



Restoration Analysis

Discover Educate Inspire

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EXECUTIVE SUMMARY

In July of 2021, Audubon of Martin County (AoMC) engaged the services of two consulting firms, WGI, Inc. (WGI) and Environmental Consulting Services Group (ECS) to conduct an environmental baseline assessment, pre- and post-restoration bird surveys, adult education and educational lectures. Highlights of the findings of this research are described below.

OPPORTUNITY

Since the 2010 stormwater retrofit project which created the pond, Possum Long Nature Center (PLNC) has been in a gradual state of decline, with invasive plant species consuming much of the understory and a fair amount of the canopy. Bird activity had become virtually non-existent in all but a select few areas of the preserve. Conducting bird surveys in the preserve's current state would allow us to witness any post-restoration changes in either abundance or variety of species.

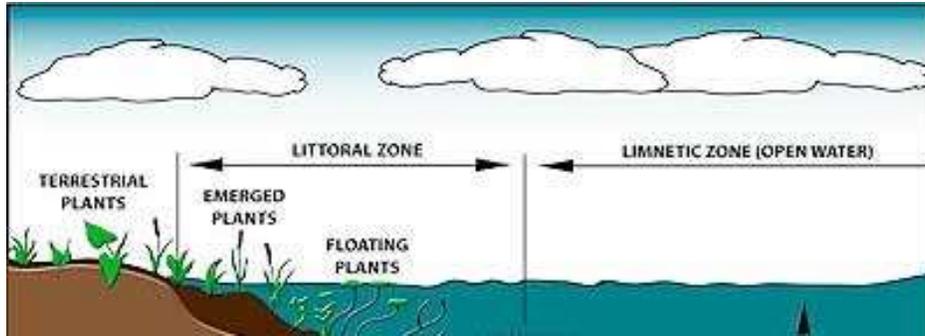
SOLUTION

In the spring of 2021, AoMC engaged Phyllis Mills of Wild About Natives, to lead a small group of volunteers in removing non-native and invasive overgrowth in what is referred to as Phase I (Exhibits "A" & "B") of the restoration project. This area encompasses the existing beds along 7th Street, north along Palm Beach Road and east along the shared property line with Team Parks. This northern section is commonly referred to as the Butterfly Garden. Continuing to the east is an attached section commonly referred to as the Bird Garden and further east and detached from this section is the Cactus Garden (Exhibit "C"). These two sections had been planned to be Phase II of the restoration project, but have been temporarily put on hold in order to address the more overgrown areas of the property.

In the winter of 2021, AoMC made contact with Sandhill Environmental of Arcadia, Florida and began a series of site visits and conversations to consider their services for restoring the bulk of the preserve to its native state. Confident in Sandhill's expertise and ability, AoMC signed a contract for work to begin in mid-May 2022, following spring migration.

SCOPE OF WORK

A decision was made by the board of directors, that a "Florida Friendly" approach should be pursued with regard to species removal. Using a combination of hand cutting and spraying, all invasives were to be eradicated, non-native (Florida Friendly) species which did not appear to be problematic in their spreading would remain, as well as standing snags and fallen, decaying trees which served as habitat. The area to be restored, generally speaking, extended north from the property line of the adjacent house to the east all the way to the north property line, excluding the Memorial Garden. Due to cost, the area west of the pond, which is abundant with Seaside Mahoe, was excluded from the project. This area will be restored over time as funds become available. Again, due to cost, we chose to focus replanting efforts solely around the pond. Those species and quantities were as follows:



Littoral Zone - Emerged Plants

- 1350 Spikerush
- 1350 Pickerelweed
- 1400 Golden Canna

Transitional Zone -Terrestrial Plants

- 375 Muhly Grass
- 375 Sand Cordgrass
- 375 Mixed Fakahatchee Grass
- 375 Saltmeadow Cordgrass

The research report provided by WGI titled, *Bird Habitat Enhancement Opportunities*, was not completed until the project began, however, many of the plant suggestions were consistent with the guidance provided by Sandhill. In addition, two suggestions which will be implemented at a later date as funds allow, are the addition of Spatterdock, a fragrant water lily which attracts gallinules, and a tree island to provide overnight roosting for herons, egrets, ibis, anhinga and similar species. There are two locations in the pond conducive to the addition of Pond Apple to create this island.

