FINAL STUDY REPORT
STUDY TO IDENTIFY HABITAT USE AREAS FOR BALD EAGLE
RSP 3.23

CONOWINGO HYDROELECTRIC PROJECT

FERC PROJECT NUMBER 405

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EXECUTIVE SUMMARY

Exelon Generation Company, LLC has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt Conowingo Hydroelectric Project (Conowingo Project). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014. FERC issued the final study plan determination for the Project on February 4, 2010, approving the revised study plan with certain modifications. FERC's final study plan determination required Exelon to conduct nesting surveys for bald eagle in the Conowingo Project area.

An initial study report (ISR) was filed on February 22, 2011, containing Exelon's 2010 study findings. An initial study report meeting was held on March 9, 10 and 11, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on April 27, 2011 by Commission Staff, several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on May 27, 2011. On June 24, 2011, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISRs should be made. For this study, FERC's June 24, 2011 order required no modifications to the original study plan. An updated study report (USR) was filed on January 23, 2012 describing the combined results of the 2010 and 2011 bald eagle surveys. This final study report is being filed with the Final License Application for the Project.

The lower Susquehanna River in the upper Chesapeake Bay is a breeding, foraging, and roosting area for bald eagles.

Surveys were conducted in 2010 and 2011 to determine the abundance levels of bald eagles, specific locations of foraging, roosting, and nesting habitat, and daily/seasonal patterns of use by migrant and nesting bald eagles within the Conowingo Project area. To achieve these objectives, this study used aerial surveying to document the status, distribution, and productivity of nesting bald eagles, used satellite telemetry to delineate eagle roosts and foraging areas, and monitored eagle roosts and foraging areas with ground surveys.

It was determined that the shoreline forests along Conowingo Pond and the Susquehanna River downstream of Conowingo Dam provide habitat that currently supports 11 pairs of actively breeding bald eagles and many foraging and roosting bald eagles each year. Summer use of foraging and roosting areas was significantly greater than winter use.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CCB	Center for Conservation Biology
Exelon	Exelon Generation Company, LLC
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
GPS	Global Positioning System
ILP	Integrated Licensing Process
MW	Megawatt
NOI	Notice of Intent
PAD	Pre-Application Document
PSP	Proposed Study Plan
RSP	Revised Study Plan
USFWS	United States Fish and Wildlife Service

1. INTRODUCTION

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt (MW) Conowingo Hydroelectric Project (Project). Exelon is applying for license renewal using the FERC's Integrated Licensing Process (ILP). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014.

Exelon filed its Pre-Application Document (PAD) and Notice of Intent (NOI) with FERC on March 12, 2009. On June 11 and 12, 2009, a site visit and two scoping meetings were held at the Project for resource agencies and interested members of the public. Following these meetings, formal study requests were filed with FERC by several resource agencies. Many of these study requests were included in Exelon's Proposed Study Plan (PSP), which was filed on August 24, 2009. On September 22 and 23, 2009, Exelon held a meeting with resource agencies and interested members of the public to discuss the PSP.

Formal comments on the PSP were filed with FERC on November 22, 2009 by Commission staff and several resource agencies. Exelon filed a Revised Study Plan (RSP) for the Project on December 22, 2009. FERC issued the final study plan determination for the Project on February 4, 2010, approving the RSP with certain modifications.

The final study plan determination requires Exelon to conduct a study to determine the abundance levels of bald eagles, specific locations of foraging, roosting, and nesting habitat, and daily/seasonal patterns of use by migrant and nesting bald eagles within the Conowingo Project area. To achieve these objectives, this study used aerial surveying to document the status, distribution, and productivity of nesting bald eagles, used satellite telemetry to delineate eagle roosts and foraging areas, and monitored eagle roosts and foraging areas with ground surveys. Field work for the study was conducted in 2010 and 2011; this final study report incorporates results from both field seasons.

An initial study report (ISR) was filed on February 22, 2011, containing Exelon's 2010 study findings. An initial study report meeting was held on March 9, 10 and 11, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on April 27, 2011 by Commission Staff, several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on May 27, 2011. On June 24, 2011, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISRs should be made. For this study, FERC's June 24, 2011

order required no modifications to the original study plan. An updated study report (USR) was filed on January 23, 2012 describing the combined results of the 2010 and 2011 bald eagle surveys. This final study report is being filed with the Final License Application for the Project.

2. BACKGROUND

The Center for Conservation Biology (CCB) at the College of William and Mary has been tracking bald eagles using global positioning system (GPS) satellite telemetry for the U.S. Army Garrison at Aberdeen Proving Ground since 2007. This unrelated study has shown that a significant number of eagles have established roosts within the forested shoreline of the Susquehanna River above and below the Conowingo Dam. The most recent data shows that bald eagles of all age classes utilize shoreline habitat at the Conowingo Pond and Dam area for foraging, nesting, and roosting.

Exelon contracted CCB to conduct surveys of nesting bald eagles in the Conowingo Project area using aerial flyover techniques, as well as to analyze roosting patterns using existing GPS data from tagged eagles and ground-truthing.

The lower Susquehanna River is rich in birdlife with over 200 species documented in the area (PA Audubon 2010). The Lower Susquehanna Gorge was identified in 2002 as a candidate for recognition as an Important Bird Area (PA Audubon 2010). The first bald eagle sanctuary in the United States was established in 1936 to protect an active eagle nest on Mt Johnson Island across from the Peach Bottom Atomic Power Station (Abbott 1959).

Bald eagles from populations along the Atlantic coast congregate in the upper Chesapeake Bay and lower Susquehanna River with the largest numbers concentrating around the lower portion of the Susquehanna River (Buehler et al. 1987, Buehler et al. 1991, Watts et al. 2007). Eagle populations have grown exponentially in the Chesapeake Bay since the mid-1990s with an average doubling time of 8.2 years (Watts et al. 2008, Mojica, et al 2011). This has resulted in a large increase in the number of eagles foraging and roosting around the Conowingo reservoir and dam system (Watts et al. 2007, Watts et al. 2008, Mojica, et al. 2011). Satellite telemetry data from an ongoing study of eagles at Aberdeen Proving Ground has revealed significant use of Conowingo Pond area by eagles in the upper Bay (C. Koppie, personal communication; Watts and Mojica 2009; Watts and Mojica *in press*). This telemetry data may be used to delineate communal roosts and key foraging areas. Ground work was conducted as part of this study to determine the relationship between use of communal roosts and foraging areas by birds with transmitters and the broader eagle population.

Identification of communal roosts and foraging areas is important for successful eagle management under the United States Fish and Wildlife Service's (USFWS) National Eagle Management Guidelines. Though the bald eagle was removed from the federal Endangered Species List in 2007, it remains protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and Migratory Bird Treaty Act (16 U.S.C.

703-712). Bald eagles are listed as state threatened in Pennsylvania and are on the state watch list in Maryland.

All forested components of the Conowingo Project area were surveyed for evidence of nesting bald eagles. The survey covered all shoreline inland 1.5 km from US 40 at the mouth of the Susquehanna to PA Route 372 at the north end of the Conowingo Pond (approximately 50 miles of shoreline).

3. METHODS

3.1 Nesting and Productivity Surveys

All major waterways and tributaries associated with the study area were surveyed for breeding bald eagles. In March 2010, a high-wing Cessna 172 aircraft was used to systematically overfly the land surface at an altitude of approximately 100 m to detect eagle nests. Flights were flown to systematically move between the shoreline and a distance of approximately 1.5 km inland to cover the most probable breeding locations for bald eagles. Detected nests were plotted on 7.5 min topographic maps, assigned a unique numeric code, and plotted in ArcGIS 10.0. Each nest was examined to determine its structural condition, the type and condition of nest tree, and the condition of the surrounding landscape. Following national conventions (USFWS 2009), a breeding territory was considered "occupied" if a pair of birds was observed in association with the nest and there was evidence of recent nest maintenance (e.g., well-formed cup, fresh lining, and structural maintenance). Nests were considered "active" if a bird was observed in an incubating posture or if eggs or young were detected in the nest. A "productive" nest has young present until fledging age (11-14 weeks old). All active bald eagle nests were rechecked in May 2010 for productivity. All eaglets were counted and aged by sight.

