.07)	-	-	6 (0.35)
Belle Haven	18	-	-	2	-	-	-	58 (0.71)
Bide-a-wee	18	-	-	-	1 (0.07)	-	-	-
Chesapeake	18	-	-	-	-	-	-	89 (0.35)
Colonial	18	-	-	-	-	-	-	-
Eaglewood (Blue)	18	-	-	-	-	-	-	-
Eaglewood (Red)	18	-	-	-	-	-	-	1
Eastern Shore	18	-	2	1	-	-	-	6
Elizabeth Manor	18	-	-	3 (0.14)	-	1 (0.07)	-	-
Ford's Colony	18	-	2	-	-	-	-	15
Four Winds	18	-	-	-	-	-	-	-
Fredericksburg	18	-	-	-	-	-	-	3
Golden Horseshoe (Green)	18	-	1 (0.07)	-	1	-	-	4 (0.28)
Hamptons	18	-	1	4 (0.14)	1	-	-	16 (0.71)
Hell's Point	18	-	2	-	-	-	-	36 (1.13)
Hobbs Hole	18	-	-	-	-	-	-	9 (0.64)
Kiln Creek (Championship)	18	1	6 (0.28)	2 (0.07)	2	-	-	121 (0.42)
Kiln Creek (Creek)	9	-	2	-	1	-	-	11 (0.14)
Kingsmill (Plantation)	18	-	1	1	-	-	-	4 (0.14)
Kingsmill (River)	18	-	1 (0.07)	-	-	-	2	3 (0.07)
Kingsmill (Woods)	18	-	-	-	-	-	1 (0.07)	1
Kiskiack	18	-	-	-	1	-	-	1
Lee's Hill	18	1	5 (0.21)	-	1 (0.07)	-	-	6
Newport News (Cardinal)	18	-	-	-	-	-	-	10 (0.71)
Newport News (Deer Run)	18	-	5 (0.28)	1	-	-	-	33 (2.05)
Pohick Bay	18	-	12 (0.50)	-	-	-	-	15
Princess Anne	18	-	1 (0.07)	-	3 (0.14)	-	-	10
Red Wing Lake	18	1	2 (0.07)	1	-	-	-	81 (0.42)
Riverfront	18	-	2 (0.07)	2	1 (0.07)	-	-	10 (0.71)
Royal New Kent	18	-	-	-	-	-	-	1 (0.07)
Stonehouse	18	-	2	-	-	-	-	-
Suffolk	18	-	2 (0.07)	-	1	-	-	-
Two Rivers	18	-	2	-	-	-	-	15
Williamsburg	18	1 (0.07)	2	-	1 (0.07)	-	1	5 (0.21)
Williamsburg National	18	-	2	-	2 (0.07)	-	-	-
Woodlands	18	-	2	4 (0.21)	8 (0.35)	2 (0.14)	-	91 (2.05)
Woodside	9	-	2	-	-	-	-	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	WODU	ABDU	MALL	BLVU	TUVU	OSPR	BAEA	RSHA
Aquia Harbour	-	-	-	-	-	-	-	-
Augustine	-	-	2	-	-	-	-	-
Bay Creek	-	-	-	-	-	1	-	-
Belle Haven	-	-	43 (0.57)	7	-	-	-	-
Bide-a-wee	-	-	4 (0.14)	-	-	-	-	-
Chesapeake	-	-	6 (0.14)	-	-	-	-	-
Colonial	-	-	-	-	-	-	-	1
Eaglewood (Blue)	-	-	-	-	-	-	-	-
Eaglewood (Red)	-	-	2	-	-	-	-	-
Eastern Shore	1	1	1	-	-	1 (0.07)	-	-
Elizabeth Manor	-	-	7 (0.14)	-	-	2	-	-
Ford's Colony	-	-	6	-	-	1	-	1
Four Winds	-	-	-	-	-	-	-	-
Fredericksburg	-	-	-	-	-	-	-	-
Golden Horseshoe (Green)	-	-	2 (0.07)	-	-	-	-	4 (0.21)
Hamptons	2	-	2	-	-	-	-	-
Hell's Point	-	-	-	-	1	2 (0.07)	-	-
Hobbs Hole	-	-	-	-	-	-	-	-
Kiln Creek (Championship)	-	-	5 (0.28)	-	1	1 (0.07)	-	-
Kiln Creek (Creek)	-	-	3	-	-	1 (0.14)	-	-
Kingsmill (Plantation)	-	-	1 (0.07)	-	-	1	-	-
Kingsmill (River)	-	-	3	-	-	-	-	-
Kingsmill (Woods)	2	-	-	-	-	-	-	-
Kiskiack	-	-	1	-	-	-	-	-
Lee's Hill	-	-	-	-	2	-	-	-
Newport News (Cardinal)	-	-	7 (0.14)	-	-	1 (0.07)	-	-
Newport News (Deer Run)	12 (0.85)	-	7 (0.42)	-	-	-	-	1 (0.07)
Pohick Bay	1	-	-	-	-	-	-	2 (0.07)
Princess Anne	-	-	14 (0.92)	-	-	-	-	-
Red Wing Lake	-	-	1	-	-	-	1 (0.07)	-
Riverfront	-	-	3	-	1	1	-	-
Royal New Kent	-	-	-	-	-	-	-	-
Stonehouse	-	-	-	-	-	-	-	1 (0.07)
Suffolk	-	-	1	-	-	-	-	-
Two Rivers	-	-	-	-	-	2 (0.14)	1 (0.07)	-
Williamsburg	-	-	1	-	-	-	-	1
Williamsburg National	-	-	2	-	-	-	-	-
Woodlands	-	-	62 (0.57)	-	1	1	-	-
Woodside	-	-	2	-	-	2	1	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	RTHA	WITU	NOBO	KILL	LAGU	RBGU	HERG	ROTE
Aquia Harbour	-	-	-	-	-	-	-	-
Augustine	-	-	-	-	-	-	-	-
Bay Creek	1	-	3 (0.07)	13 (0.21)	13 (0.92)	-	9	1
Belle Haven	-	-	-	-	-	-	-	-
Bide-a-wee	-	-	-	-	-	-	-	-
Chesapeake	-	-	-	1	-	-	-	-
Colonial	-	-	1	1 (0.07)	-	-	-	-
Eaglewood (Blue)	-	-	-	-	-	-	-	-
Eaglewood (Red)	1	-	-	4 (0.28)	-	-	-	-
Eastern Shore	-	-	4 (0.07)	1	-	-	-	-
Elizabeth Manor	-	-	-	1	-	-	-	-
Ford's Colony	-	-	-	-	-	-	-	-
Four Winds	-	-	2 (0.14)	-	-	-	-	-
Fredericksburg	-	-	-	-	-	-	-	-
Golden Horseshoe (Green)	-	-	-	-	-	-	-	-
Hamptons	-	-	-	8 (0.14)	3 (0.14)	-	-	-
Hell's Point	-	-	-	-	-	-	-	-
Hobbs Hole	-	1 (0.07)	9 (0.07)	3 (0.07)	-	-	-	-
Kiln Creek (Championship)	-	-	-	1	-	-	-	-
Kiln Creek (Creek)	-	-	-	-	1	-	-	-
Kingsmill (Plantation)	-	-	-	-	-	-	-	-
Kingsmill (River)	-	-	-	-	-	-	-	-
Kingsmill (Woods)	1 (0.07)	-	-	-	-	-	-	-
Kiskiack	-	-	-	3 (0.07)	-	-	-	-
Lee's Hill	1	-	-	3 (0.07)	-	-	-	-
Newport News (Cardinal)	-	-	-	-	-	-	-	-
Newport News (Deer Run)	1	-	-	1 (0.07)	-	-	-	-
Pohick Bay	-	-	-	-	-	-	-	-
Princess Anne	-	-	7 (0.28)	-	-	-	-	-
Red Wing Lake	1 (0.07)	-	-	-	-	-	-	-
Riverfront	1	-	2 (0.07)	1 (0.07)	11 (0.42)	-	-	-
Royal New Kent	-	2 (0.14)	-	2 (0.14)	-	-	-	-
Stonehouse	-	-	2 (0.07)	2 (0.14)	-	-	-	-
Suffolk	-	-	-	-	-	-	-	-
Two Rivers	-	-	-	4	-	-	-	-
Williamsburg	1	-	1	1 (0.07)	-	-	-	-
Williamsburg National	-	-	-	1	-	-	-	-
Woodlands	-	-	-	1 (0.07)	13 (0.92)	1*	-	-
Woodside	-	-	-	-	-	-	-	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	COTE	FOTE	LETE	RODO	MODO	YBCU	EASO	GHOW
Aquia Harbour	-	-	-	-	2	-	-	-
Augustine	-	-	-	-	9 (0.57)	-	-	-
Bay Creek	-	1	-	-	3 (0.14)	1	-	-
Belle Haven	-	-	-	-	10 (0.28)	-	-	-
Bide-a-wee	-	-	-	-	5 (0.07)	-	-	-
Chesapeake	-	-	-	-	10 (0.28)	-	-	-
Colonial	-	-	-	1	1	-	-	-
Eaglewood (Blue)	-	-	-	-	6	-	-	-
Eaglewood (Red)	-	-	-	-	18 (0.57)	-	-	-
Eastern Shore	-	-	-	2	17	1	-	-
Elizabeth Manor	-	-	-	2	24 (0.50)	-	-	-
Ford's Colony	-	-	-	-	2	-	-	-
Four Winds	-	-	-	-	-	-	-	-
Fredericksburg	-	-	-	-	7 (0.07)	1	-	-
Golden Horseshoe (Green)	-	-	-	-	-	1	-	-
Hamptons	-	-	1 (0.07)	-	8 (0.07)	-	-	-
Hell's Point	-	-	-	-	2 (0.07)	-	-	-
Hobbs Hole	-	-	-	-	-	-	-	-
Kiln Creek (Championship)	-	-	-	-	12 (0.42)	-	-	-
Kiln Creek (Creek)	1	-	-	-	7 (0.28)	-	-	-
Kingsmill (Plantation)	-	-	-	-	5 (0.14)	-	-	-
Kingsmill (River)	-	-	-	-	10 (0.28)	-	-	-
Kingsmill (Woods)	-	-	-	-	-	-	-	-
Kiskiack	-	-	-	-	-	-	-	-
Lee's Hill	-	-	-	1	2	1 (0.07)	-	-
Newport News (Cardinal)	-	-	-	-	1 (0.07)	-	-	-
Newport News (Deer Run)	-	-	-	-	2 (0.07)	-	-	-
Pohick Bay	-	-	-	-	7 (0.28)	3 (0.21)	1	-
Princess Anne	-	-	-	-	9 (0.35)	-	-	1
Red Wing Lake	-	-	-	-	-	-	-	-
Riverfront	-	-	-	-	16 (0.28)	-	-	-
Royal New Kent	-	-	-	-	1 (0.07)	-	-	-
Stonehouse	-	-	-	-	5 (0.21)	-	-	-
Suffolk	-	-	-	-	2	-	-	-
Two Rivers	-	-	-	-	8 (0.57)	1 (0.07)	-	-
Williamsburg	-	-	-	-	1	-	-	-
Williamsburg National	-	-	-	-	4 (0.21)	-	-	-
Woodlands	-	-	-	14 (0.85)	10 (0.14)	-	-	-
Woodside	-	-	-	-	7 (0.28)	2 (0.28)	-	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	BAOW	CONI	CHSW	RTHU	BEKI	RHWO	RBWO	DOWO
Aquia Harbour	-	-	-	-	-	-	-	3 (0.14)
Augustine	-	-	-	-	-	-	1	2
Bay Creek	-	-	2 (0.07)	1	-	1	11 (0.14)	-
Belle Haven	-	-	56 (2.19)	-	-	-	-	1
Bide-a-wee	-	-	2 (0.07)	1 (0.07)	-	-	2	5 (0.14)
Chesapeake	-	-	8 (0.28)	-	-	-	3 (0.14)	1
Colonial	-	-	1	-	-	-	5 (0.21)	2 (0.14)
Eaglewood (Blue)	-	-	1	-	-	-	-	-
Eaglewood (Red)	-	-	1	-	-	-	1 (0.07)	1 (0.07)
Eastern Shore	-	-	2 (0.07)	-	-	-	3	2 (0.07)
Elizabeth Manor	-	-	3	-	-	-	2 (0.07)	3 (0.07)
Ford's Colony	-	-	5 (0.14)	1	-	-	5 (0.14)	2
Four Winds	-	-	-	-	-	-	-	-
Fredericksburg	-	-	6 (0.28)	-	2	-	5 (0.14)	-
Golden Horseshoe (Green)	-	-	1 (0.07)	-	-	-	4 (0.14)	2 (0.07)
Hamptons	-	-	2 (0.14)	-	-	-	1 (0.07)	-
Hell's Point	-	-	-	-	-	2	1 (0.07)	6 (0.21)
Hobbs Hole	-	1	12 (0.35)	-	-	-	-	-
Kiln Creek (Championship)	-	-	2	-	2 (0.07)	7 (0.07)	4 (0.07)	1
Kiln Creek (Creek)	-	-	1	-	-	7	-	1 (0.14)
Kingsmill (Plantation)	-	-	5 (0.14)	1	-	-	8 (0.21)	-
Kingsmill (River)	-	-	1 (0.07)	-	-	-	2 (0.07)	1 (0.07)
Kingsmill (Woods)	-	-	-	-	-	-	9 (0.57)	-
Kiskiack	-	-	1 (0.07)	-	2 (0.07)	-	2	1
Lee's Hill	1 (0.07)	-	-	-	-	-	2 (0.07)	4 (0.14)
Newport News (Cardinal)	-	-	-	-	1 (0.07)	-	2 (0.14)	3 (0.21)
Newport News (Deer Run)	-	-	-	-	-	-	5 (0.21)	1 (0.07)
Pohick Bay	-	-	5 (0.21)	1 (0.07)	-	-	6 (0.35)	2
Princess Anne	-	-	8 (0.57)	-	1	-	2 (0.07)	7 (0.21)
Red Wing Lake	-	-	-	-	-	2	11 (0.28)	3
Riverfront	-	-	1 (0.07)	-	1	-	2	3
Royal New Kent	-	-	1 (0.07)	-	-	-	-	1 (0.07)
Stonehouse	-	-	-	-	-	-	3 (0.14)	2 (0.07)
Suffolk	-	-	-	-	2 (0.14)	3	8 (0.14)	4 (0.21)
Two Rivers	-	-	5 (0.21)	-	-	-	2 (0.14)	1 (0.07)
Williamsburg	-	-	2 (0.14)	-	-	-	3 (0.07)	1
Williamsburg National	-	-	1	1	-	2	6 (0.14)	3 (0.07)
Woodlands	-	-	6 (0.14)	-	-	-	-	-
Woodside	-	-	4 (0.14)	-	-	-	4	5 (0.14)

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	HAWO	NOFL	PIWO	EAWP	ACFL	EAPH	GCFL	EAKI
Aquia Harbour	-	2	-	-	-	2	-	-
Augustine	-	3 (0.14)	1 (0.07)	-	-	1	2	3 (0.14)
Bay Creek	1	2 (0.14)	1	-	-	1	8 (0.07)	6 (0.07)
Belle Haven	1	4 (0.07)	-	-	-	-	-	1
Bide-a-wee	-	2	-	-	-	-	3	3 (0.14)
Chesapeake	-	1	-	-	-	-	-	1 (0.07)
Colonial	-	2	2 (0.07)	5 (0.21)	1 (0.07)	-	6 (0.21)	1
Eaglewood (Blue)	-	-	-	-	-	-	3	3
Eaglewood (Red)	-	-	-	-	-	-	1 (0.07)	1 (0.07)
Eastern Shore	-	3	2	-	-	-	2	5 (0.21)
Elizabeth Manor	-	1	-	-	-	-	1	3 (0.07)
Ford's Colony	-	2 (0.07)	2 (0.07)	4 (0.28)	-	-	5 (0.21)	-
Four Winds	-	-	-	3 (0.07)	-	2 (0.14)	-	-
Fredericksburg	-	-	-	3	2 (0.07)	-	-	1 (0.07)
Golden Horseshoe (Green)	-	3	3 (0.07)	6 (0.21)	7 (0.28)	2	5 (0.14)	-
Hamptons	-	-	-	5	-	-	2 (0.07)	1
Hell's Point	2 (0.14)	1	3 (0.21)	1 (0.07)	1 (0.07)	-	2 (0.14)	1
Hobbs Hole	5 (0.07)	1 (0.07)	-	-	-	1	-	-
Kiln Creek (Championship)	-	-	1	2 (0.14)	-	-	8 (0.28)	4 (0.14)
Kiln Creek (Creek)	-	1	-	-	-	-	-	1
Kingsmill (Plantation)	-	-	-	-	1 (0.07)	1 (0.07)	2 (0.14)	1 (0.07)
Kingsmill (River)	-	2 (0.07)	-	-	-	-	2	-
Kingsmill (Woods)	-	-	1	-	1 (0.07)	-	2 (0.07)	-
Kiskiack	-	-	1	10 (0.14)	3 (0.07)	2 (0.07)	4	2
Lee's Hill	-	-	2 (0.14)	3	3	2 (0.07)	2 (0.07)	2 (0.14)
Newport News (Cardinal)	-	5 (0.14)	6 (0.28)	6 (0.14)	-	4 (0.21)	13 (0.42)	-
Newport News (Deer Run)	-	5 (0.21)	1 (0.07)	23 (0.71)	-	1	10 (0.57)	-
Pohick Bay	3	-	3 (0.07)	11 (0.50)	7 (0.28)	1	-	1
Princess Anne	-	2 (0.14)	-	-	-	-	4 (0.14)	1
Red Wing Lake	-	6 (0.28)	5 (0.21)	8 (0.21)	-	1 (0.07)	5 (0.28)	1
Riverfront	-	2	-	3	-	-	5 (0.07)	5 (0.07)
Royal New Kent	-	3 (0.14)	-	2	5 (0.21)	-	-	-
Stonehouse	-	2	-	8 (0.21)	7 (0.35)	2 (0.07)	6 (0.14)	-
Suffolk	-	7 (0.07)	2	8	1	1	3 (0.07)	4 (0.07)
Two Rivers	-	3	-	-	-	-	2 (0.14)	3 (0.21)
Williamsburg	-	-	-	5 (0.14)	-	1	3 (0.07)	1 (0.07)
Williamsburg National	-	-	1	11 (0.28)	1	2 (0.07)	1	1 (0.07)
Woodlands	-	1	-	-	-	-	2 (0.14)	-
Woodside	-	2	5	10 (0.57)	6 (0.28)	-	2	1

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	PUMA	TRES	NRWS	BARS	BLJA	AMCR	FICR	CACH
Aquia Harbour	-	-	-	-	3 (0.14)	-	-	3 (0.14)
Augustine	-	2	2 (0.07)	-	1 (0.07)	-	1 (0.07)	3 (0.14)
Bay Creek	1 (0.07)	2	-	10 (0.07)	-	19 (0.14)	14 (0.14)	7
Belle Haven	2	1	-	17 (0.64)	11 (0.21)	26 (0.99)	6 (0.14)	6 (0.28)
Bide-a-wee	2 (0.14)	-	-	1	6 (0.14)	5 (0.07)	7 (0.07)	4 (0.14)
Chesapeake	26 (0.35)	-	-	1	13 (0.28)	2	11 (0.21)	3 (0.07)
Colonial	-	-	-	-	-	2 (0.07)	3	3
Eaglewood (Blue)	-	-	-	11 (0.35)	2	6 (0.21)	-	3 (0.14)
Eaglewood (Red)	-	-	-	7	8 (0.07)	14 (0.07)	2	6
Eastern Shore	2 (0.07)	-	-	8 (0.14)	6 (0.14)	2	20 (0.85)	5 (0.14)
Elizabeth Manor	2 (0.07)	-	-	5	4 (0.07)	4 (0.07)	13 (0.28)	4 (0.07)
Ford's Colony	10 (0.71)	-	2	13 (0.21)	5 (0.28)	13 (0.71)	-	7 (0.28)
Four Winds	17 (0.42)	-	-	-	-	2	-	-
Fredericksburg	-	-	-	-	2	3	4 (0.14)	9 (0.35)
Golden Horseshoe (Green)	2 (0.14)	-	-	-	5 (0.07)	5	4	4 (0.21)
Hamptons	4 (0.14)	2 (0.07)	-	-	2	4 (0.14)	-	-
Hell's Point	1 (0.07)	1	-	17 (0.71)	1 (0.07)	9 (0.42)	6 (0.35)	6 (0.28)
Hobbs Hole	3 (0.14)	-	-	-	2 (0.07)	12 (0.35)	4 (0.28)	5 (0.21)
Kiln Creek (Championship)	-	-	1 (0.07)	1 (0.07)	11 (0.21)	5 (0.21)	4 (0.28)	1
Kiln Creek (Creek)	1	-	-	6 (0.28)	2 (0.14)	7 (0.42)	-	-
Kingsmill (Plantation)	-	-	1 (0.07)	1	4 (0.14)	10 (0.07)	11 (0.71)	-
Kingsmill (River)	-	-	-	-	8 (0.28)	12 (0.28)	2 (0.14)	-
Kingsmill (Woods)	-	-	-	-	4 (0.21)	12 (0.35)	7 (0.14)	2
Kiskiack	-	-	-	7 (0.14)	4	1	2	4
Lee's Hill	-	1 (0.07)	-	1 (0.07)	3 (0.07)	3 (0.21)	-	3 (0.21)
Newport News (Cardinal)	-	-	-	-	3	23 (0.92)	12 (0.42)	5 (0.35)
Newport News (Deer Run)	-	-	-	-	15 (0.35)	40 (1.56)	9 (0.28)	3 (0.14)
Pohick Bay	5 (0.07)	-	-	5 (0.21)	4 (0.21)	7 (0.28)	8 (0.28)	17 (0.78)
Princess Anne	-	-	-	5	9 (0.28)	13 (0.21)	13 (0.35)	16 (0.35)
Red Wing Lake	1 (0.07)	-	-	1	-	11 (0.42)	19 (0.57)	11 (0.42)
Riverfront	3 (0.07)	-	1	13	3	2	3	1
Royal New Kent	2 (0.14)	-	-	3 (0.14)	-	4 (0.14)	-	3
Stonehouse	-	-	-	-	7 (0.21)	11 (0.28)	-	4 (0.21)
Suffolk	-	-	-	9 (0.14)	9 (0.14)	12 (0.28)	6 (0.07)	1
Two Rivers	4 (0.28)	2 (0.14)	-	59 (2.12)	1 (0.07)	7 (0.21)	-	2 (0.14)
Williamsburg	2 (0.14)	-	-	6 (0.07)	11 (0.42)	2	3	5 (0.14)
Williamsburg National	-	-	-	1	4	7	1	9 (0.35)
Woodlands	1	-	-	8 (0.14)	-	6	1	1
Woodside	-	-	-	-	-	16 (0.99)	-	1