The ECS report had similar findings and recommendations pertaining to vegetation, however, it was most beneficial in its ornithology monitoring recommendations. The recommended bird surveying protocols are as follows:

- Conduct no less than one count per month
- Monitor over the course of multiple years
- Consistent procedures for each survey
- Surveys should begin at dawn and last two to three hours
- Climatic conditions should be recorded
- Point count method is best suited to the PLNC terrain
- Record all species within predetermined radius
- Fly-throughs and fly-overs should be noted as such

By comparing the initial pre-restoration bird counts to subsequent counts, AoMC can determine the effects the restoration has had on both variety of bird species and populations. Additionally, comparing bird counts over multiple years will provide insight as to how the habitat has or has not improved those variables as it matures.

TIMELINE AND COSTS

The restoration project began on May 9, 2022 and was completed on May 20, 2022. The timing coincided with the end of spring migration while avoiding the summer rains which began just as the work was completed. Total cost for the project (excluding Phase I) was \$69,250 broken down as follows:

- Sandhill Environmental - \$63,800
- WGI - \$3,000
- ECS - \$2,450

RESULTS

As previously mentioned, the first bird survey conducted by ECS on December 7, 2021 found only modest activity of year-round species. The second survey, conducted on January 22, 2022 resulted in similar findings, however, the inclement weather was a factor. This second survey included AoMC staff as well as interested chapter members and was valuable training in the point count method of bird surveying, which can be translated into a citizen science initiative to conduct these surveys on our own on a regular basis. The third count was completed on October 5, 2022 and showed dramatic improvement of both number and diversity of species. The following describes the method of data collection and the results of the compiled data as published in the ECS report.

The biologists only recorded birds observed within each assigned point count circle (Exhibit “D”); and designated if each bird was a fly-thru (FT) or fly-over (FO) specimen. For these surveys, a fly-thru specimen included any bird utilizing the site by flying within the trees, nesting, perching and foraging, while a fly-over specimen consisted of any bird flying above the tallest tree or structure. If a bird was heard but not observed within a point count circle, it was only recorded once for that species and noted as *audio only* in the tables below (Exhibit “E”). To properly estimate abundance, only multiple entries for a species were included when it was reasonably certain that they were different individuals. Within the findings, notes were included indicating any unusual or interesting occurrences during the surveys, especially if they could alter survey results (i.e. noise disturbances).

Once the information was collected, it was analyzed for biodiversity. One measure of biodiversity is the species diversity within a given area. The two key components of species diversity include species richness and species evenness. Species richness is a measure of the number of different species within a given area. An area with a greater number of species will have greater species richness. However, species richness can be a misleading indicator of diversity as it does not consider the number of individuals of each species present. It gives as much weight to those species which have very few individuals as to those species which have many individuals. Species evenness is a measure of the relative abundance of the different species within a given area. An area in which all the species have similar abundances will have greater species evenness. An area with some species represented by many individuals and others represented by very few individuals will have low species evenness. The use of an index of diversity (known as Simpson's Index) calculates species diversity and takes into account both species richness and evenness. The formula for Simpson's Index of Diversity (**D**) is:

$$D = 1 - (\sum (n/N)^2)$$

where **N** is the total bird count and **n** is the total number of a given species. **D** ranges from 0 to 1, where diversity increases as the index increases.

CONCLUSION

Based on the data collected and analyzed, the habitat restoration has positively affected the total bird count, number of different species (richness), relative abundance of each species (evenness) and species diversity. The total count of birds observed or heard (evenness) increased 45% and the number of different species observed or heard (richness) increased 55% from the 2021 pre restoration bird survey to the 2022 post restoration bird survey. During the 2021 survey event, the total bird count was dominated by one species which made the species evenness very low; therefore, lowering the overall species diversity of this event. During the 2022 survey event, the total bird count was more evenly distributed among the different species; therefore, increasing the overall species diversity during this event. The increased numbers of birds and bird species observed are most likely due to the recent occurrences of invasive plant eradication in all strata resulting in an increase of suitable nesting and foraging habitat for these birds. In addition, the removal of these invasive plant species has allowed for more visibility during surveying, which probably also assisted in the increased numbers of birds and bird species observed.

When conducting future bird surveys, biologists shall continue to utilize the general bird survey protocols indicated in the methodology. These protocols include approaching the survey locations quietly, not wearing light or bright colored clothing, avoiding the use of sounds (mimic bird calls, recorded bird calls), using the same locations and survey durations each time, and conducting surveys within three hours after sunrise. In addition to general bird survey protocols, it is recommended to increase bird surveying to 1-3 counts per month for increased accuracy. Due to the off-site noise pollution as noted, it may be more beneficial to conduct surveys on weekends.