3.2 Eagle Roost and Foraging Areas

3.2.1 Delineation

GPS- telemetry data were compiled from 67 Bald Eagles tagged in the Chesapeake Bay during August 2007 – February 2010 (Watts and Mojica 2009). Thirty-nine of these eagles roosted in the study area with a total of 1,864 GPS locations included in the analysis. A nearest neighbor clustering script in Crimestat III (Levine 2004) was used to delineate the roost boundaries with a minimum convex polygon (MCP; see example Figure 3.2.1-1). This analysis searched for spatially clustered GPS locations which indicated communal roosts (Watts and Mojica *in press*). Seasonal use and variation was evaluated. A subsample of communal roosts and foraging areas was selected for follow-up ground surveys.

We identified foraging areas using GPS telemetry data filtered to include only locations collected during daylight hours. The shoreline within the study area was delineated into 100m segments and all GPS

locations within 200m of the shoreline were associated with the closest shoreline segment. Use per segment was classified in ArcGIS 10.0 using the Jenks method of classifying natural breaks in data values (Jenks 1967).

3.2.2 Monitoring

Dawn and dusk roost surveys and daytime shoreline surveys of foraging areas were conducted to determine the magnitude of use. The first set of surveys was completed, one day per week, over the course of 10 weeks between the months of July and October 2010 (Table 3.2.2-1). The second round of surveys took place between the months of January and March 2011 (Table 3.2.2-2).

Roost Surveys: Communal roosts were initially identified from the existing satellite data from telemetry-tagged birds, as described in Section 3.2.1 above. Ten weekly surveys were completed during each of the sampling periods: July-October 2010 and January-March 2011. One observer counted and aged eagles as they entered the roost at dusk or exited at dawn. Dawn surveys began 45 minutes before civil twilight[1] and ended 30 minutes after sunrise. Dusk surveys began 2 hours before civil twilight and ended when it became too dark to see (approximately civil twilight).

Ground observations of eagles using communal roosts were compared to existing satellite data to determine the relationship between the data for evaluating roost use by transmittered and non-transmittered eagles. The observation sampling period July-October 2010 was compared to GPS telemetry data from July-October 2008-2010. The observation sampling period January-March 2011 was compared to GPS telemetry data from January-March 2008-2011. The date range in the GPS telemetry data was expanded to include multiple years to increase the sample size for the analysis.

Shoreline Surveys: We planned to survey a subset of the project area shoreline each week (one day per week) to assess the overall eagle population using the Conowingo dam and reservoir system. Because of weather conditions during the survey period, excessively high water levels in the Susquehanna River resulted in limited safe access to observation points. Therefore, the field data on shoreline foraging areas could not be collected in its entirety and is inadequate for comparison to GPS telemetry data depicting those areas.

[1] Civil twilight is defined as the first moment when the horizon can be clearly seen at dawn (a.k.a. civil dawn) and the last moment when the horizon can be clearly seen at dusk (a.k.a. civil dusk).

4. RESULTS

4.1 Nesting and Productivity Surveys

Twelve occupied breeding territories were documented in the study area during spring 2010 (Figure 4.1-1). Eleven nests were active and these produced 15 eagle nestlings (Table 4.1-1). Reproductive rates were 1.25 chicks/occupied territory and 1.36 chicks/active nest.

4.2 Eagle Roost and Foraging Areas

4.2.1 Delineation

Eighteen communal roosts were identified in the study area (Figure 4.2.1-1). They ranged from high use roosts (i.e. more than 50-100 individuals) near Conowingo Dam, to smaller low-use roosts scattered on the river shoreline. Foraging areas were also delineated along shorelines of Muddy Run Reservoir. Conowingo Pond and the Susquehanna River. Coordinates for roosts are listed in Table 4.2.1-1.

4.2.2 Monitoring

Roost use varied between seasons with visitation during July-October greater than in January-March. A total of 977 observations of eagles were made in communal roosts during the July-October 2010 survey period (Table 4.2.2-1), whereas a total of 263 observations of eagles the roosts were made during the January-March 2011 survey period (Table 4.2.2-2). The highest number of individual eagles observed to be using one roost was 105 eagles within Roost No. 1 during survey week 6 (2010) (Table 4.2.2-1).

Comparison of visual observations to the GPS telemetry data was different between sampling periods. For the July-October period, the number of GPS data points per month predicted the number of eagles in the roost per day ($F_{(1,10)} = 47.2079$, $p < 0.0001$, $R^2_{Adj} = 0.81$; see Figure 4.2.2-1). However, there was no relationship between observational and GPS telemetry data during the January through March period ($F_{(1,10)} = 0.0043$, $p = 0.9488$, $R^2_{Adj} = -0.09$).

4.2.3 Shoreline Use

Shoreline use varied between sampling periods in summer and winter (Figures 4.2.3-1 through 4.2.3-4). Shoreline use was high at communal roosts where eagles often loaf during the day. Summer shoreline usage was concentrated on the shoreline at Peters Creek, shoreline downstream of the Peach Bottom discharge, shoreline below Bald Friar on the north shore of Conowingo Reservoir, shoreline at roost 9 (Fisherman's Park), shoreline at Roost No. 1 and the north side of the outfall of Conowingo Dam, shoreline at Roost No. 7, shoreline on Sterret Island, shoreline at Roost No. 11 near Lapidum boat ramp, and on Garrett Island. Winter shoreline usage concentrated around Roost No. 3 near the discharge of the

Muddy Run powerhouse, Mount Johnson Island, shoreline downstream of the Peach Bottom's discharge, shoreline at Roost No. 18, shoreline at Roost No. 10, shoreline at Roost No. 9 (Fisherman's Park), shoreline at Roost No. 1 and the north side of the outfall of Conowingo Dam, and shoreline of Roosts No's 2 and 7.

5. CONCLUSIONS

The lower Susquehanna River in the upper Chesapeake Bay is a breeding, foraging, and roosting area for bald eagles. The shoreline forests along Conowingo Pond and the Susquehanna River downstream of Conowingo Dam provide habitat that currently supports 12 nests, with 11 pairs of actively breeding bald eagles. Nest productivity was found to be above population maintenance levels for the species and similar to recent reproductive rates for the Chesapeake Bay (Watts et al 2008).

The project area also supports 18 communal roosts and is used by many foraging and roosting bald eagles each year from multiple populations along the Atlantic Coast. Shoreline along the Conowingo Pond and the Susquehanna River downstream of Conowingo Dam were used with varying frequency for perching, roosting, and foraging. Eighteen communal roosts were found in the study area demonstrating the area's concentrated use by eagles. These roosts provide an important role for the species by facilitating social interaction between individuals and providing shelter in inclement weather (Watts and Mojica *in press*). Because bald eagles are opportunistic foragers, roost use in a given night or season can depend on the availability of nearby food resources. The availability of prey and forage in the vicinity of the Conowingo Project likely affected the frequency and geographic distribution of roost use in the Project area.

The forest in and around Roost 1 at the Conowingo Dam is the most important in the study area for foraging and roosting Bald Eagles. This area was consistently used by large numbers of eagles year-round.

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TABLE 3.2.2-1 WEEKLY ROOST COUNT DATA FOR INDIVIDUAL EAGLE ROOSTS MONITORED DURING JULY-OCTOBER 2010.