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	TUTI	WBNU	BHNU	CARW	HOWR	BGGN	EABL	WOTH
Aquia Harbour	3 (0.42)	-	-	3 (0.28)	8 (0.57)	1	1	-
Augustine	1	1	-	1 (0.07)	-	-	2 (0.07)	5 (0.07)
Bay Creek	6 (0.07)	-	-	18 (0.14)	-	-	6 (0.07)	-
Belle Haven	-	-	-	1 (0.07)	3	-	-	-
Bide-a-wee	3	-	10 (0.42)	4	5 (0.21)	-	4 (0.07)	-
Chesapeake	2 (0.07)	1	1	5 (0.14)	-	-	1 (0.07)	-
Colonial	5 (0.07)	5 (0.21)	-	1 (0.07)	-	12 (0.21)	11 (0.28)	-
Eaglewood (Blue)	-	-	-	3	3 (0.14)	-	17 (0.57)	-
Eaglewood (Red)	-	-	-	2 (0.07)	2	-	11 (0.35)	-
Eastern Shore	1	-	-	10 (0.14)	-	-	7 (0.14)	-
Elizabeth Manor	3 (0.07)	-	9 (0.50)	4 (0.07)	-	-	4 (0.21)	-
Ford's Colony	7 (0.28)	5 (0.14)	-	5 (0.28)	4 (0.14)	-	9 (0.21)	2
Four Winds	-	1	-	-	-	-	7 (0.42)	-
Fredericksburg	4 (0.28)	2	-	3 (0.07)	1	3 (0.21)	8 (0.28)	-
Golden Horseshoe (Green)	9 (0.21)	1 (0.07)	-	4 (0.07)	-	6 (0.14)	14 (0.42)	-
Hamptons	2	-	-	2	-	-	-	-
Hell's Point	1	1 (0.07)	-	10 (0.28)	-	1 (0.07)	10 (0.35)	-
Hobbs Hole	7 (0.21)	1	-	2	-	-	3	-
Kiln Creek (Championship)	2	3 (0.21)	-	8 (0.21)	5 (0.14)	-	3 (0.14)	-
Kiln Creek (Creek)	-	1 (0.14)	-	-	2 (0.14)	-	4 (0.14)	-
Kingsmill (Plantation)	9 (0.28)	1 (0.07)	-	12 (0.28)	4 (0.21)	-	7 (0.07)	1
Kingsmill (River)	9 (0.14)	-	-	7 (0.14)	4	1	5 (0.07)	-
Kingsmill (Woods)	8 (0.28)	2	-	6 (0.28)	-	-	1 (0.07)	3 (0.07)
Kiskiack	4 (0.07)	5 (0.07)	-	5 (0.14)	-	7 (0.07)	6 (0.07)	2
Lee's Hill	-	-	-	6 (0.14)	1 (0.07)	5 (0.14)	3 (0.14)	3 (0.07)
Newport News (Cardinal)	19 (0.78)	7 (0.42)	-	3 (0.21)	-	-	48 (1.70)	4
Newport News (Deer Run)	17 (0.50)	5 (0.21)	-	10 (0.42)	-	-	43 (1.34)	1
Pohick Bay	23 (0.71)	2 (0.07)	-	12 (0.57)	-	7 (0.42)	17 (0.71)	1
Princess Anne	16 (0.50)	2 (0.14)	6 (0.07)	14 (0.50)	13 (0.42)	-	-	-
Red Wing Lake	10 (0.50)	1 (0.07)	12 (0.64)	4 (0.14)	1	-	15 (0.21)	-
Riverfront	1	-	-	5	-	1	6 (0.14)	1
Royal New Kent	2 (0.07)	2 (0.07)	-	-	-	3 (0.14)	-	-
Stonehouse	15 (0.42)	5 (0.14)	-	4 (0.21)	-	2 (0.14)	15 (0.78)	1 (0.07)
Suffolk	11 (0.21)	4 (0.14)	5 (0.07)	5 (0.14)	-	3 (0.14)	10 (0.21)	1 (0.07)
Two Rivers	3 (0.21)	-	-	1 (0.07)	-	-	19 (0.78)	-
Williamsburg	4 (0.21)	-	1	3	1 (0.07)	1 (0.07)	10 (0.28)	-
Williamsburg National	3 (0.07)	7 (0.14)	-	1	-	6 (0.14)	14 (0.28)	3
Woodlands	1	-	-	4	-	-	-	-
Woodside	6 (0.42)	-	-	6 (0.14)	-	2 (0.14)	9 (0.57)	3 (0.14)

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	AMRO	GRCA	NOMO	BRTH	CEDW	EUST	WEVI	BHVI
Aquia Harbour	10 (0.42)	9 (0.71)	2 (0.14)	3	-	1 (0.14)	-	-
Augustine	25 (0.64)	-	2 (0.07)	2	-	1 (0.07)	-	-
Bay Creek	5 (0.07)	-	10 (0.28)	-	15 (0.50)	28 (0.35)	-	-
Belle Haven	4 (0.14)	2 (0.14)	5 (0.07)	-	-	225 (1.77)	-	-
Bide-a-wee	61 (1.63)	6 (0.14)	4 (0.14)	4 (0.14)	-	29 (1.41)	-	-
Chesapeake	28 (0.99)	-	17 (0.42)	2 (0.07)	-	21 (0.57)	-	-
Colonial	7 (0.14)	-	2 (0.07)	-	1 (0.07)	-	2	-
Eaglewood (Blue)	104 (1.84)	-	3 (0.07)	1 (0.07)	-	60 (0.71)	-	-
Eaglewood (Red)	159 (3.25)	-	3 (0.14)	4 (0.28)	-	72 (0.78)	-	-
Eastern Shore	70 (0.99)	-	3 (0.07)	5 (0.14)	-	13 (0.35)	-	-
Elizabeth Manor	43 (1.49)	-	2	3 (0.07)	-	43 (0.35)	-	-
Ford's Colony	12 (0.21)	1	4 (0.14)	2 (0.07)	-	1	-	-
Four Winds	25 (0.92)	-	10 (0.57)	7 (0.35)	-	8	5 (0.35)	-
Fredericksburg	17 (0.71)	3 (0.21)	5 (0.07)	-	3 (0.07)	7	1	-
Golden Horseshoe (Green)	23 (0.14)	1 (0.07)	-	2 (0.14)	-	5 (0.14)	-	-
Hamptons	37 (0.85)	-	3 (0.07)	1	-	6 (0.21)	-	-
Hell's Point	63 (2.48)	1	3	3 (0.07)	-	1	-	-
Hobbs Hole	36 (1.13)	-	-	-	-	7 (0.50)	-	-
Kiln Creek (Championship)	48 (1.41)	-	10 (0.28)	2 (0.07)	-	9 (0.28)	2 (0.07)	-
Kiln Creek (Creek)	14 (0.71)	-	6 (0.14)	-	-	4 (0.28)	-	-
Kingsmill (Plantation)	26 (0.57)	-	11 (0.21)	2 (0.07)	-	23 (0.57)	-	-
Kingsmill (River)	50 (1.06)	1	6 (0.07)	-	-	17 (0.28)	-	-
Kingsmill (Woods)	18 (0.14)	-	3 (0.07)	3 (0.07)	-	14	-	-
Kiskiack	8 (0.21)	-	1 (0.07)	-	2 (0.07)	4	-	-
Lee's Hill	15 (0.28)	-	2 (0.07)	3 (0.07)	2 (0.07)	-	2 (0.14)	-
Newport News (Cardinal)	155 (4.31)	1	-	-	-	22 (0.35)	1	-
Newport News (Deer Run)	224 (5.87)	-	-	-	-	-	-	-
Pohick Bay	21 (0.92)	-	8 (0.35)	1 (0.07)	2	26 (1.56)	1 (0.07)	11 (0.35)
Princess Anne	99 (1.34)	-	2	9 (0.21)	-	37 (0.99)	-	-
Red Wing Lake	97 (4.38)	-	1 (0.07)	1	-	22 (0.07)	-	-
Riverfront	43 (1.13)	-	11 (0.28)	4 (0.07)	-	3	1	-
Royal New Kent	1 (0.07)	1	-	2 (0.14)	-	16	13 (0.50)	-
Stonehouse	2 (0.07)	-	3 (0.07)	2 (0.07)	-	-	2 (0.07)	-
Suffolk	63 (1.91)	2 (0.07)	5 (0.21)	9 (0.21)	2 (0.14)	25 (0.64)	-	-
Two Rivers	51 (1.70)	-	6 (0.35)	2 (0.14)	3 (0.21)	5 (0.35)	-	-
Williamsburg	40 (0.92)	1 (0.07)	11 (0.42)	2 (0.07)	-	6 (0.21)	1	-
Williamsburg National	12 (0.28)	-	4	3 (0.07)	-	1	1	-
Woodlands	31 (0.71)	6 (0.35)	3 (0.21)	3 (0.14)	-	55 (1.34)	-	-
Woodside	8 (0.42)	-	1	1	2 (0.28)	1	-	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	YTVI	REVI	NOPA	YWAR	YTWA	PIWA	PRAW	BAWW
Aquia Harbour	-	-	-	-	-	-	-	-
Augustine	-	-	-	-	-	-	-	-
Bay Creek	1	-	-	1	-	4	-	-
Belle Haven	-	-	-	-	-	-	-	-
Bide-a-wee	-	-	-	-	1	5	-	-
Chesapeake	-	-	-	-	-	2	-	-
Colonial	2 (0.07)	4 (0.14)	2 (0.07)	-	-	1 (0.07)	1	-
Eaglewood (Blue)	-	-	-	-	-	2	-	-
Eaglewood (Red)	-	-	-	-	-	-	-	-
Eastern Shore	-	-	-	-	-	4 (0.21)	-	-
Elizabeth Manor	-	-	-	-	-	4	-	-
Ford's Colony	-	1 (0.07)	-	-	-	1	-	-
Four Winds	-	-	-	-	-	-	-	-
Fredericksburg	1	3 (0.07)	1 (0.07)	-	-	4 (0.07)	1	-
Golden Horseshoe (Green)	-	4 (0.14)	2	-	3 (0.14)	2 (0.14)	-	-
Hamptons	-	1	-	-	-	-	-	-
Hell's Point	-	5 (0.21)	-	1	-	5 (0.21)	-	-
Hobbs Hole	-	-	-	-	-	-	-	-
Kiln Creek (Championship)	-	1 (0.07)	-	-	-	5 (0.07)	-	-
Kiln Creek (Creek)	-	-	-	-	-	2 (0.28)	-	-
Kingsmill (Plantation)	-	-	-	-	-	-	-	-
Kingsmill (River)	-	1	-	-	-	-	-	-
Kingsmill (Woods)	-	5 (0.14)	-	-	-	-	-	-
Kiskiack	1	12 (0.21)	-	-	1	2 (0.07)	-	-
Lee's Hill	-	3 (0.14)	1 (0.07)	-	-	-	-	-
Newport News (Cardinal)	-	19 (0.78)	1 (0.07)	-	-	1 (0.07)	-	-
Newport News (Deer Run)	1 (0.07)	16 (0.57)	1 (0.07)	-	-	4 (0.14)	-	-
Pohick Bay	1 (0.07)	-	2 (0.07)	-	-	6 (0.28)	2	3
Princess Anne	-	-	-	-	-	18 (0.28)	-	-
Red Wing Lake	-	-	-	-	4	12 (0.42)	-	-
Riverfront	-	1	-	-	-	-	-	-
Royal New Kent	1 (0.07)	7 (0.07)	-	-	-	4 (0.21)	5 (0.07)	-
Stonehouse	2 (0.07)	14 (0.57)	3 (0.07)	-	-	2	2	-
Suffolk	-	1	-	-	-	21 (0.50)	-	-
Two Rivers	-	-	-	-	-	-	-	-
Williamsburg	-	5 (0.28)	-	-	-	3	-	-
Williamsburg National	-	2	-	-	-	-	-	-
Woodlands	-	-	-	-	-	1 (0.07)	-	-
Woodside	-	7 (0.28)	-	1	-	3 (0.14)	1 (0.14)	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	PROW	OVEN	KEWA	COYE	HOWA	YBCH	SUTA	SCTA
Aquia Harbour	-	-	-	1 (0.14)	-	-	-	-
Augustine	-	-	-	-	-	-	-	-
Bay Creek	1	1	-	-	-	-	4	-
Belle Haven	-	-	-	-	-	-	-	-
Bide-a-wee	-	-	-	-	-	-	-	-
Chesapeake	-	-	-	-	-	-	-	-
Colonial	-	2 (0.07)	-	3	-	1 (0.07)	2 (0.07)	-
Eaglewood (Blue)	-	-	-	-	-	-	-	-
Eaglewood (Red)	-	-	-	-	-	-	-	-
Eastern Shore	-	2 (0.07)	-	-	-	-	1	-
Elizabeth Manor	-	-	-	-	-	-	-	-
Ford's Colony	-	1 (0.07)	-	1 (0.07)	-	-	-	-
Four Winds	-	-	-	-	-	-	-	-
Fredericksburg	-	-	-	-	-	-	-	-
Golden Horseshoe (Green)	-	1 (0.07)	-	-	1 (0.07)	-	5 (0.28)	1
Hamptons	-	1 (0.07)	-	8 (0.21)	-	-	1	-
Hell's Point	-	1	-	3 (0.14)	-	-	-	-
Hobbs Hole	-	2 (0.07)	-	1 (0.07)	-	-	1	-
Kiln Creek (Championship)	-	-	-	2 (0.14)	-	1 (0.07)	-	-
Kiln Creek (Creek)	-	-	-	-	-	-	-	-
Kingsmill (Plantation)	-	-	1 (0.07)	-	-	-	-	-
Kingsmill (River)	-	-	-	1 (0.07)	-	-	1	-
Kingsmill (Woods)	-	-	1	-	-	-	-	-
Kiskiack	-	4 (0.14)	-	2	-	-	-	-
Lee's Hill	-	2 (0.07)	-	-	-	2 (0.07)	-	1 (0.07)
Newport News (Cardinal)	-	-	-	-	-	-	-	1 (0.07)
Newport News (Deer Run)	3 (0.14)	-	-	-	-	-	2 (0.14)	2
Pohick Bay	-	-	-	-	-	-	-	-
Princess Anne	-	-	-	-	-	-	-	-
Red Wing Lake	-	-	-	-	-	-	1 (0.07)	-
Riverfront	-	-	-	3 (0.07)	-	-	1	-
Royal New Kent	-	10 (0.35)	-	3 (0.21)	-	6 (0.35)	1	2
Stonehouse	-	12 (0.42)	-	4 (0.14)	-	1 (0.07)	7 (0.14)	3 (0.07)
Suffolk	1 (0.07)	-	-	5 (0.14)	-	-	-	-
Two Rivers	-	-	-	-	-	-	-	-
Williamsburg	-	-	-	3 (0.07)	-	1	-	-
Williamsburg National	-	2	-	4	1	-	5 (0.21)	1
Woodlands	-	-	-	1	-	-	-	-
Woodside	-	14 (0.71)	-	-	2 (0.14)	-	3 (0.14)	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	NOCA	BLGR	INBU	EATO	CHSP	FISP	GRSP	SOSP
Aquia Harbour	5	-	-	1	5 (0.28)	-	-	1
Augustine	3 (0.14)	-	-	-	3 (0.07)	-	-	-
Bay Creek	16 (0.14)	1	6	-	5 (0.14)	-	2 (0.07)	-
Belle Haven	1	-	-	-	-	-	-	12 (0.50)
Bide-a-wee	4 (0.07)	-	-	3	-	-	-	1 (0.07)
Chesapeake	5 (0.14)	-	-	-	1 (0.07)	-	-	5 (0.21)
Colonial	5 (0.21)	7 (0.21)	4 (0.14)	2 (0.14)	10 (0.07)	-	-	-
Eaglewood (Blue)	7 (0.07)	-	-	-	5 (0.28)	-	-	6 (0.28)
Eaglewood (Red)	7 (0.28)	-	1	-	7 (0.14)	-	-	7 (0.35)
Eastern Shore	6 (0.07)	-	-	-	34 (0.57)	-	-	3
Elizabeth Manor	8 (0.21)	-	-	-	-	-	-	1
Ford's Colony	3 (0.07)	-	-	1 (0.07)	5 (0.14)	1 (0.07)	-	-
Four Winds	6 (0.28)	-	-	-	3 (0.14)	1 (0.07)	-	-
Fredericksburg	13 (0.50)	-	4 (0.14)	1	18 (0.57)	-	-	10 (0.07)
Golden Horseshoe (Green)	9 (0.14)	-	1 (0.07)	5 (0.21)	14 (0.35)	-	-	-
Hamptons	3 (0.07)	-	1	-	1 (0.07)	-	-	-
Hell's Point	7 (0.14)	-	5 (0.14)	-	-	1	-	-
Hobbs Hole	6 (0.14)	-	5 (0.14)	-	18 (0.64)	1	-	-
Kiln Creek (Championship)	8 (0.21)	-	-	-	-	-	-	2
Kiln Creek (Creek)	3 (0.14)	-	1	-	-	-	-	3
Kingsmill (Plantation)	9 (0.35)	-	-	2 (0.07)	2	-	-	5 (0.07)
Kingsmill (River)	9 (0.28)	-	-	2	3 (0.07)	-	-	1
Kingsmill (Woods)	3	1	1 (0.07)	-	3 (0.07)	-	-	2 (0.07)
Kiskiack	-	-	1	-	14 (0.50)	-	-	7 (0.42)
Lee's Hill	7 (0.21)	-	4 (0.21)	3 (0.14)	6 (0.28)	-	-	2 (0.14)
Newport News (Cardinal)	11 (0.71)	-	-	1 (0.07)	29 (1.27)	-	-	1
Newport News (Deer Run)	3 (0.21)	-	-	-	13 (0.71)	-	-	-
Pohick Bay	11 (0.57)	-	5 (0.21)	2 (0.07)	12 (0.50)	-	-	-
Princess Anne	15 (0.21)	-	-	14 (0.35)	-	-	-	1
Red Wing Lake	3 (0.07)	-	1 (0.07)	1 (0.07)	2 (0.07)	-	-	-
Riverfront	9 (0.28)	5 (0.07)	7 (0.07)	1	1 (0.07)	3	-	-
Royal New Kent	3	3	17 (0.50)	1	13 (0.21)	11 (0.42)	-	-
Stonehouse	11 (0.50)	2 (0.14)	9 (0.21)	-	16 (0.50)	5 (0.14)	-	-
Suffolk	10 (0.14)	-	-	8 (0.28)	2 (0.14)	-	-	-
Two Rivers	5 (0.35)	1 (0.07)	-	1 (0.07)	6 (0.14)	-	-	-
Williamsburg	8 (0.21)	1	2	-	18 (0.50)	1	-	-
Williamsburg National	3 (0.07)	1	2 (0.14)	-	6 (0.14)	-	-	-
Woodlands	3 (0.07)	-	-	-	-	-	-	-
Woodside	13 (0.85)	-	1	-	26 (1.84)	-	-	-