NEXT STEPS / FUTURE OPPORTUNITIES

For future restoration work, it is recommended to continue treating and removing invasive plant species throughout the site to potentially increase the number of birds and bird species utilizing the preserve. While conducting the October 2022 bird survey, it was noted that only a few plant species were installed along the perimeter of the surface water area, and there were still more wading bird flyovers than fly-thru species (flying within trees, nesting, perching and foraging) observed. Therefore, it is recommended to install additional transitional/littoral shelf species as well as aquatic species to increase plant diversity, ultimately resulting in wading bird diversity on site. Although native plants have been installed along the perimeter of the surface water area, it is suggested to continue to plant native vegetation within this area and start planting throughout the remainder of the site. Additional items to increase total bird count and number of bird species include planting an assortment of wildflowers to attract a variety of birds seeking nectar, insects or seeds. Native plants used should require low to medium amounts of water, be able to thrive in the site's natural soil conditions and generally not require fertilizer or pesticides. In addition, it is important to know plant specific conditions (i.e. full sun, part sun/part shade, full shade, wet soil, dry soil, acidic soil, sandy soil, etc.). The following recommended approach, provided in December 2021, can continue to be applied:

- Eradicate monoculture of invasive grasses in wetland/surface water area **COMPLETED**

- Plant native wetland and transitional zone species within and around wetland **COMPLETED**
- Remove invasive vines particularly air potato and rosary pea **COMPLETED / ONGOING**
- Remove invasive poisonous species and species on the FISC (FKA: FLEPPC)
- Remove remaining invasive understory and canopy species
- Plant native understory and canopy species in the upland areas

BIOGRAPHIES

John Abbott – John is the Director of Environmental Services at WGI, a national design and professional services firm leading in technology-based solutions for the construction of public infrastructure and real estate development. John has over 25 years' experience in environmental planning, contamination, protected species, environmental permitting, National Environmental Policy Act (NEPA), and environmental compliance. John is a Professional Geologist (FL, TX, NC, GA), Certified Environmental Professional, Florida Fish and Wildlife Conservation Commission (FWC) Authorized Gopher Tortoise Agent and Burrowing Owl Registered Agent.

Marisa Magrino – Marisa has been working as an environmental professional in Florida since 2004 and is the owner of Environmental Consulting Services Group (ECS). Marisa has extensive experience and knowledge of Florida ecosystems. She provides an array of environmental services and innovative solutions to clients with a focus on creating customized action plans and ensuring client's needs are met in a timely manner. Marisa is an ISA Certified Arborist, FDEP Certified Stormwater Inspector, LIAF Certified Landscape Inspector, FNGLA Certified Landscape Technician, FNGLA Certified Horticulture Professional and an Authorized Gopher Tortoise Agent.

Phyllis Mills - Phyllis has a combined 20 years' experience in the environmental field working as both an employee and volunteer with agencies such as Busch Wildlife Sanctuary, The Florida Park Service, and Audubon of Martin County to name a few. In 2012, she joined Jonathan Dickinson State Park (JDSP) as an intern working on vegetation surveys to assist the park in determining if the park had viable habitat for the reintroduction of red-cockaded woodpeckers, which has become a successful project. In 2013 she spent a year with the Florida Park Service (FPS) AmeriCorps program at JDSP treating and removing invasive exotic plant species, training in wildland fire management, as well as environmental education and interpretation. Phyllis is the owner of Wild About Natives, a native plant consulting firm focusing on native plant species.

EXHIBIT "A"



EXHIBIT "C"