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
1	1	7/28/2010	Morning	63	35	0	98
	2	8/4/2010	Evening	57	25	0	82
	3	8/12/2010	Morning	13	6	33	52
	4	8/19/2010	Evening	41	6	0	47
	5	8/26/2010	Morning	8	1	30	39
	6	9/2/2010	Evening	81	24	0	105
	7	9/9/2010	Evening	22	4	0	26
	8	9/16/2010	Morning	8	2	9	19
	9	9/22/2010	Evening	32	17	0	49
	10	10/7/2010	Evening	56	26	0	82
2&7	1	7/28/2010	Morning	1	1	2	4
	2	8/4/2010	Evening	4	2	0	6
	3	8/12/2010	Morning	4	3	1	8
	4	8/19/2010	Evening	2	1	0	3
	5	8/26/2010	Morning	2	0	0	2
	6	9/2/2010	Evening	0	3	0	3
	7	9/9/2010	Evening	5	1	0	6
	8	9/16/2010	Morning	6	0	0	6
	9	9/22/2010	Evening	3	4	0	7
	10	10/7/2010	Evening	2	5	0	7
3	1	7/27/2010	Evening	1	6	1	8
	2	8/3/2010	Morning	0	0	0	0
	3	8/13/2010	Evening	2	4	0	6
	4	8/19/2010	Morning	0	0	1	1
	5	8/25/2010	Evening	0	0	0	0
	6	9/2/2010	Morning	0	0	0	0
	7	9/8/2010	Morning	2	0	0	2
	8	9/15/2010	Evening	3	1	0	4
	9	9/23/2010	Morning	0	2	0	0
	10	10/6/2010	Evening	0	0	0	0
4	1	7/28/2010	Morning	1	4	0	5
	2	8/5/2010	Morning	0	0	1	1
	3	8/11/2010	Evening	0	2	0	2
	4	8/20/2010	Morning	1	2	0	3
	5	8/26/2010	Evening	3	0	0	3
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	2	6	0	8
	8*	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	0	0	0	0
	10	10/7/2010	Morning	2	12	2	16
5	1	7/28/2010	Morning	0	0	0	0
	2	8/5/2010	Morning	1	1	0	2
	3	8/12/2010	Morning	0	2	0	2

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
	4	8/20/2010	Morning	0	2	0	2
	5	8/26/2010	Evening	0	1	0	1
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	2	1	1	4
	8*	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	3	2	1	6
	10	10/7/2010	Morning	1	2	0	3
9	1	7/28/2010	Morning	0	2	0	2
	2	8/4/2010	Evening	1	3	0	4
	3	8/12/2010	Morning	0	2	0	2
	4	8/19/2010	Evening	4	1	0	5
	5	8/26/2010	Morning	0	0	0	0
	6	9/2/2010	Evening	1	0	0	1
	7	9/9/2010	Evening	0	3	0	3
	8	9/16/2010	Morning	6	0	1	7
	9	9/22/2010	Evening	0	0	0	0
	10	10/7/2010	Evening	2	5	0	7
10	1	7/28/2010	Morning	0	0	3	3
	2	8/5/2010	Morning	0	1	0	1
	3	8/12/2010	Morning	1	0	0	1
	4	8/20/2010	Morning	0	0	1	1
	5	8/26/2010	Evening	0	0	2	2
	6	9/1/2010	Evening	0	0	3	3
	7	9/9/2010	Morning	1	1	0	2
	8*	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	1	2	0	3
	10	10/7/2010	Morning	0	0	0	0
11	1	7/31/2010	Morning	6	6	2	14
	2	8/8/2010	Evening	5	11	1	17
	3	8/14/2010	Morning	16	15	5	36
	4	8/22/2010	Evening	2	4	0	6
	5	8/26/2010	Morning	4	4	0	8
	6	9/2/2010	Evening	5	4	0	9
	7	9/9/2010	Evening	3	3	0	6
	8	9/16/2010	Morning	2	2	4	8
	9	9/22/2010	Evening	4	2	1	7
	10	10/7/2010	Evening	2	5	0	7
15	1	7/27/2010	Evening	0	1	1	2
	2	8/3/2010	Morning	0	0	0	0
	3	8/13/2010	Evening	1	2	0	3
	4	8/19/2010	Morning	1	1	0	2
	5	8/25/2010	Evening	0	0	0	0
	6	9/2/2010	Morning	2	0	0	2
	7	9/8/2010	Evening	0	1	0	1
	8	9/15/2010	Evening	0	0	0	0
	9	9/23/2010	Morning	0	0	0	0

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
	10	10/6/2010	Evening	8	3	0	11
17	1	7/31/2010	Evening	1	3	0	4
	2	8/8/2010	Evening	0	0	0	0
	3	8/14/2010	Morning	1	1	0	2
	4	8/21/2010	Morning	0	1	0	1
	5	8/26/2010	Evening	1	1	0	2
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	0	0	0	0
	8*	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	1	0	0	1
	10	10/7/2010	Morning	0	0	0	0
19	1	7/27/2010	Evening	9	4	0	13
	2	8/3/2010	Morning	0	0	2	2
	3	8/13/2010	Evening	8	4	0	12
	4	8/19/2010	Morning	0	0	0	0
	5	8/25/2010	Evening	1	3	0	4
	6	9/2/2010	Morning	2	2	0	4
	7	9/8/2010	Evening	4	2	0	6
	8	9/15/2010	Evening	3	4	0	7
	9	9/23/2010	Morning	2	1	0	3
	10	10/6/2010	Evening	0	0	0	0
* In week 8, an extensive weather system forced cancellation of surveys at 4 roosts							

TABLE 3.2.2-2 WEEKLY ROOST COUNT DATA FOR INDIVIDUAL EAGLE ROOSTS MONITORED DURING JANUARY-MARCH 2011.

Roost	Week	DATE	Observation Period	Juvenile	Adult	Unknown Age	Total
1	1	1/8/2011	evening	5	8	0	13
	2	1/15/2011	morning	1	2	0	3
	3	1/22/2011	morning	0	0	0	0
	4	1/29/2011	morning	0	0	0	0
	5	2/4/2011	evening	0	0	0	0
	6	2/12/2011	morning	4	6	0	10
	7	2/20/2011	evening	2	1	0	3
	8	2/26/2011	morning	0	0	0	0
	9	3/5/2011	evening	2	0	0	2
	10	3/13/2011	morning	0	0	0	0
2&7	1	1/8/2011	evening	0	0	0	0
	2	1/15/2011	morning	1	2	0	3
	3	1/22/2011	morning	2	2	0	4
	4	1/29/2011	morning	0	0	0	0
	5	2/4/2011	evening	3	4	0	7
	6	2/11/2011	morning	2	4	0	6
	7	2/20/2011	evening	1	3	0	4
	8	2/26/2011	morning	1	2	0	3
	9	3/5/2011	evening	2	7	0	9
	10	3/13/2011	morning	1	4	0	5
3	1	1/11/2011	morning	0	1	0	1
	2	1/21/2011	evening	1	3	0	4
	3	1/28/2011	morning	0	2	1	3
	4	2/4/2011	evening	1	0	0	1
	5	2/9/2011	morning	1	1	0	2
	6	2/18/2011	evening	0	1	0	1
	7	2/26/2011	morning	1	0	1	2
	8	3/7/2011	evening	1	1	1	3
	9	3/13/2011	morning	2	2	2	6
	10	3/20/2011	evening	1	0	2	3
4	1	1/9/2011	morning	1	3	0	4
	2	1/15/2011	evening	0	3	0	3
	3	1/19/2011	evening	0	1	0	1
	4	1/29/2011	evening	1	2	0	3
	5	2/6/2011	morning	0	3	0	3