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	RWBL	EAME	COGR	BHCO	OROR	BAOR	HOFI	AMGO
Aquia Harbour	-	-	-	-	-	-	3 (0.42)	-
Augustine	4 (0.07)	-	1	-	-	-	-	-
Bay Creek	31 (0.78)	3 (0.14)	52 (1.70)	16 (0.07)	1 (0.07)	-	-	5
Belle Haven	5 (0.28)	-	26 (0.92)	9 (0.28)	-	-	-	7 (0.50)
Bide-a-wee	-	-	11 (0.28)	5 (0.28)	-	-	4 (0.21)	3 (0.07)
Chesapeake	7 (0.21)	-	60 (2.55)	7 (0.28)	-	-	2 (0.07)	6 (0.14)
Colonial	1	-	4 (0.14)	3 (0.07)	3 (0.07)	-	-	2
Eaglewood (Blue)	10	-	8 (0.07)	3	3	-	17 (0.14)	5 (0.14)
Eaglewood (Red)	3 (0.07)	-	32 (0.85)	5	-	-	7 (0.35)	6 (0.14)
Eastern Shore	7	-	73 (1.49)	1	2	-	4 (0.07)	5 (0.14)
Elizabeth Manor	3 (0.14)	-	80 (3.25)	2	-	-	2	-
Ford's Colony	3	-	9	1	-	-	5	5 (0.07)
Four Winds	-	1	7 (0.07)	8 (0.35)	-	-	-	1 (0.07)
Fredericksburg	-	-	20 (0.71)	4	2 (0.14)	-	5 (0.07)	8 (0.21)
Golden Horseshoe (Green)	-	-	22 (0.99)	9 (0.35)	-	-	2	9 (0.28)
Hamptons	23 (0.78)	-	12 (0.21)	2	-	-	-	5 (0.21)
Hell's Point	-	-	17 (0.64)	5 (0.07)	-	-	-	9 (0.42)
Hobbs Hole	6 (0.28)	1	167 (5.30)	-	-	-	-	7 (0.35)
Kiln Creek (Championship)	9 (0.28)	-	39 (1.13)	2 (0.07)	-	1	1	3
Kiln Creek (Creek)	3 (0.28)	-	15 (0.85)	1	-	-	2	2 (0.14)
Kingsmill (Plantation)	8 (0.21)	-	12 (0.21)	7 (0.42)	-	-	9 (0.07)	2 (0.07)
Kingsmill (River)	-	-	33 (0.57)	1	-	-	6 (0.14)	2 (0.14)
Kingsmill (Woods)	-	-	30 (0.78)	8 (0.07)	-	-	-	-
Kiskiack	2	-	4 (0.14)	4	1	-	2	6 (0.07)
Lee's Hill	2 (0.07)	-	10 (0.28)	3 (0.14)	-	1	2	3 (0.14)
Newport News (Cardinal)	3 (0.21)	-	36 (0.99)	5 (0.28)	-	-	-	8 (0.14)
Newport News (Deer Run)	12 (0.14)	1 (0.07)	42 (0.99)	5	-	-	-	18 (0.71)
Pohick Bay	-	-	30 (1.98)	7 (0.42)	-	-	1 (0.07)	4 (0.21)
Princess Anne	6 (0.07)	-	103 (2.76)	1	-	-	17 (0.28)	-
Red Wing Lake	1	-	48 (0.99)	7 (0.21)	-	-	4 (0.28)	23 (0.85)
Riverfront	26 (0.42)	-	109 (1.84)	6	6 (0.28)	2 (0.07)	5 (0.28)	9 (0.21)
Royal New Kent	-	5 (0.35)	1	8 (0.35)	1	-	-	3 (0.21)
Stonehouse	-	-	1	13 (0.71)	-	-	3 (0.14)	3 (0.21)
Suffolk	-	-	33 (0.99)	6	-	-	3 (0.07)	3 (0.14)
Two Rivers	1 (0.07)	-	37 (2.62)	2	2 (0.07)	-	6 (0.28)	2
Williamsburg	1	-	9 (0.07)	2 (0.07)	-	-	1	2 (0.07)
Williamsburg National	2	-	8	11 (0.14)	1 (0.07)	-	2	7 (0.14)
Woodlands	1	-	6 (0.42)	1	-	-	1 (0.07)	-
Woodside	1	-	15	3	-	-	-	2

APPENDIX E2 – Golf Courses in Coastal Plain (cont.)

Golf Course	HOSP
Aquia Harbour	1 (0.14)
Augustine	-
Bay Creek	-
Belle Haven	40 (0.71)
Bide-a-wee	-
Chesapeake	8 (0.35)
Colonial	-
Eaglewood (Blue)	4
Eaglewood (Red)	1
Eastern Shore	2
Elizabeth Manor	-
Ford's Colony	-
Four Winds	-
Fredericksburg	1 (0.07)
Golden Horseshoe (Green)	-
Hamptons	-
Hell's Point	-
Hobbs Hole	-
Kiln Creek (Championship)	3 (0.07)
Kiln Creek (Creek)	1
Kingsmill (Plantation)	2 (0.07)
Kingsmill (River)	2 (0.07)
Kingsmill (Woods)	-
Kiskiack	-
Lee's Hill	-
Newport News (Cardinal)	-
Newport News (Deer Run)	2
Pohick Bay	8 (0.28)
Princess Anne	-
Red Wing Lake	-
Riverfront	3 (0.21)
Royal New Kent	1
Stonehouse	-
Suffolk	-
Two Rivers	1
Williamsburg	-
Williamsburg National	-
Woodlands	1 (0.07)
Woodside	-

APPENDIX E3 – Golf Courses in Piedmont

Golf Course	# Counts	GTBH	GNHE	CAGO	MALL	TUVU	RSHA	RTHA
Army Navy (Red)	9	-	-	-	-	-	-	-
Army Navy (White)	9	1	1 (0.14)	6 (0.85)	-	-	-	-
Birdwood	18	-	2 (0.07)	-	2 (0.14)	-	1	-
Birkdale	18	1 (0.07)	-	4	1	-	-	-
Boonsboro	18	-	-	1 (0.07)	-	2 (0.14)	-	-
Brambleton	18	2 (0.07)	6 (0.28)	22 (1.13)	5 (0.35)	1	3	-
Colonial Hills	18	-	-	7 (0.50)	1 (0.07)	-	-	-
Fairfax National	18	1 (0.07)	-	22 (0.28)	-	-	-	-
Falling River	18	-	-	4	-	-	-	-
Farmington	18	-	-	-	-	-	-	-
Fawn Lake	18	1	-	-	3 (0.21)	-	4 (0.21)	-
Glenmore	18	2 (0.07)	-	2	-	-	-	-
Heartland	9	1	1	36	-	-	-	-
Ivy Hill	18	-	-	9 (0.21)	3	-	-	-
Jefferson District	9	-	3	4 (0.14)	-	-	-	-
Keswick	18	-	1	11 (0.71)	-	-	1 (0.07)	-
Lake Chesdin	18	1	-	-	-	-	1	1 (0.07)
London Downs	18	1	2	2	2	-	-	-
Longwood	9	-	-	-	-	-	-	-
Meadowcreek	18	-	-	-	3	-	-	1 (0.07)
Oak Marr	9	-	-	-	-	-	-	-
Oakwood	18	-	-	-	-	-	-	-
Shenandoah Crossing	18	-	-	20	-	-	1	-
Tanyard	18	2	1	6 (0.21)	1	-	-	-
Washington	18	-	-	-	-	-	-	-

Golf Course	WITU	NOBO	KILL	SPSA	RODO	MODO	BBCU	YBCU
Army Navy (Red)	-	-	-	-	-	6 (0.85)	-	-
Army Navy (White)	-	-	-	-	-	4 (0.57)	-	-
Birdwood	-	1	1 (0.07)	-	1 (0.07)	3 (0.14)	-	-
Birkdale	-	1	-	-	-	15 (0.21)	-	-
Boonsboro	-	-	-	-	-	5 (0.14)	-	-
Brambleton	-	2 (0.14)	1	1*	-	15 (0.21)	1	1 (0.07)
Colonial Hills	-	-	-	-	-	5	-	1
Fairfax National	-	-	-	-	-	12 (0.42)	-	-
Falling River	-	-	3 (0.07)	-	-	1 (0.07)	-	1 (0.07)
Farmington	-	-	-	-	-	4 (0.14)	-	-
Fawn Lake	-	-	1	-	1	2 (0.14)	-	-
Glenmore	-	-	1 (0.07)	-	-	3 (0.14)	-	1 (0.07)
Heartland	-	1 (0.14)	7	-	-	6	-	-
Ivy Hill	-	-	-	-	-	11 (0.21)	-	-
Jefferson District	-	-	-	-	1	2	-	-
Keswick	-	-	1 (0.07)	-	3 (0.14)	3 (0.14)	-	-
Lake Chesdin	2 (0.07)	-	1	-	-	10	-	4
London Downs	-	-	5 (0.21)	-	-	6 (0.14)	-	-
Longwood	-	-	-	-	1	2	-	-
Meadowcreek	-	-	-	-	-	4 (0.07)	-	2
Oak Marr	-	-	1 (0.14)	-	-	2 (0.14)	-	-
Oakwood	-	-	-	-	-	3 (0.14)	-	-
Shenandoah Crossing	-	-	-	-	-	1	-	-
Tanyard	-	-	2 (0.07)	-	-	5 (0.14)	-	-
Washington	-	-	-	-	-	7 (0.42)	-	-

APPENDIX E3 – Golf Courses in Piedmont (cont.)

Golf Course	GHOW	CHSW	RTHU	BEKI	RHWO	RBWO	DOWO	HAWO
Army Navy (Red)	-	1	-	-	-	2	-	-
Army Navy (White)	-	2 (0.14)	-	1	-	2 (0.28)	-	-
Birdwood	-	6 (0.42)	-	-	-	4 (0.21)	-	-
Birkdale	-	7 (0.07)	1 (0.07)	-	4 (0.07)	10 (0.14)	2	1
Boonsboro	-	6 (0.28)	-	-	-	9 (0.28)	8 (0.28)	-
Brambleton	-	15 (0.57)	-	-	-	6 (0.07)	12 (0.50)	2
Colonial Hills	-	1	-	-	-	4	2 (0.07)	-
Fairfax National	-	6 (0.07)	-	-	-	4 (0.28)	3 (0.21)	-
Falling River	-	3 (0.21)	-	-	-	3 (0.14)	-	-
Farmington	-	8 (0.14)	-	-	-	4 (0.14)	2 (0.07)	-
Fawn Lake	1 (0.07)	4 (0.07)	-	-	-	2 (0.07)	1	-
Glenmore	-	8 (0.50)	1 (0.07)	-	-	2 (0.14)	1	1
Heartland	-	5 (0.42)	2 (0.28)	-	-	1	-	-
Ivy Hill	-	6 (0.28)	-	1 (0.07)	-	3 (0.07)	-	-
Jefferson District	-	1	-	-	-	1	-	-
Keswick	-	2 (0.07)	-	-	-	1 (0.07)	-	1 (0.07)
Lake Chesdin	-	1	1 (0.07)	-	-	7 (0.21)	3 (0.07)	-
London Downs	-	1	-	-	1	2	-	-
Longwood	-	4	-	-	1	3 (0.14)	1 (0.14)	-
Meadowcreek	-	7 (0.28)	-	-	-	-	2 (0.07)	-
Oak Marr	-	22 (3.11)	-	-	-	1	2 (0.14)	-
Oakwood	-	3 (0.07)	-	-	-	2 (0.07)	2 (0.07)	-
Shenandoah Crossing	-	-	-	-	-	1 (0.07)	2 (0.14)	-
Tanyard	-	11 (0.35)	1	-	-	7 (0.21)	6 (0.07)	-
Washington	-	5 (0.35)	-	-	-	5 (0.21)	-	-

Golf Course	NOFL	PIWO	EAWP	ACFL	WIFL	EAPH	GCFL	EAKI
Army Navy (Red)	-	2	-	-	-	-	-	-
Army Navy (White)	2 (0.28)	-	-	-	-	1 (0.14)	-	1 (0.14)
Birdwood	1 (0.07)	-	-	-	-	-	-	2
Birkdale	6 (0.07)	1	3 (0.14)	-	-	1	2	-
Boonsboro	3 (0.14)	1 (0.07)	7 (0.07)	-	-	2 (0.07)	-	4 (0.14)
Brambleton	6 (0.07)	-	4 (0.07)	-	2	1	9 (0.21)	4 (0.14)
Colonial Hills	-	-	1	-	-	-	-	3
Fairfax National	1 (0.07)	1 (0.07)	1 (0.07)	-	-	1 (0.07)	1 (0.07)	4 (0.14)
Falling River	2 (0.07)	1	1 (0.07)	-	-	-	-	1 (0.07)
Farmington	2	1 (0.07)	3 (0.07)	-	-	4 (0.07)	-	3 (0.07)
Fawn Lake	6 (0.21)	-	2 (0.07)	-	-	-	-	2 (0.07)
Glenmore	3 (0.21)	2	1	1	-	3 (0.07)	-	1
Heartland	-	-	1	-	-	1	-	3 (0.14)
Ivy Hill	3 (0.07)	1	7 (0.07)	-	-	2 (0.07)	1	1 (0.07)
Jefferson District	1	-	-	-	-	-	-	2 (0.14)
Keswick	2 (0.07)	-	2 (0.14)	-	-	1 (0.07)	-	4 (0.21)
Lake Chesdin	2 (0.07)	4 (0.07)	16 (0.28)	15 (0.14)	-	1	3	3 (0.07)
London Downs	1	1	1	-	-	-	1	6 (0.07)
Longwood	1	1 (0.14)	5	-	-	-	1	4
Meadowcreek	1	-	-	-	-	4 (0.14)	-	2 (0.07)
Oak Marr	2	-	3 (0.28)	-	-	1 (0.14)	-	1 (0.14)
Oakwood	2 (0.14)	-	-	-	-	1 (0.07)	-	1 (0.07)
Shenandoah Crossing	1	2	5 (0.07)	-	-	1 (0.07)	3	-
Tanyard	1	1	3 (0.14)	-	-	3 (0.07)	1 (0.07)	-
Washington	2	-	-	-	-	2 (0.14)	2 (0.14)	1 (0.07)

APPENDIX E3 – Golf Courses in Piedmont (cont.)

Golf Course	PUMA	TRES	NRWS	BANS	BARS	BLJA	AMCR	FICR
Army Navy (Red)	8 (1.13)	-	-	-	-	2	3	-
Army Navy (White)	7 (0.28)	-	-	-	1 (0.14)	4 (0.42)	4	-
Birdwood	-	3 (0.14)	-	-	4 (0.21)	2 (0.14)	11 (0.28)	-
Birkdale	1 (0.07)	-	-	-	-	6 (0.14)	8 (0.07)	-
Boonsboro	-	2	-	-	-	-	2	1
Brambleton	-	32 (1.56)	1	1 (0.07)	9 (0.42)	19 (0.57)	33 (1.06)	9 (0.21)
Colonial Hills	-	-	-	-	-	6 (0.07)	7 (0.14)	-
Fairfax National	-	3	-	-	3 (0.21)	9 (0.21)	17 (0.85)	-
Falling River	-	-	1 (0.07)	-	4 (0.21)	2 (0.07)	5 (0.28)	-
Farmington	3	-	-	-	-	3 (0.07)	7 (0.28)	2 (0.14)
Fawn Lake	-	-	-	-	-	5 (0.21)	17 (0.64)	3 (0.07)
Glenmore	-	3 (0.07)	-	-	1 (0.07)	5 (0.28)	11 (0.28)	3 (0.14)
Heartland	-	6 (0.14)	-	-	3 (0.28)	-	6 (0.28)	-
Ivy Hill	2	3	2	-	5 (0.21)	10 (0.28)	6 (0.28)	-
Jefferson District	4	-	-	-	1 (0.14)	3 (0.28)	2 (0.14)	-
Keswick	-	-	1	-	3 (0.14)	2	6 (0.42)	1
Lake Chesdin	-	-	-	-	1	2	10 (0.07)	2
London Downs	-	-	1	-	1 (0.07)	2	4	-
Longwood	-	-	-	-	1	5 (0.14)	7 (0.14)	-
Meadowcreek	-	16 (0.42)	7 (0.35)	-	-	2 (0.07)	13 (0.42)	-
Oak Marr	2 (0.14)	1	-	4 (0.57)	-	3	3	1
Oakwood	-	-	1 (0.07)	-	-	2 (0.07)	3 (0.14)	1 (0.07)
Shenandoah Crossing	-	1 (0.07)	-	-	-	5	12 (0.28)	-
Tanyard	-	5 (0.21)	1	-	34 (0.28)	6 (0.07)	6 (0.21)	-
Washington	16 (1.13)	1 (0.07)	-	-	1 (0.07)	2 (0.14)	9 (0.42)	-

Golf Course	CACH	TUTI	WBNU	CARW	HOWR	BGGN	EABL	WOTH
Army Navy (Red)	-	7 (0.99)	-	4	-	2 (0.28)	-	-
Army Navy (White)	2 (0.28)	10 (0.99)	2 (0.28)	2	-	-	-	-
Birdwood	2 (0.07)	-	1	3 (0.07)	1	2 (0.07)	7 (0.42)	-
Birkdale	5 (0.07)	8 (0.14)	7 (0.14)	10 (0.21)	3 (0.07)	1	9 (0.35)	4 (0.07)
Boonsboro	7 (0.07)	4 (0.14)	4 (0.14)	4 (0.14)	-	1	20 (0.57)	4 (0.21)
Brambleton	11 (0.21)	17 (0.50)	4 (0.07)	3 (0.14)	4 (0.14)	5	22 (0.57)	1
Colonial Hills	8 (0.21)	7 (0.07)	1	5 (0.14)	1 (0.07)	7 (0.21)	8 (0.07)	-
Fairfax National	3 (0.14)	8 (0.50)	-	9 (0.50)	3 (0.21)	1 (0.07)	3 (0.21)	-
Falling River	1 (0.07)	1	2 (0.07)	1	-	-	5 (0.21)	-
Farmington	3 (0.21)	6 (0.21)	2 (0.07)	6 (0.28)	5 (0.07)	-	15 (0.35)	1 (0.07)
Fawn Lake	-	4 (0.14)	3 (0.14)	2 (0.14)	-	-	20 (0.78)	-
Glenmore	7 (0.42)	9 (0.42)	2 (0.07)	5 (0.21)	2 (0.07)	2 (0.07)	16 (0.64)	2 (0.14)
Heartland	-	1	1 (0.14)	-	-	2 (0.14)	10 (0.42)	-
Ivy Hill	1	5 (0.14)	-	3 (0.14)	-	-	14 (0.21)	-
Jefferson District	-	-	-	-	-	-	2 (0.28)	-
Keswick	5 (0.14)	5 (0.28)	1	2 (0.14)	1 (0.07)	-	8 (0.14)	-
Lake Chesdin	5 (0.07)	17 (0.21)	11 (0.28)	6 (0.07)	-	23 (0.42)	9 (0.14)	2 (0.07)
London Downs	1	4 (0.14)	-	1 (0.07)	-	-	13 (0.35)	1
Longwood	4	6 (0.28)	2	3 (0.14)	-	-	5 (0.14)	1
Meadowcreek	1	7 (0.28)	1 (0.07)	9 (0.35)	-	-	10 (0.28)	1
Oak Marr	2 (0.28)	2 (0.28)	-	6 (0.28)	2 (0.14)	1 (0.14)	4 (0.28)	1 (0.14)
Oakwood	1	-	-	1 (0.07)	1	-	5 (0.35)	-
Shenandoah Crossing	6 (0.28)	16 (0.28)	5 (0.14)	2 (0.07)	-	5 (0.14)	4 (0.14)	2
Tanyard	5 (0.07)	5 (0.07)	2	1 (0.07)	5	5 (0.21)	14 (0.14)	1 (0.07)
Washington	7 (0.28)	5 (0.14)	2 (0.14)	6 (0.21)	16 (0.64)	-	2 (0.07)	1 (0.07)

APPENDIX E3 – Golf Courses in Piedmont (cont.)