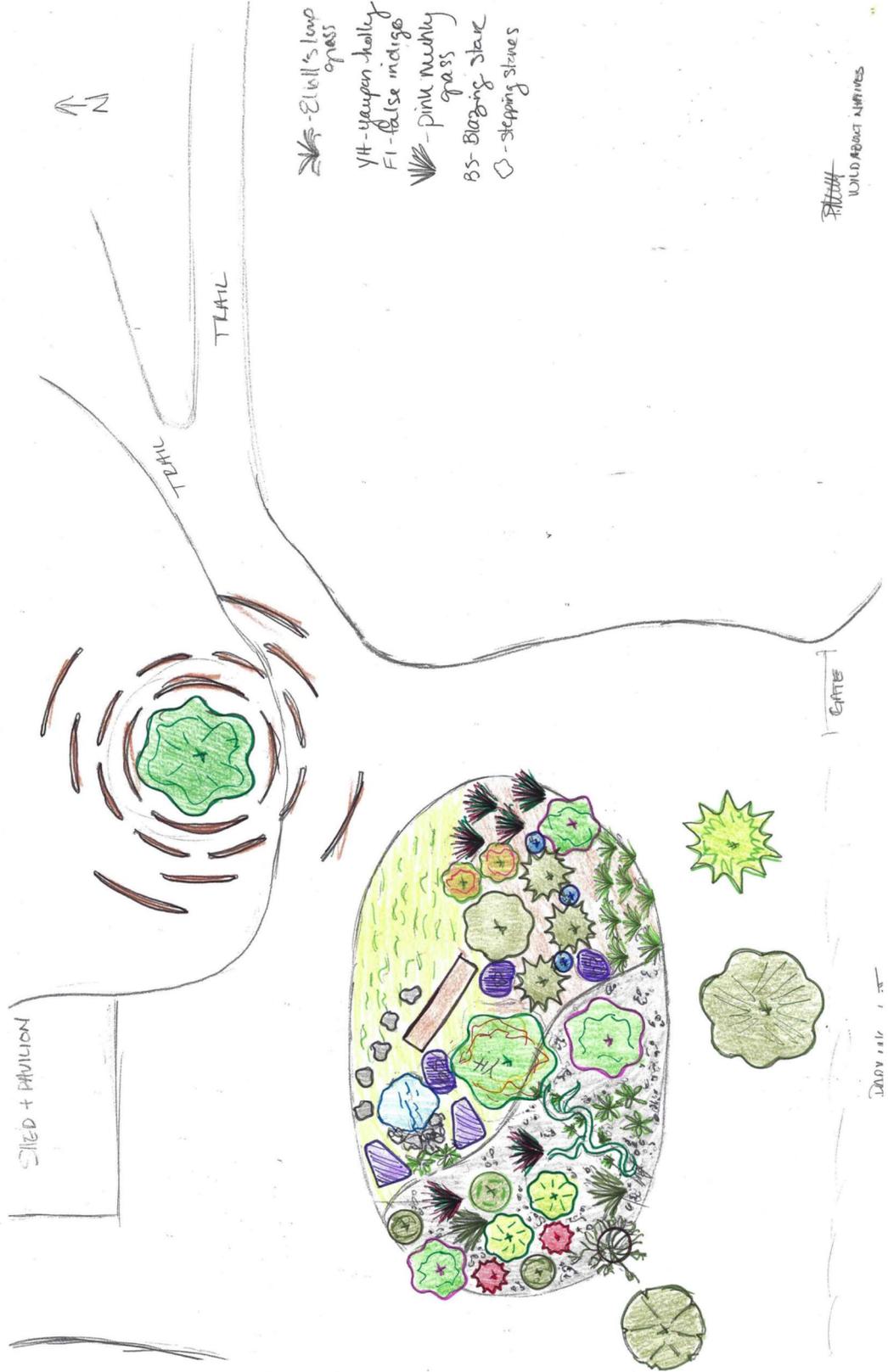


EXHIBIT "D"