Roost	Week	DATE	Observation Period	Juvenile	Adult	Unknown Age	Total
	6	2/12/2011	evening	0	0	0	0
	7	2/20/2011	morning	0	0	0	0
	8	2/26/2011	evening	0	0	0	0
	9	3/5/2011	morning	0	0	0	0
	10	3/12/2011	evening	0	1	0	1
5	1	1/9/2011	morning	0	0	0	0
	2	1/15/2011	evening	2	2	0	4
	3	1/19/2011	evening	0	0	0	0
	4	1/29/2011	evening	2	3	0	5
	5	2/6/2011	morning	1	0	0	1
	6	2/12/2011	evening	1	0	0	1
	7	2/20/2011	morning	0	0	0	0
	8	2/26/2011	evening	0	0	0	0
	9	3/5/2011	morning	0	2	0	2
	10	3/12/2011	evening	0	1	0	1
9	1	1/8/2011	evening	6	12	0	18
	2	1/15/2011	morning	1	3	0	4
	3	1/22/2011	morning	0	3	0	3
	4	1/29/2011	morning	1	5	0	6
	5	2/4/2011	evening	0	2	0	2
	6	2/12/2011	morning	1	3	0	4
	7	2/20/2011	evening	2	2	0	4
	8	2/26/2011	morning	0	0	0	0
	9	3/5/2011	evening	0	1	0	1
	10	3/13/2011	morning	0	0	0	0
10	1	1/9/2011	morning	3	2	0	5
	2	1/15/2011	evening	1	0	0	1
	3	1/19/2011	evening	2	3	0	5
	4	1/29/2011	evening	2	4	0	6
	5	2/6/2011	morning	0	2	0	2
	6	2/13/2011	evening	2	4	0	6
	7	2/20/2011	morning	0	0	0	0
	8	2/26/2011	evening	3	4	0	7
	9	3/5/2011	morning	4	1	0	5
	10	3/12/2011	evening	4	2	0	6
11	1	1/9/2011	evening	3	0	0	3
	2	1/16/2011	morning	1	0	0	1
	3	1/20/2011	evening	0	0	0	0
	4	1/30/2011	morning	1	3	0	4

Roost	Week	DATE	Observation Period	Juvenile	Adult	Unknown Age	Total
	5	2/7/2011	evening	0	0	0	0
	6	2/13/2011	morning	0	0	0	0
	7	2/19/2011	evening	1	2	0	3
	8	2/27/2011	morning	0	2	0	2
	9	3/6/2011	evening	0	2	0	2
	10	3/12/2011	morning	1	1	0	2
15	1	1/10/2011	morning	0	1	0	1
	2	1/19/2011	evening	0	2	0	2
	3	1/29/2011	morning	0	0	0	0
	4	2/3/2011	evening	0	0	0	0
	5	2/11/2011	morning	0	0	0	0
	6	2/19/2011	evening	1	2	0	3
	7	2/27/2011	morning	1	2	2	5
	8	3/3/2011	evening	1	1	0	2
	9	3/10/2011	morning	0	0	0	0
	10	3/18/2011	evening	0	2	0	2
17	1	1/9/2011	evening	0	0	0	0
	2	1/16/2011	morning	1	3	0	4
	3	1/22/2011	evening	0	0	0	0
	4*			---	---	---	---
	5	2/7/2011	evening	0	3	0	3
	6	2/12/2011	morning	0	0	0	0
	7	2/18/2011	evening	0	0	0	0
	8	2/27/2011	morning	0	0	0	0
	9	3/6/2011	evening	0	0	0	0
	10	3/11/2011	morning	0	0	0	0
19	1	1/10/2011	morning	0	0	0	0
	2	1/19/2011	evening	0	1	0	1
	3	1/29/2011	morning	0	2	0	2
	4	2/3/2011	evening	0	1	0	1
	5	2/11/2011	morning	0	0	0	0
	6	2/19/2011	evening	1	1	0	2
	7	2/27/2011	morning	0	1	0	1
	8	3/3/2011	evening	0	1	0	1
	9	3/10/2011	morning	1	0	0	1
	10	3/19/2011	evening	2	1	0	3

* In week 4 , a snowstorm prevented completion of survey at Roost 17

TABLE 4.1-1: EAGLE NESTS SURVEYED IN THE CONOWINGO PROJECT AREA IN 2010

Nest	Tree	Quad	Location	Occupied	Active	Productivity	Latitude	Longitude
1	Cell tower	Havre de Grace	Perryville Substation	Y	Y	2	39.55776	-76.07447
2	Hardwood tree	Aberdeen	Robert Island	Y	N	0	39.61716	-76.14355
3	Electrical tower	Conowingo Dam	Conowingo Dam	Y	Y	0	39.65979	-76.16452
4	Oak tree	Conowingo Dam	Pilot Station	N	N	0	39.68692	-76.19777
5	Oak tree	Conowingo Dam	N of Broad Creek	Y	Y	2	39.71076	-76.24259
6	Beech tree	Conowingo Dam	Gazebo House	Y	Y	0	39.68768	-76.22283
7	Oak tree	Conowingo Dam	S of Conowingo Dam	Y	Y	1	39.64688	-76.16607
8	Hardwood tree	Conowingo Dam	Buck Branch	Y	Y	2	39.62858	-76.16959
9	Poplar tree	Havre de Grace	Susquehanna SP	Y	Y	2	39.58456	-76.11948
10	Sycamore tree	Aberdeen	Lapidum	Y	Y	2	39.60310	-76.13372
11	Beech tree	Holtwood	Upper Bear Island	Y	Y	0	39.80755	-76.31106
12	Electrical tower	Holtwood	Fulton Power Plant	Y	Y	1	39.75708	-76.25157

TABLE 4.2.1-1: MID-POINT COORDINATES FOR BALD EAGLE COMMUNAL ROOSTS NEAR THE CONOWINGO PROJECT AREA.

Roost	Latitude	Longitude
1	39.66217	-76.16338
2	39.64643	-76.15228
3	39.79283	-76.30243
4	39.66064	-76.18978
5	39.67518	-76.20484
6	39.65178	-76.15210
7	39.65023	-76.15480
8	39.64256	-76.16318
9	39.65288	-76.17223
10	39.67328	-76.18185
11	39.58558	-76.12101
12	39.64316	-76.16975
13	39.63322	-76.16224
15	39.80718	-76.31599
16	39.78512	-76.25716
17	39.70784	-76.24005
18	39.72146	-76.24227
19	39.80587	-76.30643

Coordinates are in WGS 1984.

TABLE 4.2.2-1: NUMBER OF INDIVIDUAL EAGLES OBSERVED IN EACH ROOST SURVEYED BY WEEK- 2010

Roost	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Total Observations
1	98	82	52	47	39	105	26	19	49	82	**599**
2&7[a]	4	6	8	3	2	3	6	6	7	7	**52**
3	8	0	6	1	0	0	2	4	0	0	**21**
4	5	1	2	3	3	0	8	0	0	16	**38**
5	0	2	2	2	1	0	4	0	6	3	**20**
9	2	4	2	5	0	1	3	7	0	7	**31**
10	3	1	1	1	2	3	2	0	3	0	**16**
11	14	17	36	6	8	9	6	8	7	7	**118**
15	2	0	3	2	0	2	1	0	0	11	**21**
17	4	0	2	1	2	0	0	0	1	0	**10**
19	13	2	12	0	4	4	6	7	3	0	**51**
Total	**153**	**115**	**126**	**71**	**61**	**127**	**64**	**51**	**76**	**133**	**977**