Golf Course	AMRO	GRCA	NOMO	BRTH	CEDW	EUST	WEVI	YTVI
Army Navy (Red)	25 (1.13)	15 (1.56)	5 (0.71)	5 (0.14)	4 (0.14)	34 (4.38)	-	-
Army Navy (White)	27 (1.98)	8 (0.57)	4 (0.57)	4 (0.42)	-	32 (1.27)	-	-
Birdwood	-	2 (0.07)	-	1	-	5 (0.35)	1 (0.07)	-
Birkdale	33 (0.71)	5 (0.14)	8	3 (0.07)	-	12 (0.07)	-	-
Boonsboro	25 (0.78)	2 (0.14)	7 (0.42)	2 (0.07)	6 (0.14)	2 (0.07)	-	-
Brambleton	8 (0.07)	16 (0.78)	16 (0.42)	1 (0.07)	16	10 (0.14)	2	-
Colonial Hills	6 (0.14)	1 (0.07)	11 (0.07)	1 (0.07)	4 (0.14)	-	1	1
Fairfax National	44 (2.33)	-	8 (0.28)	1 (0.07)	2 (0.14)	27 (1.34)	-	2 (0.14)
Falling River	10 (0.35)	1 (0.07)	9 (0.35)	2 (0.07)	8 (0.28)	5 (0.28)	-	-
Farmington	14 (0.35)	3 (0.07)	7 (0.14)	2 (0.07)	-	5 (0.07)	-	-
Fawn Lake	10 (0.14)	-	2 (0.14)	-	2 (0.14)	3	-	-
Glenmore	11 (0.50)	-	10 (0.50)	3 (0.14)	2 (0.14)	2	-	2 (0.07)
Heartland	10 (0.14)	-	8 (0.57)	3 (0.14)	2	1	1	-
Ivy Hill	27 (0.42)	3 (0.07)	21 (0.78)	4 (0.07)	-	24 (0.71)	-	-
Jefferson District	2 (0.28)	1 (0.14)	5 (0.42)	-	-	5 (0.71)	-	-
Keswick	4 (0.28)	2 (0.07)	10 (0.57)	1 (0.07)	2	10	-	-
Lake Chesdin	1	-	-	-	-	-	2	3 (0.07)
London Downs	26 (0.71)	1	12 (0.07)	2	-	1	-	-
Longwood	3 (0.14)	2	8 (0.14)	1	-	-	-	-
Meadowcreek	2 (0.07)	-	7 (0.35)	1	-	2	-	-
Oak Marr	3 (0.42)	6 (0.42)	1 (0.14)	1	-	2 (0.28)	1 (0.14)	-
Oakwood	4 (0.21)	2 (0.14)	3 (0.21)	1 (0.07)	-	4 (0.14)	-	-
Shenandoah Crossing	3 (0.07)	-	-	-	-	1 (0.07)	1	-
Tanyard	20 (0.21)	4	9 (0.28)	3	5 (0.21)	12 (0.21)	1	-
Washington	9 (0.50)	9 (0.35)	1	2	35 (2.48)	11 (0.21)	1 (0.07)	-

Golf Course	REVI	YWAR	YTWA	PIWA	PRAW	BAWW	AMRE	OVEN
Army Navy (Red)	-	-	-	-	-	-	-	-
Army Navy (White)	2	-	-	-	-	-	-	-
Birdwood	1	-	-	-	3 (0.07)	-	-	-
Birkdale	2	-	-	-	-	-	-	3
Boonsboro	7 (0.14)	-	-	2	-	-	-	-
Brambleton	-	-	-	5 (0.21)	10 (0.14)	-	-	-
Colonial Hills	4	-	-	-	-	-	-	-
Fairfax National	2 (0.07)	-	-	3 (0.21)	-	-	-	-
Falling River	2 (0.07)	-	-	2	-	-	-	-
Farmington	1 (0.07)	-	-	-	-	-	-	-
Fawn Lake	4 (0.21)	-	-	-	-	-	-	1 (0.07)
Glenmore	1	-	-	-	1	-	-	-
Heartland	-	-	-	1 (0.14)	2	-	-	-
Ivy Hill	-	-	-	-	-	-	-	-
Jefferson District	-	-	-	-	-	-	-	-
Keswick	-	-	-	1 (0.07)	-	-	-	-
Lake Chesdin	20 (0.42)	-	9 (0.28)	9 (0.07)	-	-	1	13 (0.42)
London Downs	-	-	-	-	-	-	-	-
Longwood	4 (0.14)	1 (0.14)	-	-	-	-	-	-
Meadowcreek	1	-	-	-	1 (0.07)	-	-	-
Oak Marr	-	-	-	1 (0.14)	-	-	-	-
Oakwood	-	-	-	-	-	-	-	-
Shenandoah Crossing	10 (0.28)	-	-	-	-	2	-	12 (0.28)
Tanyard	3	-	-	4 (0.07)	1	-	-	-
Washington	-	-	-	-	-	-	-	-

APPENDIX E3 – Golf Courses in Piedmont (cont.)

Golf Course	COYE	HOWA	YBCH	SUTA	SCTA	NOCA	BLGR	INBU
Army Navy (Red)	-	-	-	-	-	7 (0.71)	-	-
Army Navy (White)	-	-	-	-	-	2 (0.14)	-	-
Birdwood	2 (0.07)	-	1 (0.07)	-	-	19 (0.99)	-	10 (0.50)
Birkdale	-	-	-	-	-	12 (0.35)	2 (0.07)	3 (0.07)
Boonsboro	-	-	-	-	-	6 (0.21)	-	2 (0.07)
Brambleton	13 (0.28)	-	-	-	1	18 (0.35)	-	12 (0.35)
Colonial Hills	1	-	-	-	-	17 (0.42)	-	15 (0.35)
Fairfax National	-	-	-	-	-	13 (0.57)	-	-
Falling River	1	-	-	-	-	2 (0.14)	-	1 (0.07)
Farmington	-	-	-	-	-	13 (0.42)	-	1
Fawn Lake	-	-	-	1	-	5 (0.21)	-	-
Glenmore	4 (0.21)	-	1	-	-	7 (0.28)	3 (0.21)	7 (0.42)
Heartland	2 (0.14)	-	2	-	-	1	-	5 (0.28)
Ivy Hill	-	-	-	-	-	15 (0.57)	-	3 (0.07)
Jefferson District	-	-	-	-	-	2 (0.14)	-	-
Keswick	2 (0.07)	-	1	-	2 (0.07)	6 (0.35)	1	2 (0.07)
Lake Chesdin	1 (0.07)	4 (0.07)	1	14 (0.07)	4 (0.14)	6 (0.21)	-	9 (0.14)
London Downs	-	-	-	-	-	2	-	-
Longwood	1	-	-	-	-	4 (0.28)	-	4
Meadowcreek	1	-	1	-	-	17 (0.71)	1	3 (0.07)
Oak Marr	-	-	-	-	-	8 (0.28)	-	-
Oakwood	-	-	-	-	-	4 (0.14)	-	-
Shenandoah Crossing	2 (0.07)	-	1	-	-	3 (0.07)	-	3 (0.07)
Tanyard	2	-	1	-	1	11 (0.14)	-	4 (0.14)
Washington	-	-	-	-	-	8 (0.28)	-	-

Golf Course	EATO	CHSP	FISP	GRSP	SOSP	RWBL	EAME	COGR
Army Navy (Red)	4 (0.57)	-	-	-	2 (0.28)	-	-	11 (0.57)
Army Navy (White)	-	-	-	-	8 (0.28)	13 (0.28)	-	23 (0.71)
Birdwood	2 (0.07)	5 (0.07)	1 (0.07)	-	4 (0.14)	4 (0.28)	-	14 (0.50)
Birkdale	-	10 (0.28)	-	-	5 (0.14)	5 (0.07)	-	16 (0.14)
Boonsboro	-	23 (0.64)	-	-	1 (0.07)	-	-	17 (0.35)
Brambleton	13 (0.42)	16 (0.57)	13 (0.35)	-	13 (0.35)	37 (0.71)	-	23 (0.35)
Colonial Hills	3 (0.07)	10 (0.28)	3	2 (0.07)	1	9 (0.21)	2 (0.07)	4 (0.07)
Fairfax National	1	19 (0.92)	1 (0.07)	-	-	35 (1.70)	-	20 (0.57)
Falling River	1	7 (0.35)	1	-	3 (0.07)	1 (0.07)	4 (0.21)	10 (0.71)
Farmington	1	11 (0.42)	-	-	8 (0.28)	-	-	11 (0.28)
Fawn Lake	5 (0.21)	1 (0.07)	-	-	-	15 (0.64)	-	9 (0.28)
Glenmore	-	21 (0.71)	2 (0.07)	-	3 (0.07)	5 (0.21)	1	8 (0.21)
Heartland	-	14 (0.71)	3	1	1	13 (0.71)	7 (0.28)	10 (0.57)
Ivy Hill	1	4	-	1 (0.07)	3 (0.14)	16 (0.14)	8 (0.28)	64 (1.56)
Jefferson District	-	-	-	-	5 (0.57)	1 (0.14)	-	5 (0.28)
Keswick	2	10 (0.64)	-	-	8 (0.50)	1 (0.07)	-	31 (0.85)
Lake Chesdin	-	13 (0.14)	-	-	-	-	-	1
London Downs	-	7 (0.28)	-	-	5	11 (0.14)	7 (0.07)	12 (0.07)
Longwood	-	14 (0.42)	-	-	-	-	-	3 (0.28)
Meadowcreek	3	2 (0.07)	1 (0.07)	-	5 (0.21)	1	-	3 (0.14)
Oak Marr	2	6 (0.42)	-	-	6 (0.42)	3	-	5 (0.57)
Oakwood	-	2 (0.07)	-	-	2 (0.14)	-	-	2 (0.14)
Shenandoah Crossing	2 (0.14)	4 (0.14)	2 (0.14)	-	-	2	-	2
Tanyard	3 (0.14)	16 (0.28)	-	-	1	3	-	21 (0.42)
Washington	-	3 (0.14)	-	-	20 (0.85)	-	-	14 (0.57)

APPENDIX E3 – Golf Courses in Piedmont (cont.)

Golf Course	BHCO	OROR	BAOR	HOFI	AMGO	HOSP
Army Navy (Red)	1	3 (0.28)	2	2	5 (0.71)	15 (1.41)
Army Navy (White)	1 (0.14)	4 (0.14)	1 (0.14)	3 (0.42)	2 (0.28)	24 (2.12)
Birdwood	8 (0.14)	-	1	-	7 (0.28)	-
Birkdale	2 (0.07)	-	-	9 (0.21)	8 (0.21)	-
Boonsboro	7 (0.28)	2 (0.14)	6 (0.28)	2 (0.14)	9 (0.07)	1 (0.07)
Brambleton	10 (0.21)	-	1	3	23 (0.50)	4
Colonial Hills	8 (0.14)	5 (0.07)	1	3	18 (0.92)	-
Fairfax National	1 (0.07)	2	-	-	8 (0.42)	-
Falling River	-	-	-	1	1 (0.07)	5
Farmington	2 (0.07)	-	-	4 (0.07)	6 (0.21)	3
Fawn Lake	-	-	2 (0.07)	-	10 (0.14)	-
Glenmore	3 (0.21)	1 (0.07)	2 (0.07)	2 (0.14)	12 (0.42)	4 (0.07)
Heartland	-	1	-	-	5 (0.28)	-
Ivy Hill	2 (0.14)	1	1 (0.07)	11 (0.21)	3	3 (0.21)
Jefferson District	2 (0.14)	-	-	-	2 (0.14)	5 (0.57)
Keswick	2 (0.14)	5 (0.28)	2 (0.14)	1	10 (0.42)	1
Lake Chesdin	14 (0.21)	1 (0.07)	-	-	9	-
London Downs	2 (0.07)	-	1	3	1 (0.07)	-
Longwood	3 (0.14)	-	-	-	6 (0.14)	-
Meadowcreek	1	1 (0.07)	-	3	9 (0.14)	-
Oak Marr	3 (0.28)	-	1 (0.14)	7 (0.71)	3 (0.28)	9 (1.13)
Oakwood	-	1 (0.07)	-	1 (0.07)	1	-
Shenandoah Crossing	3 (0.14)	-	-	-	9 (0.21)	-
Tanyard	2	-	-	3 (0.14)	6 (0.28)	2 (0.07)
Washington	2 (0.14)	-	1	1	8 (0.57)	11 (0.57)

APPENDIX E4 – Golf Courses in Mountains

Golf Course	# Counts	GNHE	CAGO	WODU	MALL	BLVU	TUVU	SSHA
Blacksburg	18	4 (0.21)	18	-	-	-	-	-
Castle Rock	18	1 (0.07)	-	-	-	-	-	-
Devil's Knob	18	-	-	-	-	-	-	-
Gypsy Hill	18	-	1	-	5 (0.07)	-	-	-
Hanging Rock	18	-	-	-	4 (0.21)	-	-	-
Heritage Oaks	18	-	-	-	-	-	-	1
Lake Bonaventure	9	1 (0.14)	1 (0.14)	2	-	-	-	-
Lakeview (Lake)	9	-	-	-	2	-	-	-
Lakeview (Mountain)	9	-	-	-	-	-	-	-
Lakeview (Peak)	9	-	-	-	-	-	-	-
Lexington	18	3 (0.07)	1 (0.07)	-	1	-	-	-
Lower Cascades	18	-	-	-	-	-	1 (0.07)	-
Mountain Top	9	-	-	-	-	-	-	-
Needle's Eye	9	-	-	-	-	-	-	-
Ole Monterey	18	-	-	-	1	-	3 (0.14)	-
River Course	18	1	27 (1.91)	-	4 (0.14)	-	-	1
Round Meadows	18	1	-	-	1	-	-	-
Stoney Creek (Monocan)	9	1	-	-	-	1	-	-
Stoney Creek (Shamokin)	9	-	-	-	-	-	-	-
Stoney Creek (Tuckahoe)	9	2	2 (0.14)	1	-	-	-	-
Virginia Tech	18	-	-	-	13 (0.92)	-	-	-
Waynesboro	18	2 (0.07)	1 (0.07)	-	4 (0.14)	-	-	-
Willowbrook	9	-	-	1	-	-	-	-

Golf Course	RTHA	NOBO	KILL	RODO	MODO	YBCU	CHSW	RTHU
Blacksburg	-	-	1	-	1	1 (0.07)	2	-
Castle Rock	-	-	-	1 (0.07)	6 (0.21)	-	1 (0.07)	-
Devil's Knob	-	-	-	-	-	-	-	-
Gypsy Hill	-	-	-	1	1	-	4 (0.14)	-
Hanging Rock	-	-	3 (0.07)	-	3	-	3 (0.21)	-
Heritage Oaks	-	-	1	-	2	-	7 (0.50)	-
Lake Bonaventure	-	-	-	-	-	-	3 (0.28)	-
Lakeview (Lake)	-	-	3	-	-	-	6 (0.14)	-
Lakeview (Mountain)	1	-	2	-	6 (0.14)	-	-	-
Lakeview (Peak)	-	-	-	-	3	-	-	-
Lexington	-	-	5 (0.21)	1	5 (0.21)	-	5 (0.21)	-
Lower Cascades	-	-	-	-	3 (0.21)	3	2	-
Mountain Top	-	-	-	-	5 (0.14)	2 (0.14)	-	-
Needle's Eye	-	-	-	-	1	-	-	-
Ole Monterey	-	4 (0.14)	-	-	8 (0.28)	-	1 (0.07)	-
River Course	-	-	7 (0.07)	-	-	5 (0.14)	-	-
Round Meadows	-	-	3	-	10 (0.21)	-	1	-
Stoney Creek (Monocan)	-	-	-	-	-	-	-	-
Stoney Creek (Shamokin)	-	-	-	-	2 (0.14)	2 (0.14)	-	2
Stoney Creek (Tuckahoe)	-	-	1 (0.14)	-	1 (0.14)	-	-	1 (0.14)
Virginia Tech	-	-	-	-	3	-	8 (0.42)	-
Waynesboro	-	-	-	2 (0.07)	1 (0.07)	-	1 (0.07)	-
Willowbrook	-	-	-	-	2 (0.14)	-	2 (0.14)	3

APPENDIX E4 – Golf Courses in Mountains (cont.)

Golf Course	BEKI	RHWO	RBWO	DOWO	HAWO	NOFL	PIWO	EAWP
Blacksburg	-	-	1	1	-	-	-	-
Castle Rock	2	-	3 (0.14)	2 (0.07)	1 (0.07)	4 (0.07)	-	8 (0.21)
Devil's Knob	-	-	1 (0.07)	-	-	-	-	3 (0.14)
Gypsy Hill	-	-	6 (0.14)	-	-	4 (0.14)	-	2 (0.07)
Hanging Rock	-	-	6 (0.35)	2 (0.07)	-	2	1 (0.07)	8 (0.28)
Heritage Oaks	1	-	1	-	-	-	1	1
Lake Bonaventure	-	-	3 (0.28)	-	-	1	-	1 (0.14)
Lakeview (Lake)	-	-	1	1 (0.14)	-	-	1 (0.14)	-
Lakeview (Mountain)	-	-	3 (0.14)	-	-	3	-	2 (0.14)
Lakeview (Peak)	-	-	5 (0.14)	-	-	2	-	5 (0.14)
Lexington	-	-	2 (0.07)	1 (0.07)	-	1 (0.07)	2	-
Lower Cascades	-	-	3 (0.07)	4 (0.14)	-	2 (0.07)	-	4
Mountain Top	-	-	1 (0.14)	2	2	1	1	-
Needle's Eye	-	-	1	-	-	3 (0.28)	-	2 (0.14)
Ole Monterey	-	-	2 (0.07)	-	-	-	-	-
River Course	1 (0.07)	1 (0.07)	4 (0.28)	2 (0.07)	-	3 (0.14)	1 (0.07)	5 (0.21)
Round Meadows	-	-	7 (0.21)	3 (0.07)	-	1	-	2 (0.14)
Stoney Creek (Monocan)	-	-	-	1 (0.14)	-	1	-	-
Stoney Creek (Shamokin)	-	-	4 (0.42)	1 (0.14)	-	-	4 (0.28)	-
Stoney Creek (Tuckahoe)	-	-	1	-	-	2	-	1
Virginia Tech	-	-	1 (0.07)	-	-	3 (0.21)	-	3 (0.14)
Waynesboro	2	1	1 (0.07)	-	-	3 (0.07)	-	1 (0.07)
Willowbrook	3	-	-	1	-	1	-	2

Golf Course	ACFL	EAPH	GCFL	EAKI	TRES	NRWS	BARS	BLJA
Blacksburg	-	1 (0.07)	-	4 (0.07)	9 (0.28)	2	2 (0.07)	11 (0.14)
Castle Rock	1 (0.07)	1 (0.07)	1 (0.07)	2 (0.14)	2 (0.14)	-	1	3 (0.07)
Devil's Knob	1	3	2 (0.07)	-	-	-	-	1 (0.07)
Gypsy Hill	-	-	3	-	-	1	-	9 (0.35)
Hanging Rock	-	4 (0.07)	2 (0.07)	1 (0.07)	-	2 (0.07)	-	5 (0.28)
Heritage Oaks	-	1	1	3 (0.14)	4 (0.14)	-	7 (0.21)	5 (0.14)
Lake Bonaventure	-	3 (0.14)	1	2	-	-	3 (0.28)	-
Lakeview (Lake)	-	-	-	1	4 (0.28)	-	-	3 (0.28)
Lakeview (Mountain)	-	4 (0.28)	1 (0.14)	3 (0.14)	6	-	3	8 (0.42)
Lakeview (Peak)	-	-	1	-	4	-	1	7 (0.14)
Lexington	-	1 (0.07)	-	2	2 (0.07)	2 (0.07)	1 (0.07)	4 (0.14)
Lower Cascades	-	6 (0.07)	6 (0.21)	1	1 (0.07)	-	6 (0.28)	1
Mountain Top	-	-	-	1	-	-	-	1
Needle's Eye	-	2 (0.28)	1 (0.14)	-	-	-	-	3
Ole Monterey	-	-	-	3 (0.14)	4 (0.28)	-	3 (0.14)	4 (0.21)
River Course	3 (0.14)	3 (0.07)	-	7 (0.28)	2 (0.07)	1	6	1 (0.07)
Round Meadows	2 (0.07)	2	4 (0.21)	5 (0.21)	-	1 (0.07)	1	5 (0.14)
Stoney Creek (Monocan)	-	3 (0.14)	-	1	1	-	-	2
Stoney Creek (Shamokin)	-	2 (0.14)	-	-	-	-	-	3 (0.28)
Stoney Creek (Tuckahoe)	-	2 (0.14)	-	-	-	-	1	4 (0.14)
Virginia Tech	-	1 (0.07)	1	5 (0.07)	-	-	6 (0.28)	8 (0.50)
Waynesboro	-	-	-	-	-	-	-	18 (0.64)
Willowbrook	1	-	-	-	1	3 (0.14)	2 (0.14)	-

APPENDIX E4 – Golf Courses in Mountains (cont.)