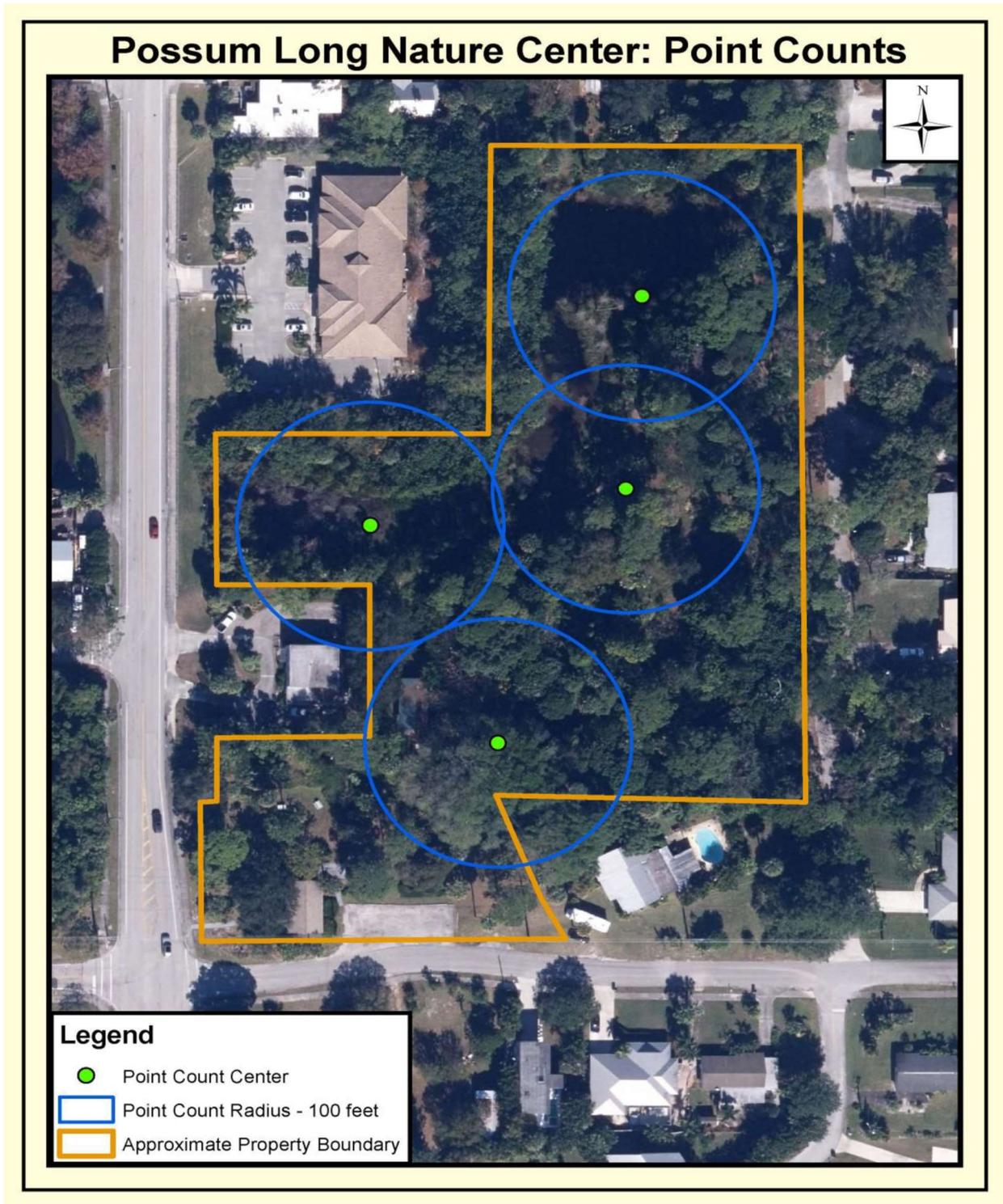


EXHIBIT “E”

Table 1: Pre-Restoration Bird Survey (12/7/21)					
Scientific Name	Common Name	1st Point	2nd Point	3rd Point	4th Point
<i>Alopochen aegyptiaca</i>	Egyptian goose	2 (FT)			
<i>Anas fulvigula</i>	Mottled duck		1 (FT)		
<i>Buteo lineatus</i>	Red-shouldered hawk	1 (FT)			
<i>Cathartes aura</i>	Turkey vulture				3 (FO)
<i>Corvus brachyrhynchos</i>	American crow	39 (FO)			
<i>Cyanocitta cristata</i>	Blue jay			1 (FT)	
<i>Dryocopus pileatus</i>	Pileated woodpecker	1 (FT)			
<i>Mimus polyglottos</i>	Northern mockingbird	1 (audio only)			
<i>Pandion haliaetus</i>	Osprey				2 (FO)
<i>Polioptila caerulea</i>	Blue-gray gnatcatcher				1 (FT)

EXHIBIT “E” cont.