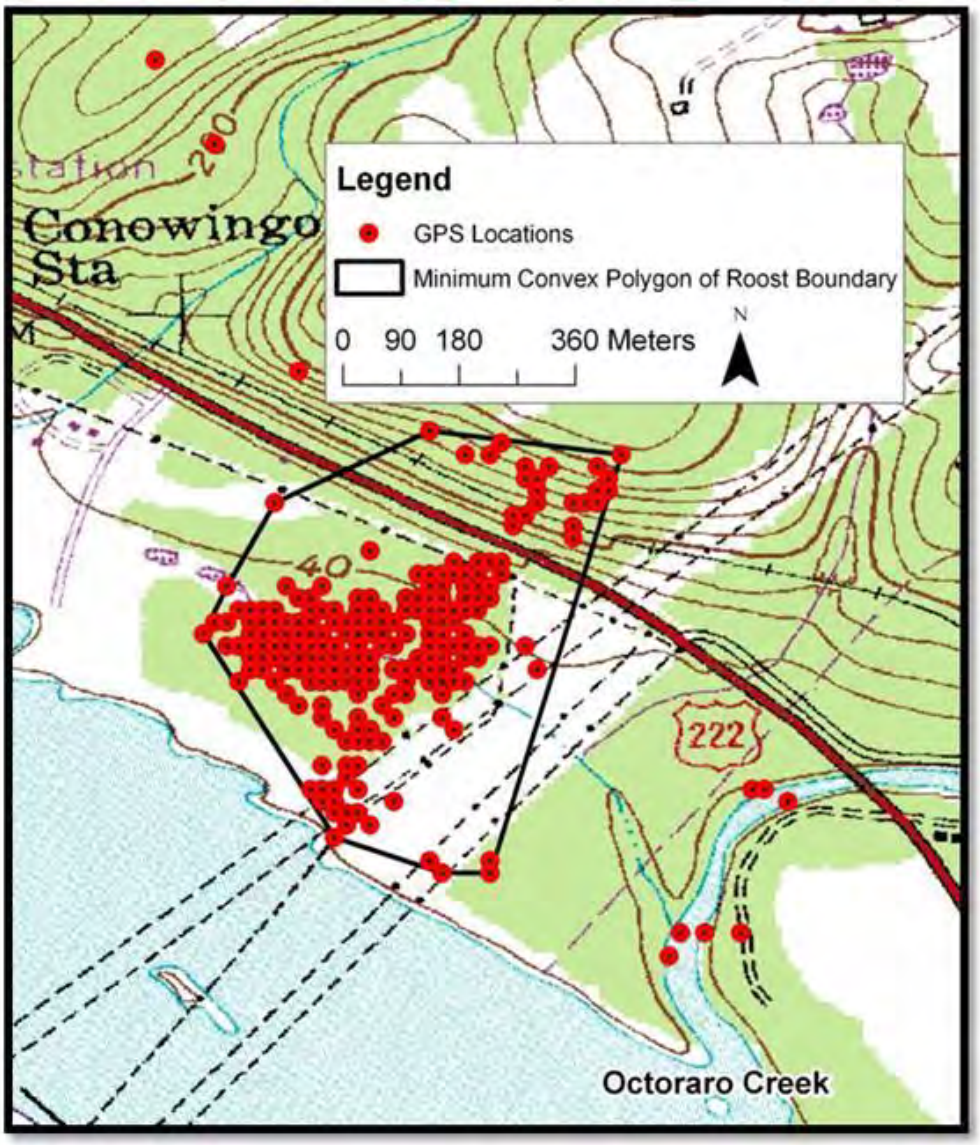
TABLE 4.2.2-2: NUMBER OF INDIVIDUAL EAGLES OBSERVED IN EACH ROOST SURVEYED BY WEEK- 2011

Roost	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Total Observations
1	13	3	0	0	0	10	3	0	2	0	**31**
2&7[a]	0	3	4	0	7	6	4	3	9	5	**41**
3	1	4	3	1	2	1	2	3	6	3	**26**
4	4	3	1	3	3	0	0	0	0	1	**15**
5	0	4	0	5	1	1	0	0	2	1	**14**
9	18	4	3	6	2	4	4	0	1	0	**42**
10	5	1	5	6	2	6	0	7	5	6	**43**
11	3	1	0	4	0	0	3	2	2	2	**17**
14	3	5	3	4	2	1	5	4	0	4	**31**
15	1	2	0	0	0	3	5	2	0	2	**15**
17	0	4	0	---[b]	3	0	0	0	0	0	**7**
19	0	1	2	1	0	2	1	1	1	3	**12**
Total	**48**	**35**	**21**	**30**	**22**	**34**	**27**	**22**	**28**	**27**	**294**

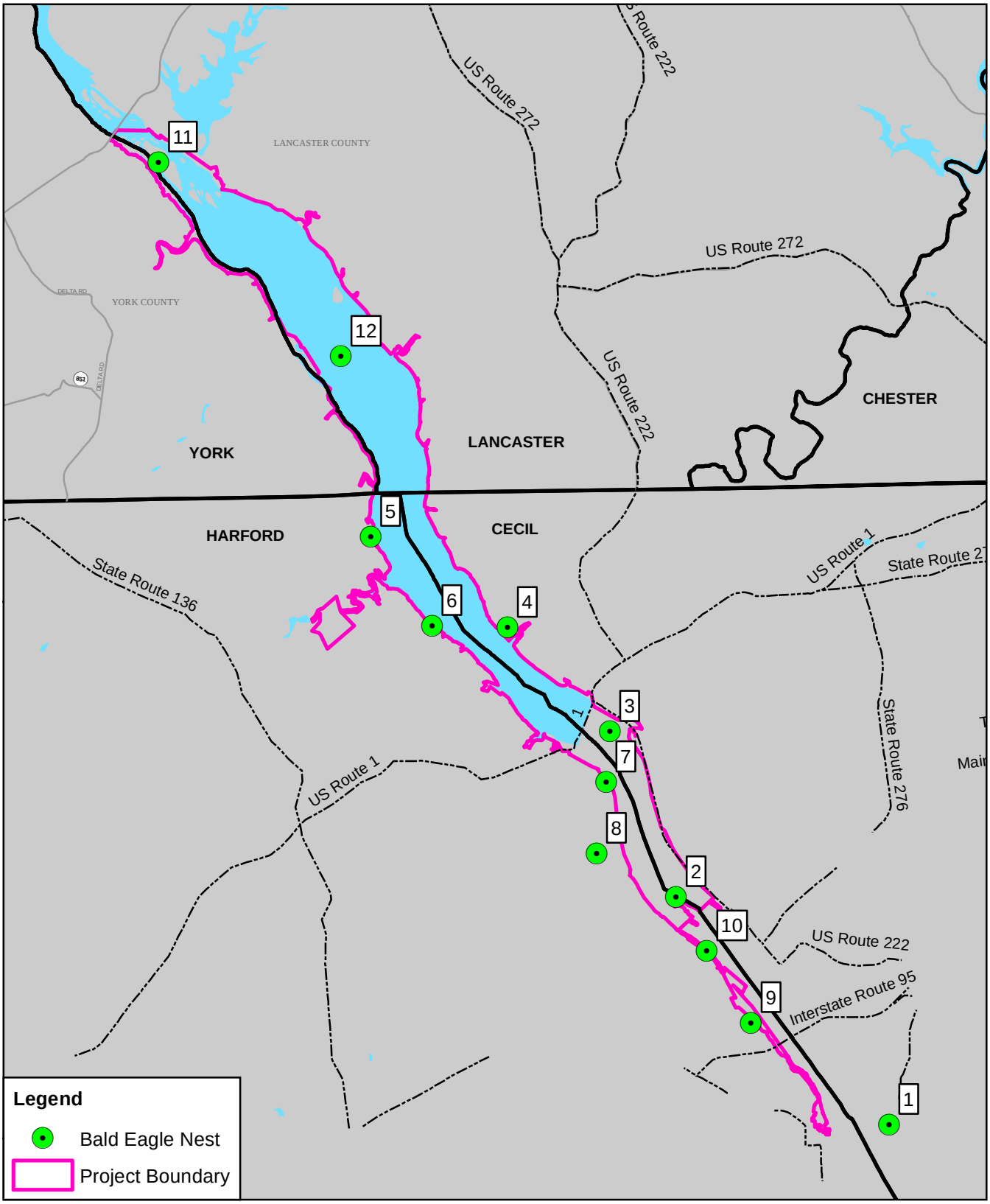
[a] Roosts 2 and 7 were surveyed jointly because close proximity of the roosts made separation of observations between roosts difficult.