Golf Course	AMCR	FICR	CORA	BCCH	CACH	TUTI	WBNU	CARW
Blacksburg	16 (0.35)	-	-	-	7 (0.42)	5	2 (0.14)	4 (0.07)
Castle Rock	4 (0.28)	-	-	-	2 (0.14)	3 (0.07)	4 (0.21)	1 (0.07)
Devil's Knob	3 (0.07)	-	-	-	-	2	2 (0.14)	2 (0.07)
Gypsy Hill	11 (0.35)	2 (0.07)	-	-	3 (0.14)	4 (0.21)	1 (0.07)	1
Hanging Rock	5 (0.28)	-	-	-	10 (0.35)	2 (0.07)	5 (0.35)	7 (0.35)
Heritage Oaks	8 (0.14)	-	-	-	7 (0.21)	9 (0.21)	2 (0.07)	3 (0.14)
Lake Bonaventure	5 (0.42)	-	-	-	1 (0.14)	3 (0.14)	2 (0.14)	2 (0.28)
Lakeview (Lake)	8 (0.14)	-	-	-	4	1 (0.14)	1	-
Lakeview (Mountain)	1 (0.14)	-	-	-	2 (0.28)	3 (0.42)	1	-
Lakeview (Peak)	6 (0.42)	-	-	-	2	3 (0.28)	4 (0.14)	1
Lexington	19 (0.57)	-	-	-	7 (0.35)	7 (0.28)	-	3 (0.07)
Lower Cascades	10 (0.21)	-	-	-	2 (0.14)	12 (0.14)	3	9 (0.21)
Mountain Top	5 (0.14)	-	-	-	4	1	2 (0.28)	6 (0.28)
Needle's Eye	7 (0.28)	-	-	1 (0.14)	-	2 (0.14)	-	-
Ole Monterey	9 (0.42)	-	-	-	-	4 (0.14)	-	5 (0.21)
River Course	9 (0.50)	-	-	-	7 (0.28)	7 (0.28)	1	14 (0.50)
Round Meadows	17 (0.28)	-	-	-	10 (0.21)	6 (0.07)	3 (0.21)	18 (0.42)
Stoney Creek (Monocan)	5 (0.14)	-	-	-	2 (0.14)	-	-	4
Stoney Creek (Shamokin)	9 (0.57)	2	1	-	6 (0.42)	6	2 (0.14)	8 (0.42)
Stoney Creek (Tuckahoe)	11 (0.42)	-	-	-	5 (0.42)	5 (0.42)	1	2
Virginia Tech	6 (0.28)	-	-	-	2 (0.07)	1	-	-
Waynesboro	13 (0.21)	3 (0.07)	-	-	10 (0.42)	11 (0.35)	-	3 (0.07)
Willowbrook	5 (0.42)	-	-	-	1	1 (0.14)	1	-

Golf Course	HOWR	BGGN	EABL	WOTH	AMRO	GRCA	NOMO	BRTH
Blacksburg	1	-	18 (0.21)	-	10 (0.07)	-	6 (0.07)	-
Castle Rock	1	7 (0.35)	5 (0.28)	6 (0.28)	31 (1.41)	1	9 (0.57)	5 (0.28)
Devil's Knob	-	-	-	7 (0.35)	31 (0.85)	2	-	-
Gypsy Hill	6 (0.35)	-	5 (0.14)	-	18 (0.78)	9 (0.42)	8 (0.21)	-
Hanging Rock	-	2 (0.14)	22 (0.99)	-	26 (0.78)	-	3	1 (0.07)
Heritage Oaks	-	2 (0.07)	5 (0.07)	-	8 (0.28)	3 (0.14)	3 (0.07)	-
Lake Bonaventure	-	3	3 (0.28)	1 (0.14)	15 (0.85)	2	-	-
Lakeview (Lake)	1 (0.14)	-	5 (0.28)	-	10 (0.42)	-	3 (0.28)	-
Lakeview (Mountain)	-	-	8 (0.14)	-	6 (0.28)	2	7 (0.28)	7 (0.14)
Lakeview (Peak)	-	-	6 (0.42)	-	7 (0.42)	-	-	1
Lexington	-	-	2 (0.07)	-	8 (0.50)	1	4 (0.21)	1 (0.07)
Lower Cascades	-	3 (0.14)	2	1	16 (0.28)	3 (0.14)	-	1 (0.07)
Mountain Top	-	1 (0.14)	3	1	7 (0.28)	-	-	-
Needle's Eye	2 (0.14)	-	7 (0.71)	-	6 (0.14)	4 (0.28)	-	2 (0.14)
Ole Monterey	3 (0.14)	-	2 (0.07)	-	7 (0.28)	1	5 (0.28)	1
River Course	1	10 (0.57)	5 (0.21)	3 (0.14)	9 (0.07)	-	3 (0.14)	-
Round Meadows	3 (0.14)	2	11 (0.35)	1	31 (0.92)	3 (0.14)	10 (0.21)	-
Stoney Creek (Monocan)	2 (0.28)	-	3	-	-	1 (0.14)	1	-
Stoney Creek (Shamokin)	1	-	6 (0.14)	2	1	2	2 (0.14)	-
Stoney Creek (Tuckahoe)	1 (0.14)	-	1	-	-	3 (0.14)	2 (0.14)	1
Virginia Tech	1	-	2	-	15 (0.57)	2 (0.07)	4 (0.14)	1
Waynesboro	13 (0.21)	-	3 (0.07)	-	5 (0.21)	11 (0.64)	1 (0.07)	-
Willowbrook	1	4 (0.28)	2	2 (0.28)	3	-	-	1 (0.14)

APPENDIX E4 – Golf Courses in Mountains (cont.)

Golf Course	CEDW	EUST	WEVI	BHVI	YTVI	WAVI	REVI	NOPA
Blacksburg	-	4	-	-	1 (0.07)	-	-	-
Castle Rock	4 (0.07)	3	-	-	-	1	8 (0.35)	1
Devil's Knob	-	-	-	-	-	-	3 (0.07)	-
Gypsy Hill	4	14 (0.57)	-	-	-	-	-	-
Hanging Rock	2	9 (0.28)	-	-	-	-	-	-
Heritage Oaks	-	8 (0.14)	-	-	-	-	-	-
Lake Bonaventure	9 (0.85)	2	-	1	3 (0.28)	-	5 (0.42)	2
Lakeview (Lake)	-	2	-	-	-	-	-	-
Lakeview (Mountain)	1	1 (0.14)	-	-	-	-	-	-
Lakeview (Peak)	-	5	-	-	-	-	-	-
Lexington	2 (0.07)	8 (0.50)	-	-	-	-	-	-
Lower Cascades	4 (0.14)	-	1 (0.07)	-	-	-	17 (0.71)	3 (0.14)
Mountain Top	2 (0.28)	-	-	1	-	-	7	-
Needle's Eye	-	-	-	-	-	-	2	-
Ole Monterey	7 (0.28)	43 (0.07)	-	-	-	1 (0.07)	-	-
River Course	3 (0.21)	1	1	-	-	6 (0.28)	3 (0.14)	6 (0.21)
Round Meadows	16 (0.99)	3	-	-	-	-	1	-
Stoney Creek (Monocan)	1 (0.14)	2	-	-	-	-	2 (0.28)	-
Stoney Creek (Shamokin)	-	-	-	-	-	-	5 (0.42)	-
Stoney Creek (Tuckahoe)	-	1	2	-	1	-	4	-
Virginia Tech	9 (0.57)	2 (0.14)	1 (0.07)	-	-	-	-	-
Waynesboro	-	13 (0.35)	-	-	-	-	-	-
Willowbrook	5	1	-	-	2	-	4 (0.14)	3 (0.28)

Golf Course	YWAR	CSWA	BTNW	YTWA	PIWA	PRAW	CERW	BAWW
Blacksburg	-	-	-	-	-	-	-	-
Castle Rock	2 (0.07)	-	-	-	-	-	-	-
Devil's Knob	1 (0.07)	1	-	-	-	-	-	1 (0.07)
Gypsy Hill	-	-	-	-	-	-	-	-
Hanging Rock	-	-	-	-	-	-	-	-
Heritage Oaks	-	-	-	-	-	-	-	-
Lake Bonaventure	3 (0.14)	-	-	2 (0.14)	-	-	-	3
Lakeview (Lake)	-	-	-	-	-	-	-	-
Lakeview (Mountain)	-	-	-	-	-	-	-	-
Lakeview (Peak)	-	-	-	-	-	-	-	-
Lexington	-	-	-	-	-	-	-	-
Lower Cascades	-	-	-	-	-	-	-	-
Mountain Top	2	-	1 (0.14)	7 (0.14)	-	-	1 (0.14)	5 (0.42)
Needle's Eye	-	-	-	-	1 (0.14)	-	-	-
Ole Monterey	-	-	-	-	-	-	-	-
River Course	10 (0.21)	-	-	-	-	-	-	-
Round Meadows	-	-	-	-	-	-	-	1 (0.07)
Stoney Creek (Monocan)	-	-	-	-	-	-	-	-
Stoney Creek (Shamokin)	-	-	-	-	1	-	-	-
Stoney Creek (Tuckahoe)	-	-	-	-	-	1	-	-
Virginia Tech	-	-	-	-	-	-	-	-
Waynesboro	-	-	-	-	-	-	-	-
Willowbrook	2 (0.14)	-	-	2	-	-	1	1

APPENDIX E4 – Golf Courses in Mountains (cont.)

Golf Course	AMRE	OVEN	COYE	HOWA	YBCH	SUTA	SCTA	NOCA
Blacksburg	-	-	-	-	-	-	-	9 (0.07)
Castle Rock	3 (0.14)	-	-	-	1	-	3 (0.14)	4 (0.21)
Devil's Knob	-	-	-	-	-	-	5 (0.21)	-
Gypsy Hill	-	-	-	-	-	-	-	16 (0.64)
Hanging Rock	-	-	-	-	-	-	-	4 (0.14)
Heritage Oaks	-	-	-	-	-	-	-	5 (0.21)
Lake Bonaventure	-	-	-	-	2 (0.14)	2 (0.14)	-	6 (0.42)
Lakeview (Lake)	-	-	-	-	-	-	-	3 (0.42)
Lakeview (Mountain)	-	-	-	-	-	-	-	2
Lakeview (Peak)	-	-	-	-	-	-	-	4 (0.14)
Lexington	-	-	-	-	-	-	-	7 (0.28)
Lower Cascades	-	-	-	-	-	-	4 (0.07)	4 (0.07)
Mountain Top	1	4	-	1	-	-	1	3
Needle's Eye	-	-	2	-	-	-	-	3
Ole Monterey	-	-	-	-	1 (0.07)	-	-	6 (0.14)
River Course	1	-	-	-	-	-	2 (0.07)	9 (0.28)
Round Meadows	-	1 (0.07)	-	-	-	-	-	8 (0.35)
Stoney Creek (Monocan)	-	-	-	-	-	-	-	4 (0.28)
Stoney Creek (Shamokin)	-	-	-	-	-	-	-	6 (0.14)
Stoney Creek (Tuckahoe)	-	-	-	-	1 (0.14)	-	-	7 (0.42)
Virginia Tech	-	-	-	-	-	-	-	2 (0.07)
Waynesboro	-	-	-	-	-	-	-	16 (0.64)
Willowbrook	-	2 (0.28)	-	1	1	-	-	-

Golf Course	RBGR	INBU	EATO	CHSP	FISP	GRSP	SOSP	DEJU
Blacksburg	-	-	9 (0.42)	12 (0.28)	-	-	19 (0.35)	-
Castle Rock	-	3 (0.14)	3	21 (0.78)	-	-	9 (0.42)	-
Devil's Knob	4	2 (0.14)	17 (0.42)	3 (0.07)	-	-	-	14 (0.35)
Gypsy Hill	-	3	-	12 (0.28)	-	-	3 (0.07)	-
Hanging Rock	-	2 (0.14)	3 (0.07)	19 (0.71)	1	-	1	-
Heritage Oaks	-	8 (0.28)	4 (0.14)	1 (0.07)	5 (0.28)	-	4 (0.21)	-
Lake Bonaventure	-	4 (0.14)	1 (0.14)	10 (0.71)	-	-	7 (0.14)	-
Lakeview (Lake)	-	-	1	10 (0.28)	-	-	2 (0.14)	-
Lakeview (Mountain)	-	5 (0.14)	-	-	-	2 (0.28)	1	-
Lakeview (Peak)	-	-	3 (0.28)	7 (0.42)	1	-	-	-
Lexington	-	1 (0.07)	2 (0.07)	-	-	-	12 (0.57)	-
Lower Cascades	-	5 (0.21)	1 (0.07)	15 (0.28)	-	-	12 (0.50)	6 (0.07)
Mountain Top	-	6 (0.28)	2	14 (0.28)	-	-	2	-
Needle's Eye	-	3 (0.14)	4	3 (0.42)	5 (0.28)	-	3 (0.14)	-
Ole Monterey	-	4 (0.14)	5 (0.21)	8 (0.35)	3 (0.14)	1	9 (0.35)	-
River Course	-	18 (0.64)	6 (0.28)	4 (0.21)	-	-	15 (0.71)	-
Round Meadows	-	13 (0.28)	15 (0.50)	19 (0.71)	3 (0.07)	-	15 (0.28)	-
Stoney Creek (Monocan)	-	5 (0.28)	1	3 (0.14)	3 (0.14)	-	3	-
Stoney Creek (Shamokin)	-	7 (0.28)	6 (0.28)	4 (0.14)	1 (0.14)	-	-	-
Stoney Creek (Tuckahoe)	-	5 (0.28)	4 (0.14)	2 (0.14)	3 (0.28)	-	2	-
Virginia Tech	-	-	-	4 (0.21)	-	-	1 (0.07)	-
Waynesboro	-	3 (0.14)	1	-	-	-	17 (0.50)	-
Willowbrook	-	2 (0.14)	1	10 (0.57)	-	-	8 (0.71)	-

APPENDIX E4 – Golf Courses in Mountains (cont.)

Golf Course	RWBL	EAME	COGR	BHCO	OROR	BAOR	HOFI	AMGO
Blacksburg	2	-	24 (0.35)	1 (0.07)	-	1	-	16 (0.64)
Castle Rock	6 (0.07)	4 (0.21)	3 (0.07)	3 (0.14)	2 (0.07)	2 (0.14)	2 (0.07)	10 (0.50)
Devil's Knob	-	-	-	6 (0.21)	-	-	-	2 (0.07)
Gypsy Hill	-	-	7 (0.28)	-	-	-	1 (0.07)	7 (0.14)
Hanging Rock	-	-	3	5 (0.21)	-	-	3	1 (0.07)
Heritage Oaks	-	-	52 (0.07)	2 (0.07)	-	-	1	9 (0.28)
Lake Bonaventure	7 (0.28)	-	-	2	-	1 (0.14)	-	9 (0.14)
Lakeview (Lake)	-	-	15 (1.84)	1	-	-	-	2 (0.14)
Lakeview (Mountain)	-	3 (0.14)	23 (0.28)	-	-	-	1	2 (0.14)
Lakeview (Peak)	-	-	4 (0.14)	2	-	-	3	6 (0.28)
Lexington	1 (0.07)	-	19 (0.50)	1	-	5 (0.35)	1	2 (0.14)
Lower Cascades	1	-	14 (0.64)	-	-	-	-	9 (0.28)
Mountain Top	-	-	-	1	-	-	-	17 (1.27)
Needle's Eye	2	1	-	1	-	-	-	2
Ole Monterey	-	5 (0.21)	10 (0.35)	3 (0.14)	-	3	3 (0.21)	3 (0.14)
River Course	1	4 (0.14)	6 (0.35)	1 (0.07)	6 (0.35)	9 (0.35)	-	10 (0.14)
Round Meadows	2 (0.07)	5 (0.21)	22 (0.64)	19 (0.57)	2 (0.07)	-	1 (0.07)	14 (0.42)
Stoney Creek (Monocan)	-	2	-	1	-	-	-	8 (0.57)
Stoney Creek (Shamokin)	1	-	-	-	-	-	1	1
Stoney Creek (Tuckahoe)	3 (0.14)	-	1 (0.14)	-	-	-	-	5 (0.28)
Virginia Tech	-	-	16 (0.50)	-	4 (0.21)	3 (0.07)	4 (0.21)	12 (0.42)
Waynesboro	1	-	14 (0.57)	2 (0.07)	-	-	4 (0.21)	4 (0.14)
Willowbrook	2 (0.14)	-	-	-	-	-	-	5 (0.42)

Golf Course	HOSP
Blacksburg	-
Castle Rock	1
Devil's Knob	-
Gypsy Hill	1 (0.07)
Hanging Rock	-
Heritage Oaks	-
Lake Bonaventure	-
Lakeview (Lake)	7 (0.28)
Lakeview (Mountain)	-
Lakeview (Peak)	-
Lexington	1 (0.07)
Lower Cascades	-
Mountain Top	-
Needle's Eye	-
Ole Monterey	4 (0.07)
River Course	-
Round Meadows	3 (0.14)
Stoney Creek (Monocan)	-
Stoney Creek (Shamokin)	-
Stoney Creek (Tuckahoe)	-
Virginia Tech	6 (0.21)
Waynesboro	7 (0.28)
Willowbrook	-

APPENDIX F

Avian community data for reference sites (Appendix F1) and golf courses in the Coastal Plain (Appendix F2), Piedmont (Appendix F3), and mountains (Appendix F4). As some surveys consisted of only 9, rather than 18, point counts and "fairway" counts, the number of counts per survey is noted. (CP = Coastal Plain, P = Piedmont, M = mountains; c.c. = species of conservation concern, open hab. = open habitat-dependent species, forest dep. = forest-dependent Neotropical migrants, wetland = wetland-dependent species)

APPENDIX F1 – Reference Sites

Reference Habitat	Province	# Counts	Habitat Group	Density (all)	Density (c.c.)	Density (open hab., c.c.)	Density (forest dep., c.c.)
Intact Mature Forest	CP	18	forest	7.214	3.253	0.778	2.687
Intact Mature Forest	P	18	forest	7.143	3.678	0.495	2.475
Intact Mature Forest	M	18	forest	3.465	1.980	0.071	1.980
Early Successional	CP	18	forest	6.789	3.607	1.556	2.051
Early Successional	P	18	forest	5.375	4.031	3.112	1.414
Early Successional	M	18	forest	5.163	3.819	2.970	0.778
Fragmented Forest	CP	18	forest	8.911	3.536	1.768	1.414
Fragmented Forest	P	18	forest	4.314	1.839	1.061	0.707
Fragmented Forest	M	18	forest	6.365	3.748	1.556	2.617
Row Crops	CP	18	agriculture	10.750	6.365	4.526	1.768
Row Crops	P	18	agriculture	8.062	2.758	1.839	0.212
Row Crops	M	18	agriculture	1.980	0.424	0.354	0.000
Pasture	CP	18	agriculture	8.840	3.253	2.192	0.141
Pasture	P	9	agriculture	1.414	0.707	0.707	0.000
Pasture	M	18	agriculture	4.455	1.839	1.202	0.212
Grassland/Hay Field	CP	18	agriculture	4.809	4.526	4.385	0.000
Grassland/Hay Field	P	18	agriculture	8.062	4.173	3.748	0.141
Grassland/Hay Field	M	18	agriculture	2.900	2.051	1.980	0.071
Low-density Suburban	CP	18	developed	10.679	3.465	1.627	1.061
Low-density Suburban	P	18	developed	5.375	2.829	1.980	0.424
Low-density Suburban	M	18	developed	8.911	2.122	1.344	0.212
High-density Suburban	CP	18	developed	10.325	2.546	0.636	1.202
High-density Suburban	P	18	developed	11.033	1.697	0.990	0.566
High-density Suburban	M	18	developed	10.891	1.485	0.707	0.495
Urban	CP	18	developed	10.255	1.627	0.000	0.778
Urban	P	9	developed	7.214	3.395	1.697	1.414
Urban	M	18	developed	10.679	1.273	0.283	0.566

APPENDIX F1 – Reference Sites (cont.)

Reference Habitat	Province	Density (wetland, c.c.)	Richness (all)	Richness (c.c.)	Diversity (all)	Migratory Behavior Rank
Intact Mature Forest	CP	0.849	39	20	2.996	98
Intact Mature Forest	P	0.424	35	20	3.004	88
Intact Mature Forest	M	0.071	25	16	2.779	84
Early Successional	CP	0.707	35	17	2.981	91
Early Successional	P	0.636	35	21	3.108	110
Early Successional	M	0.000	25	14	2.342	68
Fragmented Forest	CP	1.061	60	31	3.317	173
Fragmented Forest	P	0.212	26	13	2.780	79
Fragmented Forest	M	0.212	32	18	3.049	91
Row Crops	CP	0.495	47	32	3.379	137
Row Crops	P	0.141	43	23	3.102	107
Row Crops	M	0.071	19	7	2.521	39
Pasture	CP	0.283	52	25	3.330	130
Pasture	P	0.000	36	18	2.303	81
Pasture	M	0.141	23	9	2.462	52
Grassland/Hay Field	CP	1.202	32	18	2.354	86
Grassland/Hay Field	P	0.424	37	21	3.284	100
Grassland/Hay Field	M	0.000	28	16	1.923	69
Low-density Suburban	CP	0.354	57	29	3.466	140
Low-density Suburban	P	0.141	38	20	3.290	95
Low-density Suburban	M	0.212	38	15	3.182	83
High-density Suburban	CP	0.071	47	19	3.402	101
High-density Suburban	P	0.000	34	12	2.816	68
High-density Suburban	M	0.000	30	11	2.757	61
Urban	CP	0.849	17	4	2.217	35
Urban	P	0.141	27	10	2.573	47
Urban	M	0.000	25	5	2.638	38

APPENDIX F1 – Reference Sites (cont.)