Table 2: Post-Restoration Bird Survey (10/5/22)					
Scientific Name	Common Name	1 st Point	2 nd Point	3 rd Point	4 th Point
<i>Alopochen aegyptiaca</i>	Egyptian goose			3 (FO)	
<i>Anas fulvigula</i>	Mottled duck	4 (FO)			
<i>Anhinga anhinga</i>	Anhinga			1 (FO)	
<i>Archilochus colubris</i>	Ruby-throated hummingbird	2 (FT)	1 (FT)		
<i>Ardea alba</i>	Great egret	1 (FO)			
<i>Ardea herodias</i>	Great blue heron	1 (FO)			
<i>Buteo lineatus</i>	Red-shouldered hawk	1			1 (FT)
<i>Cardinalis cardinalis</i>	Northern cardinal	4 (FT)		1 (FT)	1 (FT)
<i>Corvus ossifragus</i>	Fish crow		1 (FT)	5 (FT)	1 (FT)
<i>Cyanocitta cristata</i>	Blue jay	3 (FT)	1 (FT)	2 (FT)	
<i>Dendrocygna autumnalis</i>	Black-bellied whistling-duck			2 (FO)	
<i>Dryocopus pileatus</i>	Pileated woodpecker	1 (audio only)			1 (FT)
<i>Dumetella carolinensis</i>	Gray catbird	1 (FT)	1 (FT)	2 (FT)	
<i>Eudocimus albus</i>	White ibis	10 (FO)		4 (FO)	
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	3 (FT)		2 (FT)	1 (FT)
<i>Mimus polyglottos</i>	Northern mockingbird	1 (FT)		1 (audio only)	1 (FT)
<i>Poliophtila caerulea</i>	Blue-gray gnatcatcher	4 (FT)		3 (FT)	1 (FT)
<i>Setophaga americana</i>	Northern parula			1 (audio only)	
<i>Setophaga discolor</i>	Prairie warbler		1 (FT)	6 (FT)	
<i>Setophaga dominica</i>	Yellow-throated warbler	1 (FT)			1 (FT)
<i>Setophaga ruticilla</i>	American redstart	4 (FT)		1 (audio only)	
<i>Zenaida macroura</i>	Mourning dove		1 (FT)	2 (FT), 3 (FO)	

EXHIBIT “E” cont.

Table 3: Comparison of Pre- and Post-Restoration Bird Surveys					
Scientific Name	Common Name	Pre-Restoration		Post-Restoration	
<i>Alopochen aegyptiaca</i>	Egyptian goose	2	3.8%	3	3.2%
<i>Anas fulvigula</i>	Mottled duck	1	1.9%	4	4.3%
<i>Anhinga anhinga</i>	Anhinga			1	1.1%
<i>Archilochus colubris</i>	Ruby-throated hummingbird			3	3.2%
<i>Ardea alba</i>	Great egret			1	1.1%
<i>Ardea herodias</i>	Great blue heron			1	1.1%
<i>Buteo lineatus</i>	Red-shouldered hawk	1	1.9%	2	2.1%
<i>Cardinalis cardinalis</i>	Northern cardinal			6	6.4%
<i>Cathartes aura</i>	Turkey vulture	3	5.8%		
<i>Corvus brachyrhynchos</i>	American crow	39	75%		
<i>Corvus ossifragus</i>	Fish crow			7	7.4%
<i>Cyanocitta cristata</i>	Blue jay	1	1.9%	6	6.4%
<i>Dendrocygna autumnalis</i>	Black-bellied whistling-duck			2	2.1%
<i>Dryocopus pileatus</i>	Pileated woodpecker	1	1.9%	1 (audio), 1 (visual)	2.1%
<i>Dumetella carolinensis</i>	Gray catbird			4	4.3%
<i>Eudocimus albus</i>	White ibis			14	14.9%
<i>Melanerpes carolinus</i>	Red-bellied woodpecker			6	6.4%
<i>Mimus polyglottos</i>	Northern mockingbird	1 (audio)	1.9%	1 (audio), 2 (visual)	3.2%
<i>Pandion haliaetus</i>	Osprey	2	3.8%		
<i>Polioptila caerulea</i>	Blue-gray gnatcatcher	1	1.9%	8	8.9%
<i>Setophaga americana</i>	Northern parula			1 (audio)	1.1%
<i>Setophaga discolor</i>	Prairie warbler			7	7.4%
<i>Setophaga dominica</i>	Yellow-throated warbler			2	2.1%
<i>Setophaga ruticilla</i>	American redstart			1 (audio), 4 (visual)	5.3%
<i>Zenaidura macroura</i>	Mourning dove			6	6.4%
Species Evenness		Very Low		Moderate	
		Pre-Restoration		Post-Restoration	
Total Bird Count		52		94	
Total Number of Different Species (Richness)		10		22	
Simpson's Index (Species Diversity)		0.4288		0.9314	