[b] One roost survey was cancelled during a snow storm in week 4.

FIGURE 3.2.1-1: MINIMUM CONVEX POLYGON OF ROOST #1 BOUNDARY



Notes: A Minimum Convex Polygon was drawn around roost locations recorded by GPS-transmitters. The polygon represents the boundary of the communal roost... The roost in the figure is Roost 1 located downstream of Conowingo Dam.



EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

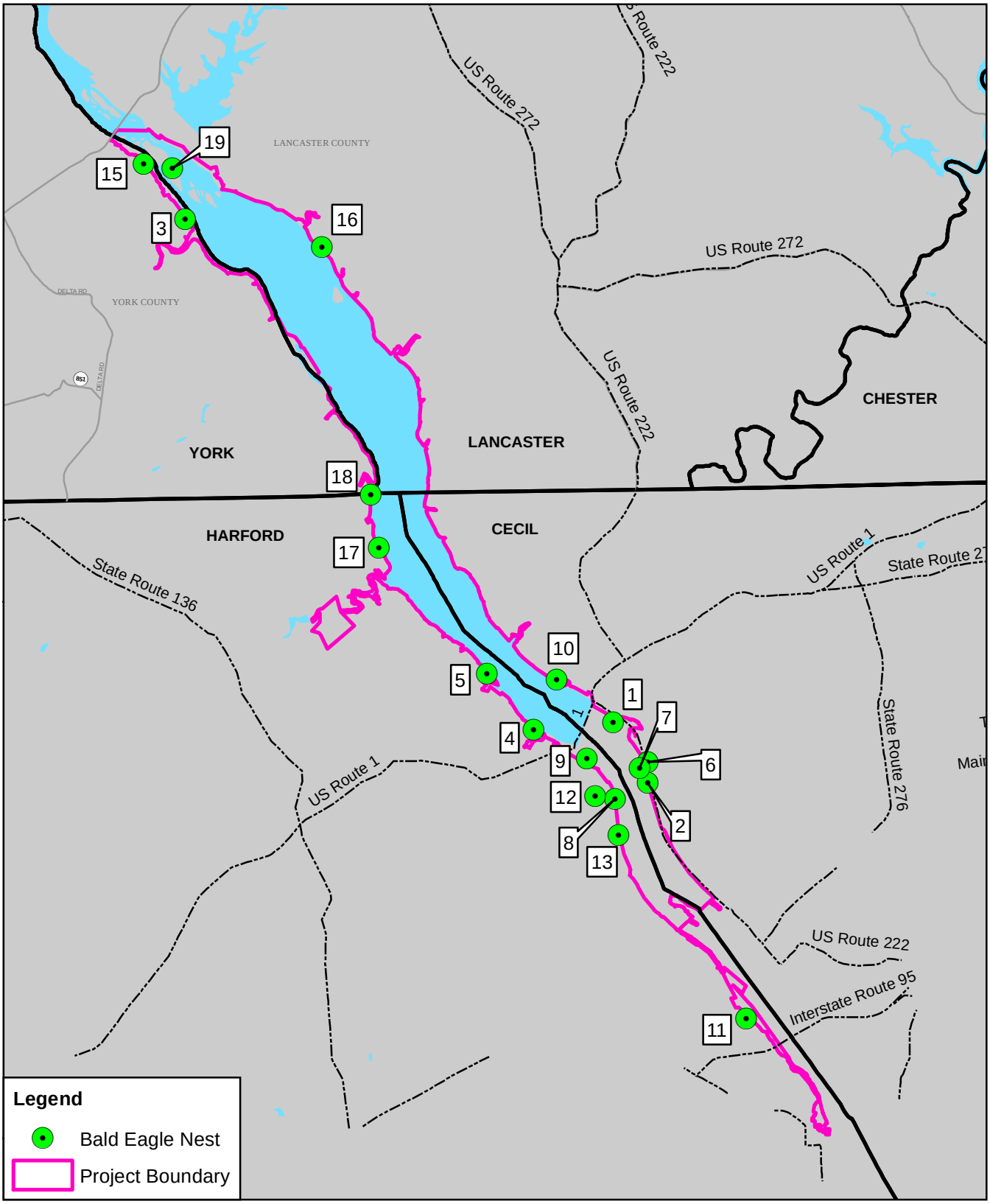
N

1 inch = 2.5 miles

0 1.25 2.5 5 Miles

Figure 4.1-1:
Bald Eagle Nests Located in 2010
Near the Conowingo Project Area

Path: X:\GISMaps\project_maps\rsp\conowingo\3_23_study_to_identify_critical_habitat_areas_for_bald_eagle\fig_4_1-1_nest_locations.mxd



EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

N

1 inch = 2.5 miles

0 1.25 2.5 5 Miles

Figure 4.2.1-1:
Communal Bald Eagle Roosts
Delineated in the Conowingo Project Area

Path: X:\GISMaps\project_maps\rsp\conowingo\3_23_study_to_identify_critical_habitat_areas_for_bald_eagle\fig_4_2_1-1_roost_locations.mxd

FIGURE 4.2.2-1: THE NUMBER OF OBSERVED EAGLES USING A COMMUNAL ROOST (Y) CAN BE ESTIMATED BY MULTIPLYING THE NUMBER OF GPS DATA POINTS PER MONTH (X) FOR A ROOST BY 2.466 AND ADDING 3.2.
($F_{(1,10)}$ = 47.2079, p <0.0001, R^2_{Adj} = 0.81)

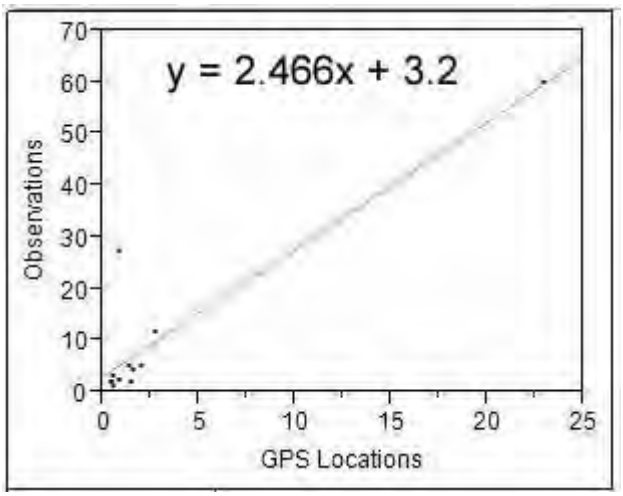


FIGURE 4.2.3-1: USE OF SHORELINE BY BALD EAGLES IN SUMMER (A) AND WINTER (B) FROM RT 372 TO PEACH BOTTOM NUCLEAR PLANT.