Reference Habitat	Province	Habitat Specificity Rank	Wetland-dependence Rank	Conservation Priority Rank
Intact Mature Forest	CP	85	24	635
Intact Mature Forest	P	91	14	575
Intact Mature Forest	M	77	9	429
Early Successional	CP	75	17	555
Early Successional	P	87	14	583
Early Successional	M	71	7	421
Fragmented Forest	CP	130	70	963
Fragmented Forest	P	54	18	418
Fragmented Forest	M	88	20	528
Row Crops	CP	109	13	809
Row Crops	P	75	14	675
Row Crops	M	23	8	282
Pasture	CP	90	28	806
Pasture	P	66	13	577
Pasture	M	31	14	340
Grassland/Hay Field	CP	54	12	516
Grassland/Hay Field	P	71	18	597
Grassland/Hay Field	M	66	10	453
Low-density Suburban	CP	111	29	905
Low-density Suburban	P	74	18	607
Low-density Suburban	M	70	20	569
High-density Suburban	CP	77	23	720
High-density Suburban	P	54	7	530
High-density Suburban	M	44	12	434
Urban	CP	23	21	235
Urban	P	37	11	402
Urban	M	37	2	339

APPENDIX F2 – Golf Courses in Coastal Plain

Golf Course	# Counts	Density (all)	Density (c.c.)	Density (open hab., c.c.)	Density (forest dep., c.c.)	Density (wetland, c.c.)
Aquia Harbour	9	4.102	1.273	1.132	0.000	0.141
Augustine	18	3.536	0.707	0.354	0.071	0.000
Bay Creek	18	7.426	2.405	0.919	0.141	1.202
Belle Haven	18	11.457	3.465	0.212	2.192	0.000
Bide-a-wee	18	6.436	1.273	0.424	0.141	0.071
Chesapeake	18	8.557	0.919	0.212	0.283	0.000
Colonial	18	3.819	2.051	1.273	1.061	0.141
Eaglewood (Blue)	18	5.092	0.849	0.354	0.000	0.000
Eaglewood (Red)	18	8.345	0.919	0.778	0.071	0.283
Eastern Shore	18	6.294	2.475	0.990	0.354	0.000
Elizabeth Manor	18	7.992	1.132	0.141	0.000	0.071
Ford's Colony	18	5.233	1.839	0.778	0.707	0.071
Four Winds	18	4.385	1.273	1.132	0.071	0.141
Fredericksburg	18	5.728	2.475	1.344	0.707	0.071
Golden Horseshoe (Green)	18	6.719	2.758	1.202	1.556	0.354
Hamptons	18	4.738	0.990	0.424	0.283	0.566
Hell's Point	18	9.406	2.334	0.495	0.566	0.212
Hobbs Hole	18	11.245	2.051	1.061	0.424	0.141
Kiln Creek (Championship)	18	8.133	1.627	0.707	0.495	0.212
Kiln Creek (Creek)	9	4.809	0.566	0.000	0.283	0.000
Kingsmill (Plantation)	18	6.011	1.697	0.212	0.424	0.141
Kingsmill (River)	18	4.526	0.495	0.212	0.071	0.071
Kingsmill (Woods)	18	3.748	1.132	0.212	0.212	0.071
Kiskiack	18	2.970	1.414	0.778	0.566	0.283
Lee's Hill	18	5.021	2.192	1.344	0.566	0.212
Newport News (Cardinal)	18	16.761	3.465	1.627	0.778	0.283
Newport News (Deer Run)	18	20.297	4.385	1.839	2.687	1.061
Pohick Bay	18	14.922	5.021	2.122	2.475	0.283
Princess Anne	18	12.659	2.970	0.990	0.990	0.141
Red Wing Lake	18	12.306	3.536	0.707	0.990	0.141
Riverfront	18	7.496	1.556	0.919	0.141	0.636
Royal New Kent	18	5.728	4.385	3.253	1.061	0.566
Stonehouse	18	8.345	3.678	1.980	1.697	0.707
Suffolk	18	8.062	2.405	1.132	0.849	0.354
Two Rivers	18	12.164	3.607	0.778	0.424	0.071
Williamsburg	18	5.304	1.627	1.061	0.424	0.212
Williamsburg National	18	3.182	1.768	0.919	0.636	0.141
Woodlands	18	9.194	2.475	0.566	0.354	1.485
Woodside	9	9.052	4.668	2.970	2.687	0.424

APPENDIX F2 – Golf Courses in Coastal Plain (cont.)

Golf Course	Richness (all)	Richness (c.c.)	Diversity (all)	Migratory Behavior Rank	Habitat Specificity Rank
Aquia Harbour	23	9	2.462	38	37
Augustine	29	11	2.406	52	53
Bay Creek	55	29	2.873	154	119
Belle Haven	30	7	2.640	62	42
Bide-a-wee	35	16	2.610	81	53
Chesapeake	34	12	2.676	58	56
Colonial	45	26	3.305	122	99
Eaglewood (Blue)	26	9	2.161	57	36
Eaglewood (Red)	32	11	2.280	63	44
Eastern Shore	45	19	2.560	98	83
Elizabeth Manor	34	13	2.147	71	60
Ford's Colony	44	18	3.017	103	80
Four Winds	19	8	2.428	37	39
Fredericksburg	41	20	2.957	108	83
Golden Horseshoe (Green)	45	24	3.315	120	99
Hamptons	36	16	2.701	96	64
Hell's Point	43	18	2.782	105	89
Hobbs Hole	31	15	2.130	66	67
Kiln Creek (Championship)	48	19	3.110	113	88
Kiln Creek (Creek)	33	10	2.673	81	57
Kingsmill (Plantation)	39	15	3.153	94	71
Kingsmill (River)	34	11	2.723	70	50
Kingsmill (Woods)	30	12	2.657	61	58
Kiskiack	44	23	2.835	119	92
Lee's Hill	50	23	3.562	133	102
Newport News (Cardinal)	37	16	2.648	86	73
Newport News (Deer Run)	41	18	2.761	95	93
Pohick Bay	50	26	3.267	126	112
Princess Anne	36	15	2.910	64	60
Red Wing Lake	43	19	2.621	92	87
Riverfront	54	28	2.689	142	94
Royal New Kent	42	27	3.188	120	90
Stonehouse	43	26	3.370	117	105
Suffolk	44	23	2.951	102	90
Two Rivers	39	16	2.727	83	64
Williamsburg	49	24	3.007	119	95
Williamsburg National	47	27	2.896	133	97
Woodlands	34	14	2.574	78	52
Woodside	41	20	2.747	111	91

APPENDIX F2 – Golf Courses in Coastal Plain (cont.)

Golf Course	Wetland-dependence Rank	Conservation Priority Rank
Aquia Harbour	6	349
Augustine	29	442
Bay Creek	72	865
Belle Haven	24	420
Bide-a-wee	16	546
Chesapeake	21	502
Colonial	21	742
Eaglewood (Blue)	5	376
Eaglewood (Red)	20	457
Eastern Shore	46	685
Elizabeth Manor	31	510
Ford's Colony	33	688
Four Winds	4	296
Fredericksburg	18	657
Golden Horseshoe (Green)	38	738
Hamptons	56	544
Hell's Point	31	675
Hobbs Hole	20	481
Kiln Creek (Championship)	55	726
Kiln Creek (Creek)	41	470
Kingsmill (Plantation)	40	593
Kingsmill (River)	26	497
Kingsmill (Woods)	22	465
Kiskiack	41	699
Lee's Hill	43	781
Newport News (Cardinal)	30	585
Newport News (Deer Run)	46	648
Pohick Bay	29	815
Princess Anne	33	545
Red Wing Lake	41	658
Riverfront	54	854
Royal New Kent	16	708
Stonehouse	19	730
Suffolk	40	713
Two Rivers	30	571
Williamsburg	45	760
Williamsburg National	34	761
Woodlands	46	502
Woodside	32	663

APPENDIX F3 – Golf Courses in Piedmont

Golf Course	# Counts	Density (all)	Density (c.c.)	Density (open hab., c.c.)	Density (forest dep., c.c.)	Density (wetland, c.c.)
Army Navy (Red)	9	15.842	2.829	2.829	0.283	0.000
Army Navy (White)	9	14.427	2.829	1.697	0.141	0.283
Birdwood	18	6.365	2.263	1.273	0.495	0.212
Birkdale	18	4.809	1.344	0.919	0.354	0.000
Boonesboro	18	7.072	2.617	1.697	0.566	0.071
Brambleton	18	15.700	5.658	3.465	1.132	0.566
Colonial Hills	18	4.809	1.485	1.273	0.212	0.000
Fairfax National	18	13.649	2.617	1.556	0.636	0.071
Falling River	18	4.950	1.839	1.132	0.354	0.071
Farmington	18	5.092	1.485	0.707	0.283	0.071
Fawn Lake	18	5.587	0.990	0.707	0.212	0.000
Glenmore	18	8.982	3.960	2.405	0.919	0.354
Heartland	9	6.365	3.112	1.980	0.990	0.141
Ivy Hill	18	7.921	1.556	0.849	0.354	0.141
Jefferson District	9	4.668	0.424	0.283	0.000	0.000
Keswick	18	7.850	2.475	1.839	0.354	0.212
Lake Chesdin	18	4.880	3.041	1.344	2.122	0.283
London Downs	18	2.546	0.707	0.636	0.000	0.212
Longwood	9	3.112	0.566	0.424	0.000	0.000
Meadowcreek	18	4.950	1.202	0.424	0.283	0.141
OakMarr	9	12.164	5.658	1.839	3.819	0.283
Oakwood	18	2.829	0.919	0.566	0.071	0.071
Shenandoah Crossing	18	3.465	1.485	0.778	0.495	0.141
Tanyard	18	5.375	2.192	0.990	0.919	0.141
Washington	18	11.457	1.909	0.636	0.566	0.141

APPENDIX F3 – Golf Courses in Piedmont (cont.)

Golf Course	Richness (all)	Richness (c.c.)	Diversity (all)	Migratory Behavior Rank	Habitat Specificity Rank	Wetland-dependence Rank
Army Navy (Red)	26	8	2.461	50	32	2
Army Navy (White)	34	13	2.984	73	56	29
Birdwood	41	21	3.108	99	76	28
Birkdale	44	18	3.206	98	82	25
Boonesboro	40	17	3.280	90	72	15
Brambleton	60	31	3.463	156	116	44
Colonial Hills	42	20	2.924	104	78	19
Fairfax National	39	17	3.010	90	71	22
Falling River	40	19	3.109	86	70	18
Farmington	36	14	3.213	77	62	7
Fawn Lake	34	12	3.032	69	64	24
Glenmore	54	27	3.458	140	108	32
Heartland	40	23	2.871	106	82	33
Ivy Hill	43	21	2.989	100	68	28
Jefferson District	24	7	2.649	50	28	16
Keswick	48	24	3.225	115	84	30
Lake Chesdin	49	31	3.234	151	121	29
London Downs	38	18	2.359	84	60	31
Longwood	33	15	2.752	75	57	8
Meadowcreek	40	18	2.923	101	74	20
OakMarr	40	18	2.949	98	70	17
Oakwood	27	12	3.046	58	39	8
Shenandoah Crossing	37	17	3.032	87	83	23
Tanyard	53	25	3.317	133	94	38
Washington	35	14	2.926	82	59	9

APPENDIX F3 – Golf Courses in Piedmont (cont.)

Golf Course	Conservation Priority Rank
Army Navy (Red)	389
Army Navy (White)	517
Birdwood	638
Birkdale	673
Boonesboro	610
Brambleton	954
Colonial Hills	658
Fairfax National	605
Falling River	620
Farmington	551
Fawn Lake	509
Glenmore	857
Heartland	640
Ivy Hill	648
Jefferson District	359
Keswick	751
Lake Chesdin	796
London Downs	592
Longwood	514
Meadowcreek	624
OakMarr	617
Oakwood	410
Shenandoah Crossing	571
Tanyard	811
Washington	533

APPENDIX F4 – Golf Courses in Mountains

Golf Course	# Counts	Density (all)	Density (c.c.)	Density (open hab., c.c.)	Density (forest dep., c.c.)	Density (wetland, c.c.)
Blacksburg	18	4.526	1.697	0.919	0.141	0.283
Castle Rock	18	9.123	3.607	2.546	1.344	0.212
Devil's Knob	18	3.536	1.556	0.778	0.849	0.000
Gypsy Hill	18	5.799	1.414	0.919	0.212	0.000
Hanging Rock	18	6.860	2.687	1.556	0.707	0.141
Heritage Oaks	18	4.314	2.051	1.132	0.566	0.000
Lake Bonaventure	9	8.062	3.395	1.697	1.132	0.283
Lakeview (Lake)	9	5.516	0.424	0.283	0.141	0.000
Lakeview (Mountain)	9	4.243	1.839	0.990	0.283	0.283
Lakeview (Peak)	9	3.395	0.990	0.849	0.141	0.000
Lexington	18	6.223	1.768	0.849	0.212	0.354
Lower Cascades	18	5.799	2.051	1.061	0.566	0.071
Mountain Top	9	4.526	1.839	0.849	1.132	0.000
Needle's Eye	9	3.960	2.263	1.697	0.424	0.283
Ole Monterey	18	6.011	1.768	1.485	0.141	0.000
River Course	18	11.174	5.021	3.748	1.768	0.354
Round Meadows	18	9.830	3.253	2.334	0.566	0.071
Stoney Creek (Monocan)	9	2.829	0.990	0.707	0.000	0.141
Stoney Creek (Shamokin)	9	4.809	1.980	0.990	0.141	0.141
Stoney Creek (Tuckahoe)	9	4.526	1.980	1.273	0.141	0.283
Virginia Tech	18	6.577	1.980	1.061	0.566	0.071
Waynesboro	18	6.577	1.627	0.919	0.141	0.071
Willowbrook	9	4.668	2.405	1.132	1.273	0.000

Golf Course	Richness (all)	Richness (c.c.)	Diversity (all)	Migratory Behavior Rank	Habitat Specificity Rank
Blacksburg	34	14	2.817	77	62
Castle Rock	53	27	3.352	143	105
Devil's Knob	25	14	2.564	77	61
Gypsy Hill	32	11	2.898	63	48
Hanging Rock	36	16	2.979	72	64
Heritage Oaks	35	17	3.072	80	69
Lake Bonaventure	41	25	3.181	127	91
Lakeview (Lake)	26	7	2.426	42	42
Lakeview (Mountain)	31	14	2.904	69	59
Lakeview (Peak)	25	10	2.455	45	43
Lexington	39	15	3.145	78	59
Lower Cascades	39	20	3.129	104	79
Mountain Top	37	19	2.485	103	93
Needle's Eye	28	14	2.680	68	50
Ole Monterey	37	16	3.333	85	61
River Course	52	28	3.348	145	110
Round Meadows	47	24	3.273	123	93
Stoney Creek (Monocan)	27	11	2.441	61	49
Stoney Creek (Shamokin)	31	13	2.812	67	59
Stoney Creek (Tuckahoe)	37	20	2.924	91	75
Virginia Tech	32	15	2.951	78	48
Waynesboro	33	12	3.035	63	49
Willowbrook	40	24	2.717	130	96

APPENDIX F4 – Golf Courses in Mountains (cont.)

Golf Course	Wetland-dependence Rank	Conservation Priority Rank
Blacksburg	26	510
Castle Rock	27	850
Devil's Knob	8	423
Gypsy Hill	14	463
Hanging Rock	15	558
Heritage Oaks	17	543
Lake Bonaventure	26	684
Lakeview (Lake)	14	374
Lakeview (Mountain)	12	470
Lakeview (Peak)	5	376
Lexington	31	576
Lower Cascades	13	628
Mountain Top	9	613
Needle's Eye	10	443
Ole Monterey	11	567
River Course	42	851
Round Meadows	27	750
Stoney Creek (Monocan)	12	417
Stoney Creek (Shamokin)	8	480
Stoney Creek (Tuckahoe)	26	600
Virginia Tech	11	487
Waynesboro	27	476
Willowbrook	28	695

APPENDIX G

Proportions of land cover types within golf courses (Appendix G1), 250-m buffer zones (Appendix G2), and 1500-m large surrounding areas (Appendix G3). Golf course area is a relative measurement based on the number of cells, or pixels, covered by the golf course in the National Land Cover Data 1992 data set. Each cell represents an area of approximately 30 m^2. ("*" indicates a land cover subtype within a category)

APPENDIX G1 – Golf Course Land Cover

Golf Course	# Counts	Province	Area (# cells)	Open Water	Herbaceous Wetland	Forest	Deciduous Forest*
Aquia Harbour	9	CP	1047	0.00	0.19	50.33	19.10
Army Navy (Red)	9	P	371	0.00	0.00	21.56	12.94
Army Navy (White)	9	P	434	0.92	0.00	13.13	7.83
Belle Haven	18	CP	717	2.09	1.12	4.74	3.21
Birdwood	18	P	1470	5.85	0.07	18.10	3.61
Birkdale	18	P	2196	0.14	0.36	55.37	25.00
Blacksburg	18	M	938	0.00	0.00	14.39	4.69
Castle Rock	18	M	535	0.37	0.00	20.00	15.51
Chesapeake	18	CP	1082	6.47	2.50	25.32	3.42
Colonial Hills	18	P	742	1.35	0.27	16.85	4.58
Devil's Knob	18	M	1590	0.31	0.00	93.84	88.36
Eaglewood (Blue)	18	CP	573	3.32	3.14	6.11	4.01
Eaglewood (Red)	18	CP	935	0.43	0.00	4.71	3.10
Eastern Shore	18	CP	600	0.17	2.33	19.17	1.50
Elizabeth Manor	18	CP	650	3.69	6.31	5.38	1.85
Fairfax National	18	P	537	0.00	0.37	13.59	5.40
Falling River	18	P	753	1.99	0.00	10.76	6.51
Farmington	18	P	1783	0.79	0.00	39.20	3.87
Four Winds	18	CP	652	0.00	0.31	1.38	0.92
Fredericksburg	18	CP	723	8.02	0.69	6.64	3.18
Golden Horseshoe (Green)	18	CP	1535	1.56	0.52	71.66	47.10
Gypsy Hill	18	M	548	0.18	0.00	17.70	12.77
Hamptons	18	CP	808	6.68	0.62	31.44	25.37
Hanging Rock	18	M	1043	0.19	0.00	57.53	45.25
Heartland	9	P	427	9.60	0.00	2.34	0.70
Hell's Point	18	CP	883	4.98	5.55	52.89	19.59
Ivy Hill	18	P	1827	2.85	0.27	14.18	6.46
Jefferson District	9	P	242	3.72	0.00	8.68	2.48
Kiln Creek (Championship)	18	CP	1287	3.73	1.17	42.89	13.91
Kiln Creek (Creek)	9	CP	924	3.79	1.95	32.14	10.61
Kingsmill (Plantation)	18	CP	1532	2.68	0.98	41.78	7.77
Kingsmill (River)	18	CP	1967	4.78	0.41	29.64	5.44
Lakeview (Lake)	9	M	313	1.28	0.00	5.11	2.56
Lakeview (Peak)	9	M	328	0.00	0.00	19.51	16.46
Lexington	18	M	657	0.91	0.00	6.85	1.67
London Downs	18	P	1434	2.37	0.00	16.18	8.79
Longwood	9	P	236	0.00	0.00	21.61	6.78
Lower Cascades	18	M	983	0.71	0.00	25.94	19.02
Meadowcreek	18	P	999	2.10	0.00	30.73	8.81
Needle's Eye	9	M	287	0.70	0.00	27.53	19.51
Newport News (Cardinal)	18	CP	1180	1.44	0.08	38.73	23.64
Newport News (Deer Run)	18	CP	1304	2.45	0.08	57.82	43.87
Oakwood	18	P	1219	0.33	0.00	39.46	14.52
Ole Monterey	18	M	717	0.42	0.00	9.90	3.77
Pohick Bay	18	CP	1175	1.62	0.00	57.11	37.70
Princess Anne	18	CP	1091	1.28	1.47	30.43	2.75
Red Wing Lake	18	CP	1047	6.49	1.05	22.64	6.88
Round Meadows	18	M	595	0.17	0.00	9.08	5.21
Shenandoah Crossing	18	P	1906	0.00	0.42	87.72	73.98
Stoney Creek (Monocan)	9	M	828	2.05	0.00	21.74	13.53
Stoney Creek (Shamokin)	9	M	1003	0.00	0.00	83.25	48.95
Suffolk	18	CP	818	3.67	0.24	40.46	6.85
Virginia Tech	18	M	677	0.00	0.00	1.92	0.44
Washington	18	P	722	0.00	0.00	35.73	17.87
Waynesboro	18	M	886	0.56	0.00	8.58	1.92
Williamsburg	18	CP	824	5.95	0.24	21.48	13.35
Woodlands	18	CP	526	5.32	2.47	8.37	3.23

APPENDIX G1 – Golf Course Land Cover (cont.)

Golf Course	Evergreen Forest*	Mixed Forest*	Woody Wetland*	Transitional*	Row Crop	Grass	Pasture/Hay*
Aquia Harbour	8.50	11.65	0.00	11.08	0.00	28.37	28.37
Army Navy (Red)	1.62	7.01	0.00	0.00	0.00	60.38	0.00
Army Navy (White)	1.15	4.15	0.00	0.00	0.00	76.27	0.00
Belle Haven	0.56	0.98	0.00	0.00	0.14	81.87	5.58
Birdwood	4.08	10.14	0.00	0.27	1.97	71.84	71.84
Birkdale	1.91	28.46	0.00	0.00	11.02	32.70	32.70
Blacksburg	0.96	8.64	0.00	0.11	0.96	81.56	81.56
Castle Rock	0.00	4.49	0.00	0.00	2.62	77.01	77.01
Chesapeake	10.54	10.81	0.55	0.00	18.95	22.74	22.74
Colonial Hills	3.37	8.49	0.00	0.40	2.02	75.47	16.44
Devil's Knob	1.32	4.15	0.00	0.00	0.19	4.53	0.13
Eaglewood (Blue)	0.52	0.52	1.05	0.00	27.23	52.18	1.40
Eaglewood (Red)	0.64	0.96	0.00	0.00	21.50	62.35	10.48
Eastern Shore	15.67	2.00	0.00	0.00	3.83	65.83	1.17
Elizabeth Manor	3.38	0.00	0.15	0.00	0.00	29.08	4.46
Fairfax National	1.86	6.33	0.00	0.00	0.37	77.28	2.61
Falling River	1.59	2.26	0.00	0.40	2.12	80.61	80.61
Farmington	13.85	21.48	0.00	0.00	0.00	38.81	1.51
Four Winds	0.00	0.15	0.31	0.00	0.46	95.71	95.71
Fredericksburg	0.00	2.63	0.28	0.55	2.07	76.07	76.07
Golden Horseshoe (Green)	1.11	19.41	4.04	0.00	14.46	11.34	0.00
Gypsy Hill	0.00	4.93	0.00	0.00	0.00	72.08	72.08
Hamptons	2.60	3.47	0.00	0.00	0.00	43.69	0.25
Hanging Rock	5.75	6.52	0.00	0.00	0.00	38.93	0.00
Heartland	1.41	0.23	0.00	0.00	0.47	76.58	7.73
Hell's Point	0.00	0.00	33.30	0.00	30.69	5.89	0.00
Ivy Hill	1.53	5.91	0.11	0.16	0.82	64.81	64.81
Jefferson District	3.31	2.89	0.00	0.00	0.00	85.12	5.37
Kiln Creek (Championship)	6.68	4.51	17.79	0.00	0.00	8.78	0.00
Kiln Creek (Creek)	0.54	2.60	18.40	0.00	0.00	11.69	0.54
Kingsmill (Plantation)	8.62	25.00	0.39	0.00	17.82	36.42	0.00
Kingsmill (River)	5.24	18.91	0.05	0.00	9.00	53.43	0.10
Lakeview (Lake)	0.96	1.60	0.00	0.00	0.00	81.79	5.43
Lakeview (Peak)	0.30	2.74	0.00	0.00	0.30	77.13	19.51
Lexington	1.07	4.11	0.00	0.00	0.00	86.61	1.67
London Downs	0.91	4.95	0.00	1.53	2.65	78.24	78.24
Longwood	6.78	7.20	0.00	0.85	0.00	68.22	68.22
Lower Cascades	0.71	6.21	0.00	0.00	2.34	60.22	60.22
Meadowcreek	7.01	9.71	4.50	0.70	8.41	47.75	47.75
Needle's Eye	1.39	6.62	0.00	0.00	3.14	68.64	68.64
Newport News (Cardinal)	2.54	12.12	0.00	0.42	0.00	31.02	0.00
Newport News (Deer Run)	0.31	11.96	1.61	0.08	0.00	34.43	0.00
Oakwood	1.80	23.13	0.00	0.00	0.08	54.06	0.66
Ole Monterey	0.98	5.16	0.00	0.00	0.00	82.71	82.71
Pohick Bay	7.91	11.49	0.00	0.00	2.64	38.55	38.55
Princess Anne	26.58	0.18	0.92	0.00	0.00	19.07	0.00
Red Wing Lake	6.59	0.48	8.31	0.38	0.67	45.27	0.00
Round Meadows	0.00	3.87	0.00	0.00	1.18	77.98	77.98
Shenandoah Crossing	2.10	9.23	2.15	0.26	0.26	11.07	11.07
Stoney Creek (Monocan)	0.12	6.40	1.69	0.00	6.16	69.69	57.73
Stoney Creek (Shamokin)	11.37	22.93	0.00	0.00	0.00	16.75	10.67
Suffolk	17.97	11.61	4.03	0.00	0.00	32.76	0.00
Virginia Tech	0.00	1.48	0.00	0.00	0.15	94.24	0.44
Washington	2.91	14.96	0.00	0.00	0.00	54.29	0.00
Waynesboro	1.47	5.19	0.00	0.00	0.11	69.41	0.23
Williamsburg	1.09	7.04	0.00	0.00	8.50	56.07	1.21
Woodlands	5.13	0.00	0.00	0.00	0.00	66.35	0.00

APPENDIX G1 – Golf Course Land Cover (cont.)

Golf Course	Urban/ Recreational Grass*	Developed	Low Intensity Residential*	High Intensity Residential*	Commercial/Industrial/ Transportation*
Aquia Harbour	0.00	21.11	21.11	0.00	0.00
Army Navy (Red)	60.38	18.06	11.86	0.00	6.20
Army Navy (White)	76.27	9.68	9.68	0.00	0.00
Belle Haven	76.29	10.04	7.81	0.14	2.09
Birdwood	0.00	2.18	2.11	0.00	0.07
Birkdale	0.00	0.41	0.00	0.00	0.41
Blacksburg	0.00	3.09	2.77	0.00	0.32
Castle Rock	0.00	0.00	0.00	0.00	0.00
Chesapeake	0.00	24.03	2.40	0.00	21.63
Colonial Hills	59.03	4.04	3.91	0.00	0.13
Devil's Knob	4.40	1.13	1.07	0.00	0.06
Eaglewood (Blue)	50.79	8.03	5.93	0.00	1.92
Eaglewood (Red)	51.87	11.02	9.63	0.00	1.39
Eastern Shore	64.67	8.67	8.17	0.00	0.50
Elizabeth Manor	24.62	55.54	43.23	9.54	2.15
Fairfax National	74.67	8.38	7.26	0.00	1.12
Falling River	0.00	4.52	4.52	0.00	0.00
Farmington	37.30	21.20	20.92	0.00	0.28
Four Winds	0.00	2.15	1.69	0.00	0.46
Fredericksburg	0.00	6.50	5.81	0.00	0.69
Golden Horseshoe (Green)	11.34	0.46	0.00	0.00	0.46
Gypsy Hill	0.00	10.04	10.04	0.00	0.00
Hamptons	43.44	17.57	1.49	0.00	16.09
Hanging Rock	38.93	3.36	3.26	0.00	0.10
Heartland	68.85	11.01	9.60	0.00	1.41
Hell's Point	5.89	0.00	0.00	0.00	0.00
Ivy Hill	0.00	17.08	17.02	0.00	0.05
Jefferson District	79.75	2.48	2.48	0.00	0.00
Kiln Creek (Championship)	8.78	43.43	41.80	0.00	1.63
Kiln Creek (Creek)	11.15	50.43	34.96	0.00	15.48
Kingsmill (Plantation)	36.42	0.33	0.00	0.00	0.33
Kingsmill (River)	53.33	2.75	1.02	0.00	1.73
Lakeview (Lake)	76.36	11.82	11.82	0.00	0.00
Lakeview (Peak)	57.62	3.05	3.05	0.00	0.00
Lexington	84.93	5.63	5.63	0.00	0.00
London Downs	0.00	0.56	0.49	0.00	0.07
Longwood	0.00	10.17	9.75	0.00	0.42
Lower Cascades	0.00	10.78	10.78	0.00	0.00
Meadowcreek	0.00	11.01	10.81	0.00	0.20
Needle's Eye	0.00	0.00	0.00	0.00	0.00
Newport News (Cardinal)	31.02	28.73	16.78	0.00	11.95
Newport News (Deer Run)	34.43	5.21	0.00	0.00	5.21
Oakwood	53.40	6.07	5.25	0.00	0.82
Ole Monterey	0.00	6.97	6.56	0.00	0.42
Pohick Bay	0.00	0.09	0.00	0.00	0.09
Princess Anne	19.07	47.75	46.56	0.09	1.10
Red Wing Lake	45.27	23.88	22.45	0.00	1.43
Round Meadows	0.00	11.60	3.53	0.00	8.07
Shenandoah Crossing	0.00	0.52	0.52	0.00	0.00
Stoney Creek (Monocan)	11.96	0.36	0.36	0.00	0.00
Stoney Creek (Shamokin)	6.08	0.00	0.00	0.00	0.00
Suffolk	32.76	22.86	14.43	0.00	8.44
Virginia Tech	93.80	3.69	3.69	0.00	0.00
Washington	54.29	9.97	9.97	0.00	0.00
Waynesboro	69.19	21.33	21.22	0.00	0.11
Williamsburg	54.85	7.77	4.73	0.00	3.03
Woodlands	66.35	17.49	14.45	0.00	3.04

APPENDIX G1 – Golf Course Land Cover (cont.)

Golf Course	Bare Rock/ Sand/Clay*	Quarries/Strip Mines/ Gravel Pits*
Aquia Harbour	0.00	0.00
Army Navy (Red)	0.00	0.00
Army Navy (White)	0.00	0.00
Belle Haven	0.00	0.00
Birdwood	0.00	0.00
Birkdale	0.00	0.00
Blacksburg	0.00	0.00
Castle Rock	0.00	0.00
Chesapeake	0.00	0.00
Colonial Hills	0.00	0.00
Devil's Knob	0.00	0.00
Eaglewood (Blue)	0.17	0.00
Eaglewood (Red)	0.00	0.00
Eastern Shore	0.00	0.00
Elizabeth Manor	0.00	0.62
Fairfax National	0.00	0.00
Falling River	0.00	0.00
Farmington	0.00	0.00
Four Winds	0.00	0.00
Fredericksburg	0.00	0.00
Golden Horseshoe (Green)	0.00	0.00
Gypsy Hill	0.00	0.00
Hamptons	0.00	0.00
Hanging Rock	0.00	0.00
Heartland	0.00	0.00
Hell's Point	0.00	0.00
Ivy Hill	0.00	0.00
Jefferson District	0.00	0.00
Kiln Creek (Championship)	0.00	0.00
Kiln Creek (Creek)	0.00	0.00
Kingsmill (Plantation)	0.00	0.00
Kingsmill (River)	0.00	0.00
Lakeview (Lake)	0.00	0.00
Lakeview (Peak)	0.00	0.00
Lexington	0.00	0.00
London Downs	0.00	0.00
Longwood	0.00	0.00
Lower Cascades	0.00	0.00
Meadowcreek	0.00	0.00
Needle's Eye	0.00	0.00
Newport News (Cardinal)	0.00	0.00
Newport News (Deer Run)	0.00	0.00
Oakwood	0.00	0.00
Ole Monterey	0.00	0.00
Pohick Bay	0.00	0.00
Princess Anne	0.00	0.00
Red Wing Lake	0.00	0.00
Round Meadows	0.00	0.00
Shenandoah Crossing	0.00	0.00
Stoney Creek (Monocan)	0.00	0.00
Stoney Creek (Shamokin)	0.00	0.00
Suffolk	0.00	0.00
Virginia Tech	0.00	0.00
Washington	0.00	0.00
Waynesboro	0.00	0.00
Williamsburg	0.00	0.00
Woodlands	0.00	0.00

APPENDIX G2 – Buffer Zone Land Cover

Golf Course	# Counts	Province	Open water	Herbaceous Wetland	Forest	Deciduous Forest*	Evergreen Forest*
Aquia Harbour	9	CP	0.00	0.15	79.46	44.63	4.79
Army Navy (Red)	9	P	0.00	0.00	17.03	13.22	1.86
Army Navy (White)	9	P	0.00	0.10	14.40	12.16	0.39
Belle Haven	18	CP	24.73	4.96	13.73	6.83	1.65
Birdwood	18	P	1.46	0.18	55.21	9.37	10.37
Birkdale	18	P	0.00	0.00	83.62	35.12	3.99
Blacksburg	18	M	0.07	0.00	40.56	21.61	5.27
Castle Rock	18	M	0.08	0.00	47.10	41.30	0.15
Chesapeake	18	CP	3.33	4.74	34.24	8.19	4.62
Colonial Hills	18	P	3.40	0.00	40.54	18.76	5.38
Devil's Knob	18	M	0.00	0.00	95.74	93.37	0.35
Eaglewood (Blue)	18	CP	2.48	10.19	24.23	1.71	4.54
Eaglewood (Red)	18	CP	0.38	3.26	12.32	1.85	2.94
Eastern Shore	18	CP	22.74	14.07	45.20	6.11	28.50
Elizabeth Manor	18	CP	14.56	13.57	8.67	1.21	7.09
Fairfax National	18	P	0.00	0.00	55.94	23.93	19.88
Falling River	18	P	0.00	0.00	53.66	26.68	12.49
Farmington	18	P	0.59	0.00	68.69	13.56	19.03
Four Winds	18	CP	4.94	0.34	28.01	14.95	1.08
Fredericksburg	18	CP	11.57	0.23	23.52	7.26	0.83
Golden Horseshoe (Green)	18	CP	2.23	0.20	72.24	35.77	5.84
Gypsy Hill	18	M	1.24	0.00	26.12	13.52	1.31
Hamptons	18	CP	0.08	0.08	72.82	51.53	0.99
Hanging Rock	18	M	0.11	0.00	80.71	63.68	2.91
Heartland	9	P	0.00	0.00	11.85	5.76	0.56
Hell's Point	18	CP	9.64	13.03	44.71	17.36	0.00
Ivy Hill	18	P	10.02	0.00	39.55	20.44	5.94
Jefferson District	9	P	0.51	0.00	37.25	26.52	0.81
Kiln Creek (Championship)	18	CP	1.84	1.67	62.63	40.55	1.90
Kiln Creek (Creek)	9	CP	4.70	2.99	35.69	19.77	1.59
Kingsmill (Plantation)	18	CP	12.38	7.89	48.77	20.32	3.85
Kingsmill (River)	18	CP	19.52	1.96	47.33	21.84	2.33
Lakeview (Lake)	9	M	2.57	0.00	16.08	7.72	3.86
Lakeview (Peak)	9	M	0.18	0.00	28.15	23.46	1.38
Lexington	18	M	1.03	0.00	19.51	2.87	5.54
London Downs	18	P	0.09	0.00	32.96	19.15	2.65
Longwood	9	P	0.24	0.00	64.94	15.65	20.82
Lower Cascades	18	M	0.00	0.00	86.10	58.66	5.24
Meadowcreek	18	P	7.76	0.50	57.58	14.16	15.28
Needle's Eye	9	M	0.10	0.49	50.97	37.67	0.58
Newport News (Cardinal)	18	CP	8.91	0.94	61.39	40.54	5.05
Newport News (Deer Run)	18	CP	5.37	0.74	78.85	41.24	5.26
Oakwood	18	P	4.94	0.00	65.20	25.67	8.44
Ole Monterey	18	M	0.00	0.00	18.71	11.86	0.54
Pohick Bay	18	CP	0.19	2.33	80.96	56.93	3.56
Princess Anne	18	CP	8.26	2.75	24.96	1.50	21.54
Red Wing Lake	18	CP	8.68	0.06	81.81	6.16	15.86
Round Meadows	18	M	0.16	0.24	27.71	23.01	0.48
Shenandoah Crossing	18	P	2.71	0.00	94.51	73.23	2.86
Stoney Creek (Monocan)	9	M	4.80	0.00	62.71	35.95	8.05
Stoney Creek (Shamokin)	9	M	0.45	0.00	66.67	47.99	5.99
Suffolk	18	CP	14.21	1.81	41.04	10.44	17.77
Virginia Tech	18	M	2.42	0.26	11.58	6.83	0.86
Washington	18	P	0.00	0.00	40.86	16.22	7.01
Waynesboro	18	M	3.55	0.37	29.49	8.48	4.05
Williamsburg	18	CP	5.38	0.32	55.26	33.09	6.10
Woodlands	18	CP	3.73	0.47	9.90	4.01	4.67

APPENDIX G2 – Buffer Zone Land Cover (cont.)

Golf Course	Mixed Forest*	Woody Wetland*	Transitional*	Row crop	Grass	Pasture/Hay*	Urban/ Recreational Grass*
Aquia Harbour	13.35	0.36	16.33	0.00	9.22	9.22	0.00
Army Navy (Red)	1.95	0.00	0.00	0.00	25.42	0.00	25.42
Army Navy (White)	1.85	0.00	0.00	0.00	14.88	0.00	14.88
Belle Haven	5.03	0.22	0.00	2.95	9.27	5.68	3.59
Birdwood	35.29	0.00	0.18	1.50	24.28	23.97	0.32
Birkdale	44.51	0.00	0.00	4.04	10.66	10.66	0.00
Blacksburg	13.68	0.00	0.00	4.20	44.70	44.70	0.00
Castle Rock	5.65	0.00	0.00	3.62	48.61	48.61	0.00
Chesapeake	3.82	17.61	0.00	11.08	10.78	10.78	0.00
Colonial Hills	15.99	0.00	0.40	0.08	46.08	35.47	10.61
Devil's Knob	1.58	0.00	0.45	0.00	3.76	0.00	3.76
Eaglewood (Blue)	4.20	13.78	0.00	18.84	21.75	0.51	21.23
Eaglewood (Red)	0.96	6.58	0.00	9.58	40.23	28.86	11.37
Eastern Shore	9.95	0.00	0.64	6.40	10.38	6.47	3.91
Elizabeth Manor	0.08	0.30	0.00	0.00	3.77	0.53	3.24
Fairfax National	12.13	0.00	0.00	0.34	28.14	6.66	21.48
Falling River	14.11	0.00	0.39	3.93	35.62	35.62	0.00
Farmington	36.09	0.00	0.00	1.38	14.30	8.28	6.02
Four Winds	3.99	7.98	0.00	16.64	40.80	40.80	0.00
Fredericksburg	7.34	2.72	5.37	14.52	36.69	36.69	0.00
Golden Horseshoe (Green)	25.88	4.75	0.00	4.40	8.21	0.25	7.97
Gypsy Hill	11.28	0.00	0.00	0.46	21.79	21.79	0.00
Hamptons	19.47	0.84	0.00	0.00	16.03	0.00	16.03
Hanging Rock	14.12	0.00	0.00	0.55	11.59	1.59	10.00
Heartland	5.52	0.00	0.00	8.89	68.61	50.60	18.01
Hell's Point	0.00	27.35	0.00	30.68	1.93	0.12	1.81
Ivy Hill	12.75	0.00	0.41	3.15	33.35	33.35	0.00
Jefferson District	8.10	1.11	0.71	0.00	7.39	3.14	4.25
Kiln Creek (Championship)	5.80	14.39	0.00	0.00	4.41	0.00	4.41
Kiln Creek (Creek)	6.47	7.87	0.00	1.83	3.23	0.06	3.17
Kingsmill (Plantation)	22.19	2.32	0.10	5.87	24.56	0.00	24.56
Kingsmill (River)	21.61	1.55	0.00	8.98	14.46	1.60	12.86
Lakeview (Lake)	4.50	0.00	0.00	4.39	63.56	27.44	36.12
Lakeview (Peak)	3.31	0.00	0.00	2.12	60.99	37.17	23.83
Lexington	11.09	0.00	0.00	0.41	54.76	23.75	31.01
London Downs	10.69	0.00	0.46	4.04	60.62	60.62	0.00
Longwood	27.29	0.00	1.18	0.35	14.59	14.59	0.00
Lower Cascades	22.07	0.12	0.00	1.52	8.66	8.66	0.00
Meadowcreek	22.42	4.60	1.12	5.59	14.78	14.78	0.00
Needle's Eye	12.72	0.00	0.00	6.60	41.84	41.84	0.00
Newport News (Cardinal)	11.99	1.56	2.24	0.31	13.29	0.31	12.98
Newport News (Deer Run)	16.36	15.78	0.21	0.00	11.20	0.00	11.20
Oakwood	30.85	0.00	0.25	0.30	13.57	10.71	2.86
Ole Monterey	6.31	0.00	0.00	0.00	74.71	74.71	0.00
Pohick Bay	8.03	12.44	0.00	0.78	9.91	9.91	0.00
Princess Anne	0.42	1.50	0.00	0.00	4.01	0.00	4.01
Red Wing Lake	1.97	57.21	0.60	1.20	2.27	0.00	2.27
Round Meadows	4.22	0.00	0.00	4.46	56.53	56.53	0.00
Shenandoah Crossing	11.97	2.90	3.53	0.75	1.69	1.69	0.00
Stoney Creek (Monocan)	17.51	1.20	0.00	4.45	28.04	24.44	3.60
Stoney Creek (Shamokin)	11.79	0.51	0.38	5.48	27.41	24.22	3.19
Suffolk	11.02	1.81	0.00	1.02	3.63	0.65	2.97
Virginia Tech	3.80	0.00	0.09	4.93	34.49	22.13	12.36
Washington	17.63	0.00	0.00	0.00	4.39	0.00	4.39
Waynesboro	16.52	0.44	0.00	2.62	11.41	5.11	6.30
Williamsburg	15.26	0.80	0.00	3.69	5.14	2.17	2.97
Woodlands	1.21	0.00	0.00	0.00	15.50	0.00	15.50

APPENDIX G2 – Buffer Zone Land Cover (cont.)