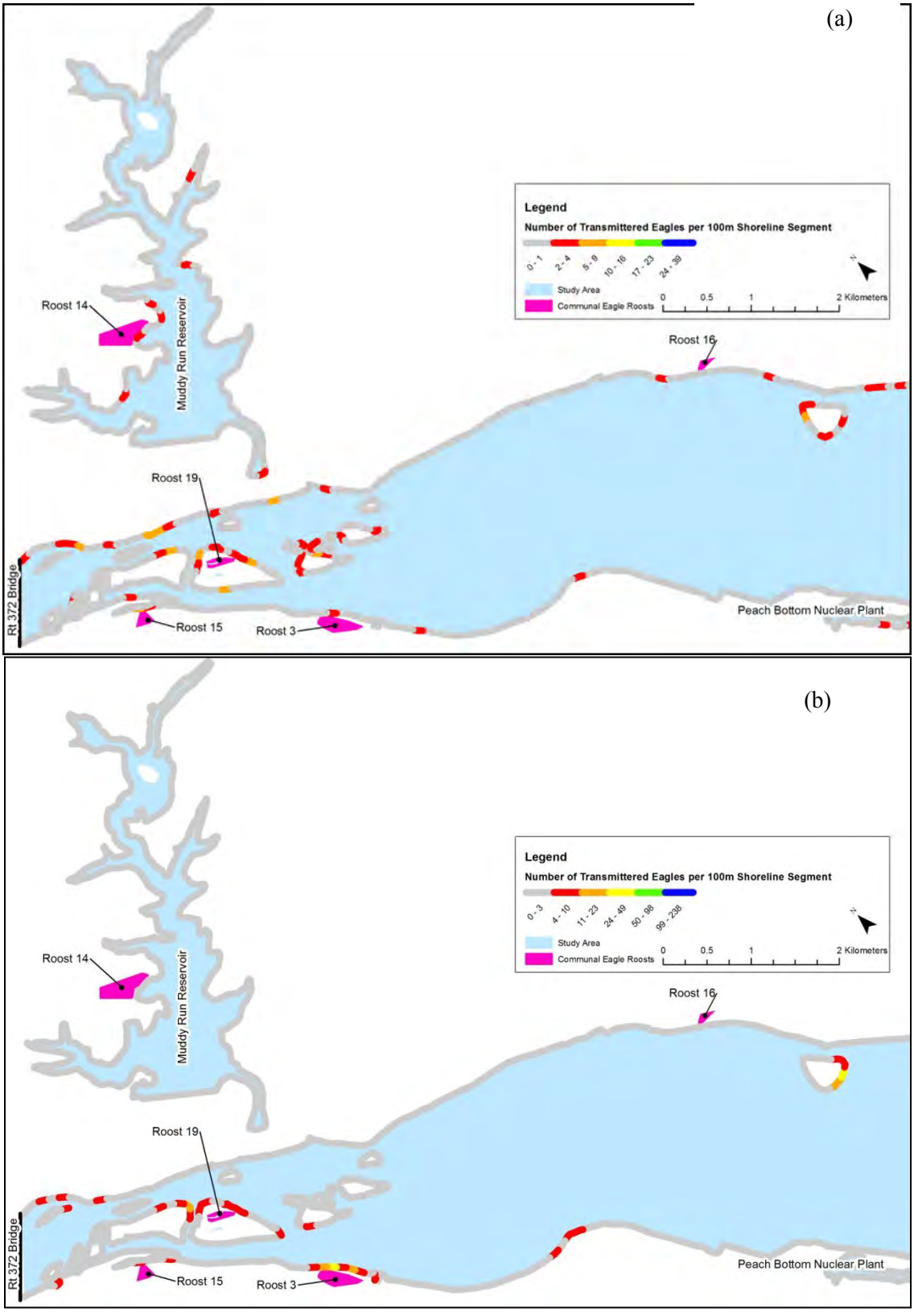


FIGURE 4.2.3-2: USE OF SHORELINE BY BALD EAGLES IN SUMMER (A) AND WINTER (B) FROM PEACH BOTTOM NUCLEAR PLANT TO ROOST 5.

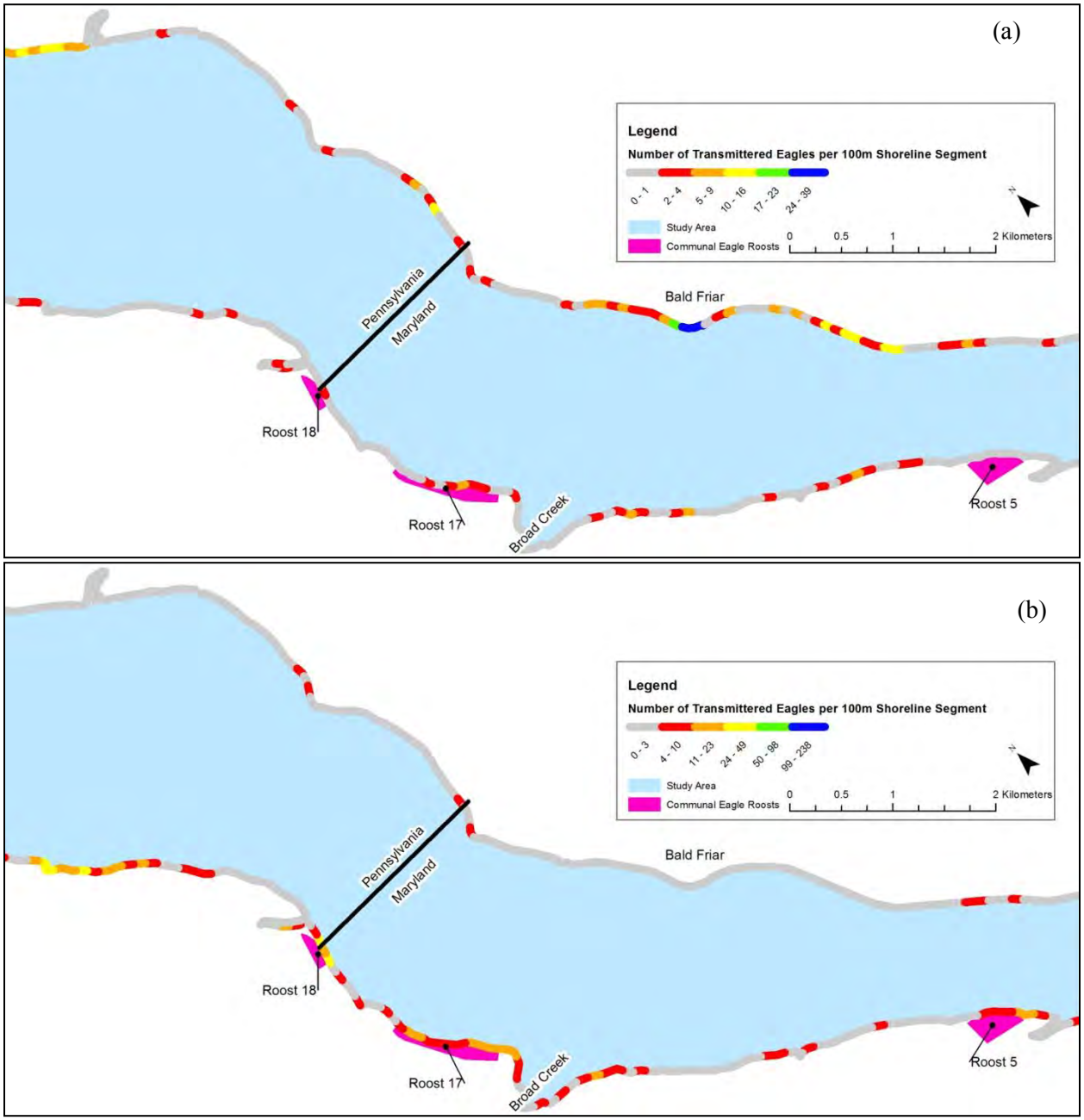


FIGURE 4.2.3-3: USE OF SHORELINE BY BALD EAGLES IN SUMMER (A) AND WINTER (B) FROM ROOST 5 TO SUSQUEHANNA STATE PARK.

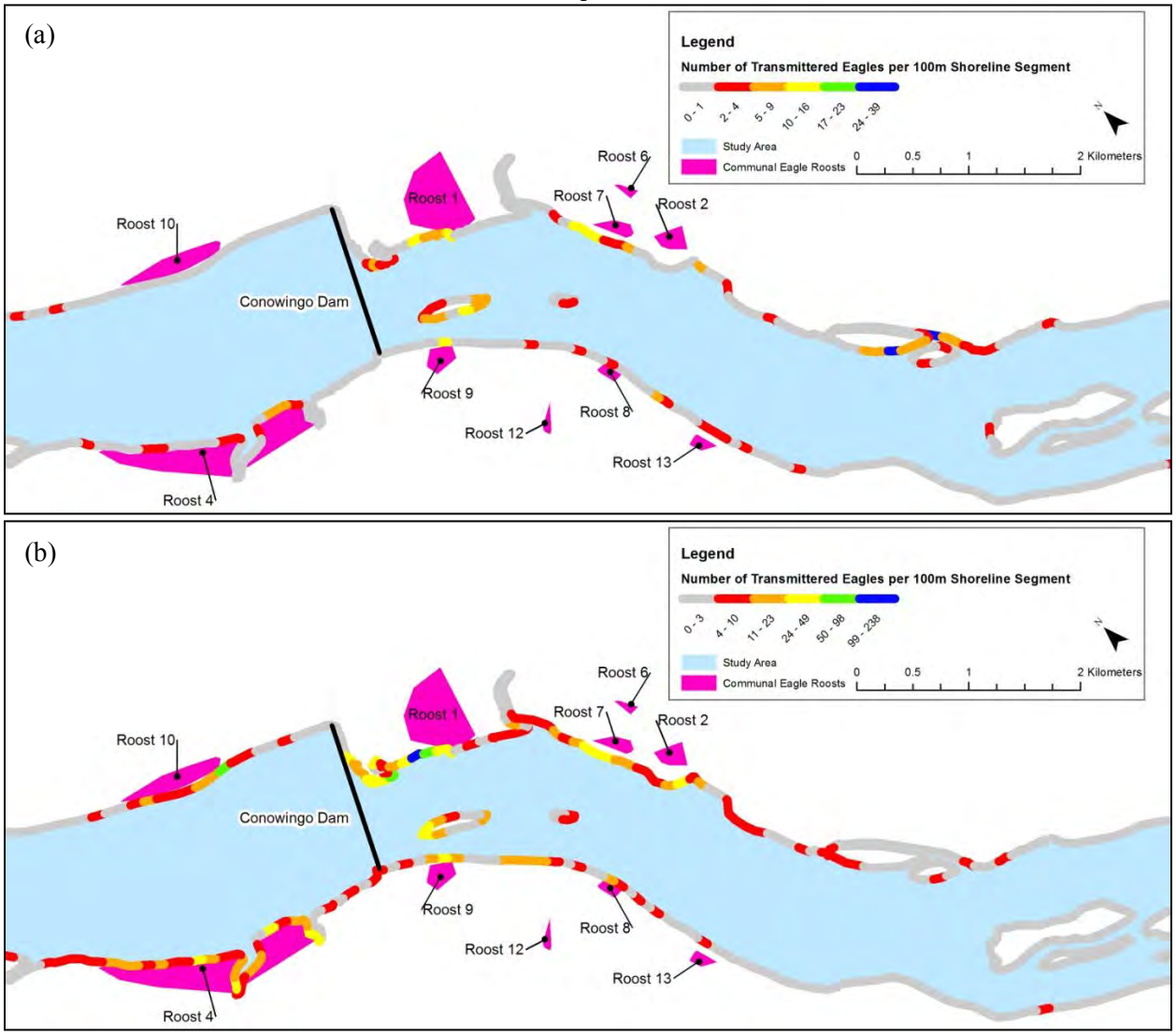
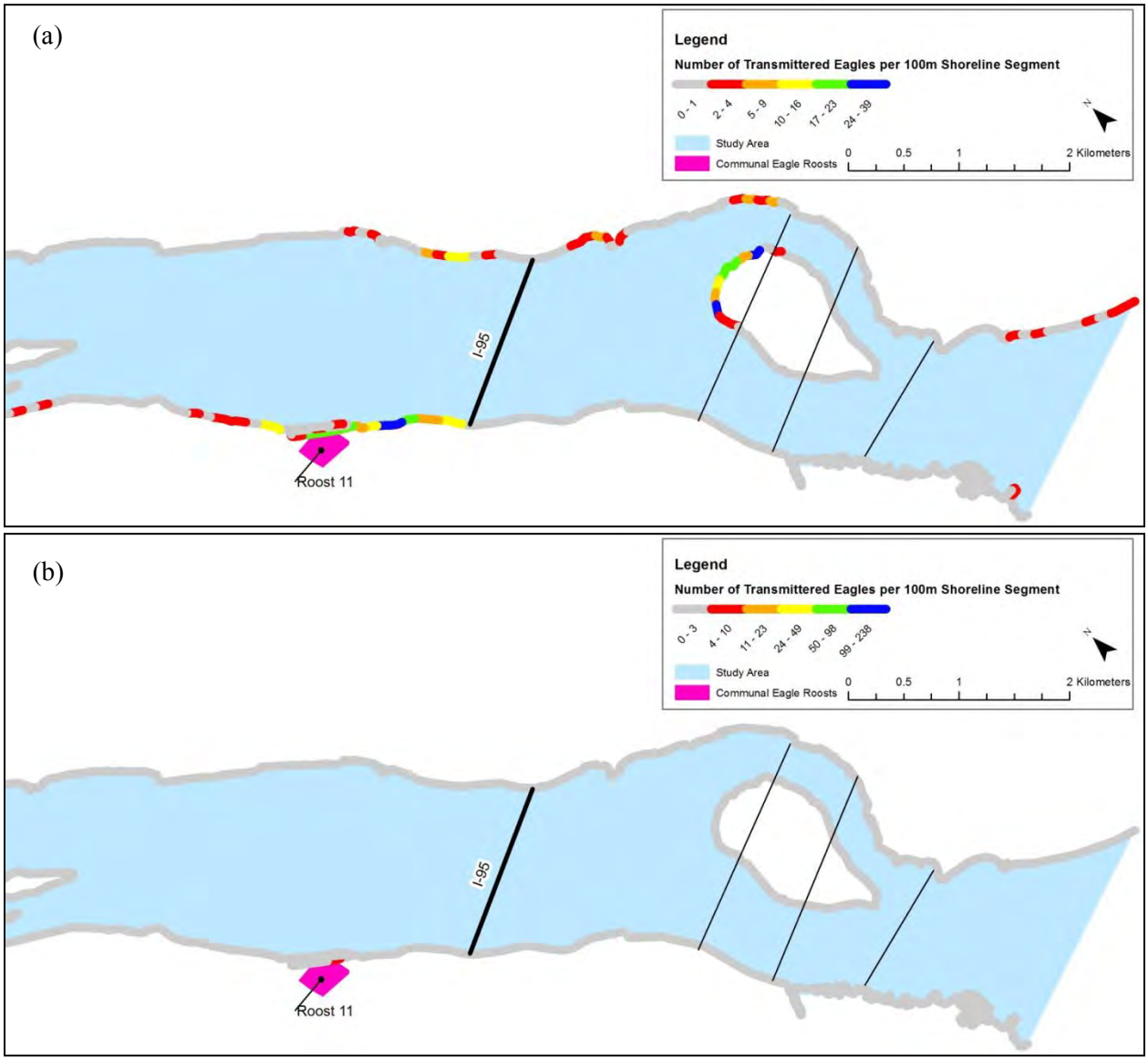


FIGURE 4.2.3-4: USE OF SHORELINE BY BALD EAGLES IN SUMMER (A) AND WINTER (B) FROM SUSQUEHANNA STATE PARK TO MOUNTH OF SUSQUEHANNA RIVER.



Photographs- Left: Adult Bald Eagle fitted with transmitter in January 2008 in Harford Co, MD. Photographed at Conowingo Dam by Robert Lin in December 2008. Bottom left: Transmission tower adjacent to roost 14 on Muddy Run Reservoir with 47 roosting Bald Eagles. Bottom right: Surveyors Beth Dzula (top) at Susquehannock State Park and Libby Mojica (bottom) at Muddy Run Reservoir.