Golf Course	Developed	Low Intensity Residential*	High Intensity Residential*	Commercial/Industrial/ Transportation*	Bare Rock/ Sand/Clay*
Aquia Harbour	11.18	11.18	0.00	0.00	0.00
Army Navy (Red)	57.54	42.37	0.00	15.17	0.00
Army Navy (White)	70.62	46.60	0.00	24.03	0.00
Belle Haven	44.36	36.52	2.08	5.75	0.00
Birdwood	17.37	13.51	0.00	3.87	0.00
Birkdale	1.68	1.54	0.00	0.14	0.00
Blacksburg	10.47	10.47	0.00	0.00	0.00
Castle Rock	0.60	0.60	0.00	0.00	0.00
Chesapeake	35.84	1.85	0.00	33.99	0.00
Colonial Hills	9.90	9.58	0.00	0.32	0.00
Devil's Knob	0.49	0.49	0.00	0.00	0.00
Eaglewood (Blue)	22.52	15.24	0.00	5.48	1.80
Eaglewood (Red)	34.23	21.97	0.00	12.20	0.06
Eastern Shore	1.21	0.21	0.00	1.00	0.00
Elizabeth Manor	59.43	39.06	16.29	4.00	0.00
Fairfax National	15.59	13.48	0.00	2.11	0.00
Falling River	6.78	6.78	0.00	0.00	0.00
Farmington	15.04	15.04	0.00	0.00	0.00
Four Winds	9.27	7.92	0.00	1.35	0.00
Fredericksburg	13.46	11.04	0.00	2.42	0.00
Golden Horseshoe (Green)	12.72	7.67	0.10	4.95	0.00
Gypsy Hill	50.39	48.45	0.93	1.00	0.00
Hamptons	10.99	6.87	0.00	4.12	0.00
Hanging Rock	7.03	6.81	0.00	0.22	0.00
Heartland	10.65	9.45	0.00	1.20	0.00
Hell's Point	0.00	0.00	0.00	0.00	0.00
Ivy Hill	13.94	13.94	0.00	0.00	0.00
Jefferson District	54.86	42.31	0.00	12.55	0.00
Kiln Creek (Championship)	29.45	28.44	0.00	1.00	0.00
Kiln Creek (Creek)	51.56	25.87	0.00	25.69	0.00
Kingsmill (Plantation)	0.54	0.00	0.00	0.54	0.00
Kingsmill (River)	7.75	5.20	0.41	2.14	0.00
Lakeview (Lake)	13.40	13.40	0.00	0.00	0.00
Lakeview (Peak)	8.56	8.56	0.00	0.00	0.00
Lexington	24.30	24.23	0.00	0.07	0.00
London Downs	2.28	1.67	0.00	0.60	0.00
Longwood	19.88	19.29	0.00	0.59	0.00
Lower Cascades	3.72	3.72	0.00	0.00	0.00
Meadowcreek	13.79	12.11	0.00	1.68	0.00
Needle's Eye	0.00	0.00	0.00	0.00	0.00
Newport News (Cardinal)	15.16	12.51	0.00	2.66	0.00
Newport News (Deer Run)	3.84	0.00	0.00	3.84	0.00
Oakwood	15.99	15.45	0.00	0.54	0.00
Ole Monterey	6.58	2.78	0.00	3.80	0.00
Pohick Bay	5.83	5.38	0.00	0.45	0.00
Princess Anne	60.02	45.12	4.97	9.93	0.00
Red Wing Lake	5.98	5.75	0.00	0.24	0.00
Round Meadows	10.91	2.55	0.00	8.36	0.00
Shenandoah Crossing	0.35	0.35	0.00	0.00	0.00
Stoney Creek (Monocan)	0.00	0.00	0.00	0.00	0.00
Stoney Creek (Shamokin)	0.00	0.00	0.00	0.00	0.00
Suffolk	38.29	20.67	0.07	17.33	0.00
Virginia Tech	46.33	24.37	0.00	21.95	0.00
Washington	54.75	50.28	0.00	4.46	0.00
Waynesboro	52.56	43.33	1.06	8.17	0.00
Williamsburg	30.20	0.08	0.00	30.12	0.00
Woodlands	70.40	52.19	0.00	18.21	0.00

APPENDIX G2 – Buffer Zone Land Cover (cont.)

Golf Course	Quarries/Strip Mines/ Gravel Pits*
Aquia Harbour	0.00
Army Navy (Red)	0.00
Army Navy (White)	0.00
Belle Haven	0.00
Birdwood	0.00
Birkdale	0.00
Blacksburg	0.00
Castle Rock	0.00
Chesapeake	0.00
Colonial Hills	0.00
Devil's Knob	0.00
Eaglewood (Blue)	0.00
Eaglewood (Red)	0.00
Eastern Shore	0.00
Elizabeth Manor	0.08
Fairfax National	0.00
Falling River	0.00
Farmington	0.00
Four Winds	0.00
Fredericksburg	0.00
Golden Horseshoe (Green)	0.00
Gypsy Hill	0.00
Hamptons	0.00
Hanging Rock	0.00
Heartland	0.00
Hell's Point	0.00
Ivy Hill	0.00
Jefferson District	0.00
Kiln Creek (Championship)	0.00
Kiln Creek (Creek)	0.00
Kingsmill (Plantation)	0.00
Kingsmill (River)	0.00
Lakeview (Lake)	0.00
Lakeview (Peak)	0.00
Lexington	0.00
London Downs	0.00
Longwood	0.00
Lower Cascades	0.00
Meadowcreek	0.00
Needle's Eye	0.00
Newport News (Cardinal)	0.00
Newport News (Deer Run)	0.00
Oakwood	0.00
Ole Monterey	0.00
Pohick Bay	0.00
Princess Anne	0.00
Red Wing Lake	0.00
Round Meadows	0.00
Shenandoah Crossing	0.00
Stoney Creek (Monocan)	0.00
Stoney Creek (Shamokin)	0.00
Suffolk	0.22
Virginia Tech	0.00
Washington	0.00
Waynesboro	0.00
Williamsburg	0.00
Woodlands	0.00

APPENDIX G3 – Large Surrounding Area Land Cover

Golf Course	# Counts	Province	Open Water	Herbaceous Wetland	Forest	Deciduous Forest*	Evergreen Forest*
Aquia Harbour	9	CP	0.43	2.69	78.53	43.14	8.10
Army Navy (Red)	9	P	0.04	0.02	11.90	8.10	1.17
Army Navy (White)	9	P	1.19	0.03	14.46	9.69	1.42
Belle Haven	18	CP	26.82	1.57	15.77	9.91	1.15
Birdwood	18	P	1.56	0.05	56.24	13.74	12.71
Birkdale	18	P	0.14	0.11	72.29	39.93	2.74
Blacksburg	18	M	0.04	0.00	47.94	30.44	6.29
Castle Rock	18	M	10.79	0.01	56.18	48.97	1.37
Chesapeake	18	CP	1.57	2.70	29.16	8.79	5.08
Colonial Hills	18	P	1.11	0.04	47.38	29.53	4.69
Devil's Knob	18	M	0.05	0.00	97.14	86.31	0.40
Eaglewood (Blue)	18	CP	4.91	13.90	14.25	4.32	1.95
Eaglewood (Red)	18	CP	1.02	4.64	13.05	4.61	2.45
Eastern Shore	18	CP	14.67	8.14	39.38	4.35	27.04
Elizabeth Manor	18	CP	13.53	12.38	7.04	0.70	5.28
Fairfax National	18	P	0.02	0.25	59.06	22.16	26.79
Falling River	18	P	0.51	0.18	59.06	27.60	13.03
Farmington	18	P	0.75	0.00	55.54	12.00	15.05
Four Winds	18	CP	14.61	2.53	28.71	9.71	0.58
Fredericksburg	18	CP	6.40	0.42	33.38	12.20	1.53
Golden Horseshoe (Green)	18	CP	1.95	0.45	68.66	38.52	4.41
Gypsy Hill	18	M	0.20	0.00	26.23	13.05	2.13
Hamptons	18	CP	1.35	0.22	68.88	39.61	5.50
Hanging Rock	18	M	0.26	0.00	76.23	59.15	3.57
Heartland	9	P	0.51	0.59	57.26	35.36	5.25
Hell's Point	18	CP	4.67	14.43	47.07	23.87	0.00
Ivy Hill	18	P	4.06	0.05	39.42	21.96	3.98
Jefferson District	9	P	0.77	0.11	26.14	17.52	1.32
Kiln Creek (Championship)	18	CP	2.93	2.18	49.74	27.93	4.04
Kiln Creek (Creek)	9	CP	2.87	1.43	46.42	24.28	2.73
Kingsmill (Plantation)	18	CP	31.82	5.40	38.55	12.05	4.22
Kingsmill (River)	18	CP	21.07	1.36	44.30	17.29	3.84
Lakeview (Lake)	9	M	2.42	0.37	26.39	20.25	1.86
Lakeview (Peak)	9	M	1.60	0.12	21.90	16.20	1.89
Lexington	18	M	0.35	0.00	19.54	4.00	6.10
London Downs	18	P	0.43	0.00	35.79	18.09	3.72
Longwood	9	P	0.90	0.03	59.61	14.70	19.44
Lower Cascades	18	M	0.12	0.00	82.91	62.66	4.07
Meadowcreek	18	P	2.59	0.11	53.68	15.44	12.15
Needle's Eye	9	M	0.05	0.51	65.68	43.69	2.02
Newport News (Cardinal)	18	CP	6.23	0.34	65.96	41.09	6.99
Newport News (Deer Run)	18	CP	3.11	0.27	81.71	44.67	10.96
Oakwood	18	P	1.48	0.00	71.97	33.14	6.98
Ole Monterey	18	M	0.11	0.00	23.25	15.57	1.32
Pohick Bay	18	CP	4.24	1.61	69.70	49.64	4.93
Princess Anne	18	CP	30.26	1.63	18.11	1.89	14.39
Red Wing Lake	18	CP	6.73	0.32	61.48	7.12	16.59
Round Meadows	18	M	0.05	0.04	21.25	15.80	1.39
Shenandoah Crossing	18	P	3.34	0.22	90.12	65.97	7.32
Stoney Creek (Monocan)	9	M	2.07	0.10	73.18	50.27	6.35
Stoney Creek (Shamokin)	9	M	0.28	0.05	63.36	42.84	5.47
Suffolk	18	CP	9.12	1.84	52.44	14.70	15.50
Virginia Tech	18	M	0.31	0.03	13.76	7.35	0.22
Washington	18	P	0.00	0.00	46.59	21.03	7.41
Waynesboro	18	M	2.30	0.50	26.39	10.37	2.81
Williamsburg	18	CP	3.38	0.32	59.17	39.32	4.71
Woodlands	18	CP	11.17	0.68	6.61	2.75	3.55

APPENDIX G3 – Large Surrounding Area Land Cover (cont.)

Golf Course	Mixed Forest*	Woody Wetland*	Transitional*	Row Crop	Grass	Pasture/Hay*	Urban/ Recreational Grass*
Aquia Harbour	13.20	3.94	10.15	0.09	10.73	10.73	0.00
Army Navy (Red)	2.64	0.00	0.00	0.00	19.99	0.00	19.99
Army Navy (White)	3.35	0.00	0.00	0.00	13.58	0.00	13.58
Belle Haven	4.22	0.49	0.00	1.00	9.62	3.28	6.34
Birdwood	29.67	0.00	0.12	0.89	25.90	24.35	1.55
Birkdale	29.61	0.00	0.00	5.77	17.89	17.89	0.00
Blacksburg	11.16	0.00	0.05	2.25	46.79	46.79	0.00
Castle Rock	5.76	0.08	0.00	4.75	26.60	26.60	0.00
Chesapeake	2.12	13.17	0.00	26.70	8.34	8.20	0.14
Colonial Hills	12.20	0.00	0.96	0.87	46.75	40.62	6.13
Devil's Knob	9.92	0.00	0.51	0.03	1.75	0.17	1.58
Eaglewood (Blue)	3.38	4.59	0.00	10.19	26.73	12.49	14.24
Eaglewood (Red)	2.90	3.09	0.00	9.47	31.94	16.84	15.10
Eastern Shore	7.72	0.00	0.27	18.02	18.30	13.55	4.75
Elizabeth Manor	0.33	0.20	0.54	0.32	3.94	1.16	2.78
Fairfax National	9.72	0.00	0.38	0.83	35.45	28.42	7.03
Falling River	16.18	1.61	0.65	1.84	36.47	36.47	0.00
Farmington	28.44	0.00	0.04	0.86	28.29	19.86	8.43
Four Winds	3.58	12.95	1.90	22.12	27.08	27.08	0.00
Fredericksburg	3.66	4.01	11.98	21.27	27.18	27.18	0.00
Golden Horseshoe (Green)	21.83	3.89	0.00	4.82	9.25	0.50	8.75
Gypsy Hill	10.84	0.00	0.21	0.56	14.35	14.35	0.00
Hamptons	22.21	1.05	0.52	1.82	7.84	1.19	6.64
Hanging Rock	13.28	0.00	0.23	0.18	14.51	7.93	6.59
Heartland	11.59	3.92	1.12	1.55	37.39	31.77	5.62
Hell's Point	0.00	23.20	0.00	32.31	1.52	0.62	0.90
Ivy Hill	12.97	0.02	0.49	3.46	45.86	45.86	0.00
Jefferson District	5.05	1.44	0.80	0.00	11.61	3.76	7.85
Kiln Creek (Championship)	7.46	10.14	0.16	0.59	15.09	0.35	14.75
Kiln Creek (Creek)	6.74	9.27	3.40	1.54	5.80	3.06	2.74
Kingsmill (Plantation)	21.11	1.14	0.03	6.47	17.19	0.14	17.05
Kingsmill (River)	22.29	0.83	0.03	7.95	18.46	0.80	17.66
Lakeview (Lake)	4.28	0.00	0.01	5.57	56.76	46.68	10.08
Lakeview (Peak)	3.82	0.00	0.00	4.73	63.65	53.58	10.08
Lexington	9.40	0.00	0.04	0.20	60.75	49.80	10.94
London Downs	12.69	0.00	1.30	3.57	58.25	58.25	0.00
Longwood	23.58	0.00	1.89	0.34	14.13	14.13	0.00
Lower Cascades	16.10	0.04	0.03	1.40	12.14	12.14	0.00
Meadowcreek	23.92	1.28	0.88	3.23	23.77	23.77	0.00
Needle's Eye	19.97	0.00	0.00	2.80	30.95	30.95	0.00
Newport News (Cardinal)	11.67	4.98	1.23	0.82	9.04	0.23	8.82
Newport News (Deer Run)	17.08	8.36	0.64	0.18	10.47	0.04	10.43
Oakwood	31.69	0.00	0.16	0.38	16.49	8.86	7.62
Ole Monterey	6.33	0.00	0.03	0.11	49.38	49.38	0.00
Pohick Bay	7.48	7.21	0.43	2.17	12.43	12.43	0.00
Princess Anne	0.33	1.51	0.00	0.00	8.02	0.00	8.02
Red Wing Lake	1.09	34.99	1.68	9.70	7.81	1.83	5.99
Round Meadows	4.06	0.00	0.00	7.34	62.22	62.22	0.00
Shenandoah Crossing	13.12	2.22	1.49	0.49	5.53	5.53	0.00
Stoney Creek (Monocan)	14.82	1.47	0.27	1.97	21.73	19.22	2.51
Stoney Creek (Shamokin)	14.60	0.27	0.18	2.67	32.51	30.02	2.49
Suffolk	16.20	5.96	0.08	3.03	7.86	4.39	3.47
Virginia Tech	4.37	0.00	1.83	4.14	39.00	30.36	8.65
Washington	18.15	0.00	0.00	0.00	5.84	0.00	5.84
Waynesboro	13.01	0.19	0.00	1.68	28.73	20.96	7.77
Williamsburg	10.54	4.60	0.00	3.96	6.02	0.74	5.28
Woodlands	0.23	0.09	0.00	0.00	16.74	0.00	16.74

APPENDIX G3 – Large Surrounding Area Land Cover (cont.)

Golf Course	Developed	Low Intensity Residential*	High Intensity Residential*	Commercial/Industrial/ Transportation*	Bare Rock/ Sand/Clay*
Aquia Harbour	7.54	6.42	0.00	1.13	0.00
Army Navy (Red)	68.05	45.86	0.00	22.19	0.00
Army Navy (White)	70.75	51.56	0.00	19.19	0.00
Belle Haven	45.23	32.80	1.64	10.79	0.00
Birdwood	15.35	10.84	0.00	4.52	0.00
Birkdale	3.81	3.60	0.00	0.22	0.00
Blacksburg	2.97	2.83	0.00	0.14	0.00
Castle Rock	1.67	1.62	0.01	0.00	0.00
Chesapeake	31.53	9.33	0.83	21.37	0.00
Colonial Hills	3.84	3.68	0.00	0.16	0.00
Devil's Knob	1.03	1.01	0.00	0.02	0.00
Eaglewood (Blue)	30.02	15.89	0.00	13.77	0.36
Eaglewood (Red)	39.89	16.31	0.00	23.24	0.34
Eastern Shore	1.49	1.04	0.00	0.45	0.00
Elizabeth Manor	62.79	32.92	25.42	4.38	0.00
Fairfax National	4.38	3.84	0.00	0.54	0.00
Falling River	1.94	1.87	0.00	0.08	0.00
Farmington	14.57	14.08	0.00	0.49	0.00
Four Winds	4.95	3.27	0.00	0.88	0.00
Fredericksburg	11.36	5.11	0.04	1.25	0.00
Golden Horseshoe (Green)	14.87	9.54	0.09	5.24	0.00
Gypsy Hill	58.66	55.02	0.51	3.13	0.00
Hamptons	19.89	8.41	0.00	11.48	0.00
Hanging Rock	8.81	7.38	0.00	1.44	0.00
Heartland	2.71	2.49	0.00	0.23	0.00
Hell's Point	0.00	0.00	0.00	0.00	0.00
Ivy Hill	7.14	7.13	0.00	0.01	0.00
Jefferson District	61.37	34.66	0.00	26.72	0.00
Kiln Creek (Championship)	29.48	21.84	0.00	7.64	0.00
Kiln Creek (Creek)	41.94	24.60	0.01	17.32	0.00
Kingsmill (Plantation)	0.57	0.02	0.05	0.50	0.00
Kingsmill (River)	6.85	4.60	0.13	2.12	0.00
Lakeview (Lake)	8.49	8.40	0.00	0.09	0.00
Lakeview (Peak)	8.00	7.87	0.00	0.13	0.00
Lexington	19.16	18.49	0.03	0.63	0.00
London Downs	1.96	1.11	0.00	0.84	0.00
Longwood	24.99	20.06	0.00	4.93	0.00
Lower Cascades	3.43	3.43	0.00	0.00	0.00
Meadowcreek	16.62	15.06	0.00	1.56	0.00
Needle's Eye	0.00	0.00	0.00	0.00	0.00
Newport News (Cardinal)	17.61	12.01	0.06	5.53	0.00
Newport News (Deer Run)	4.26	1.60	0.00	2.65	0.00
Oakwood	9.69	9.41	0.00	0.28	0.00
Ole Monterey	27.15	14.06	0.00	13.09	0.00
Pohick Bay	9.83	8.59	0.00	0.91	0.00
Princess Anne	41.97	28.37	3.56	8.84	1.19
Red Wing Lake	13.96	8.25	0.39	1.99	3.34
Round Meadows	9.09	4.67	0.00	4.43	0.00
Shenandoah Crossing	0.29	0.29	0.00	0.00	0.00
Stoney Creek (Monocan)	0.95	0.85	0.00	0.11	0.00
Stoney Creek (Shamokin)	1.13	1.05	0.00	0.08	0.00
Suffolk	25.72	13.06	1.38	11.22	0.00
Virginia Tech	42.75	26.66	0.15	15.94	0.00
Washington	47.57	42.77	0.01	4.79	0.00
Waynesboro	40.40	34.60	0.56	5.24	0.00
Williamsburg	27.15	4.98	0.00	22.18	0.00
Woodlands	64.80	45.66	0.00	19.13	0.00

APPENDIX G3 – Large Surrounding Area Land Cover (cont.)

Golf Course	Quarries/Strip Mines/ Gravel Pits*
Aquia Harbour	0.00
Army Navy (Red)	0.00
Army Navy (White)	0.00
Belle Haven	0.00
Birdwood	0.00
Birkdale	0.00
Blacksburg	0.00
Castle Rock	0.04
Chesapeake	0.00
Colonial Hills	0.00
Devil's Knob	0.00
Eaglewood (Blue)	0.00
Eaglewood (Red)	0.00
Eastern Shore	0.00
Elizabeth Manor	0.08
Fairfax National	0.00
Falling River	0.00
Farmington	0.00
Four Winds	0.81
Fredericksburg	4.96
Golden Horseshoe (Green)	0.00
Gypsy Hill	0.00
Hamptons	0.00
Hanging Rock	0.00
Heartland	0.00
Hell's Point	0.00
Ivy Hill	0.00
Jefferson District	0.00
Kiln Creek (Championship)	0.00
Kiln Creek (Creek)	0.00
Kingsmill (Plantation)	0.00
Kingsmill (River)	0.00
Lakeview (Lake)	0.00
Lakeview (Peak)	0.00
Lexington	0.00
London Downs	0.00
Longwood	0.00
Lower Cascades	0.00
Meadowcreek	0.00
Needle's Eye	0.00
Newport News (Cardinal)	0.00
Newport News (Deer Run)	0.00
Oakwood	0.00
Ole Monterey	0.00
Pohick Bay	0.33
Princess Anne	0.00
Red Wing Lake	0.00
Round Meadows	0.00
Shenandoah Crossing	0.00
Stoney Creek (Monocan)	0.00
Stoney Creek (Shamokin)	0.00
Suffolk	0.05
Virginia Tech	0.00
Washington	0.00
Waynesboro	0.00
Williamsburg	0.00
Woodlands	0.00

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