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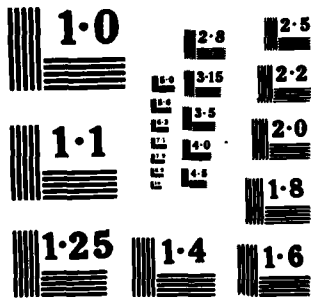
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. JD. A16	3. RECIPIENT'S CATALOG NUMBER 3225
4. TITLE (and Subtitle) BALD EAGLE FIELD INVESTIGATION, WINTER 1984-85		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Terry S. Siemsen, U.S. Army Corps of Engineers, Louisville District, and Jeffery D. Sole, Kentucky Department of Fish and Wildlife Resources		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Corps of Engineers, Louisville District P.O. Box 59 Louisville, KY 40201		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS SAME		12. REPORT DATE October 1985
		13. NUMBER OF PAGES 77
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Bald eagles Field survey techniques Feeding patterns Roosting patterns Abundance		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The population of wintering Bald eagles that center on Ballard Wildlife Management Area was studied during the winter 1984-85 as part of the Lower Ohio River Navigation Feasibility Study. The intent of the study was to determine total population, seasonal variations in abundance, feeding preferences and patterns and night roosting areas. Field techniques included driving and aerial surveys and specific efforts to survey feeding activity and food preferences.		

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

BALD EAGLE FIELD INVESTIGATION,

WINTER 1984-85

FOR THE

LOWER OHIO RIVER

NAVIGATION FEASIBILITY STUDY

TERRY S. SIEMSEN

US ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT

JEFFERY D. SOLE

KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES

OCTOBER 1985



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ACKNOWLEDGEMENTS

This second year study of the population of Bald eagles whose wintering area centers on Ballard Wildlife Management Area could not have been accomplished without the help of a large number of persons from Federal and Commonwealth of Kentucky agencies.

A number of persons from the Kentucky Department of Fish and Wildlife Resources must be recognized. Tom Young, presently Assistant Commissioner of Kentucky Department of Fish and Wildlife Resources (at the time of this effort, Manager of Ballard Wildlife Management Area), provided valuable assistance during the survey period. Vernon Anderson, District Wildlife Biologist, contributed greatly with his assistance and cooperation in our aerial surveys. John MacGregor and Sherri Evans, of the Nongame Wildlife Program provided valuable assistance in field observations. Wayne Davis and Doug Stephens of the Environmental Section provided assistance in field surveys. Dianne Ingram, Summer Aide and Eastern Kentucky University student at the time of the study, also participated and provided valuable field observations.

A number of persons from the Kentucky Nature Preserves Commission made significant contributions with their support, technical knowledge of eagles, and participation in the field surveys. A number of the staff, including Richard Hannan (Director), Brian Anderson, Lynda Andrews, Marc Evans, Brainard Palmer-Ball, and Julie Smithers participated in the field observations during some point in the study period.

Also participating in the field efforts and providing much needed support for further study effort included Douglas Winford, Mitch King, and Ted Coopwood of the US Fish and Wildlife Service, Ecological Services Office, Cookeville, Tennessee.

Last, but certainly not least, David Weyer of the US Army Corps of Engineers, Louisville District is recognized for his cooperation and assistance in the discussions of the need for a second year of study and his indulgence in allowing the absence from desk duty of one of the study principals for a number of periods during the winter 1984-85.

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
LIST OF FIGURES	v
INTRODUCTION	1
Overview of Past Eagle Surveys at Ballard Wildlife Management Area	1
Intent for the Winter 1984-85 Study	2
Overview of the Study Area	2
METHODS	4
Survey Periods	4
Survey Techniques	4
Driving Surveys	4
Aerial Surveys	5
Feeding Surveys	5
Other Field Techniques	6
Roost Counts	6
Roost Examination	6
Perch Examination	6
RESULTS	7
Driving Surveys	7
Aerial Surveys	8
Feeding Surveys	9
Other Field Techniques	10
DISCUSSION	12
General Usage Patterns	12
Patterns of Activity	13
Roosting	13
Feeding	14
Age Ratios	15
Abundance	16
SUMMARY	19
LITERATURE CITED	21
APPENDIX	22
Summary of Eagle Sightings Recorded During Driving and Aerial Surveys	22

LIST OF TABLES

	Page
TABLE 1. Total Sightings of Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded During Driving Surveys, Winter 1984-85.	7
TABLE 2. Total Sightings of Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded During Aerial Surveys, Winter 1984-85.	8
TABLE 3. Observations Recorded During Bald Eagle Feeding Surveys, Winter 1984-85.	9
TABLE 4. Roost Counts of Bald Eagles Recorded in Surveys During Winter 1984-85.	12
TABLE 5. Numbers and Percentages of Adult and Immature Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded in Surveys Conducted on Aerial Survey Dates, Winter 1984-85.	15
TABLE 6. Absolute Minimum and Potential Maximum Number of Bald Eagles Calculated for Each Driving or Aerial Survey, Winter 1984-85.	17
TABLE 7. Potential Maximum Number of Bald Eagles Calculated for Each Survey Period, Winter 1984-85.	17
TABLE 8. Estimates of Relative Abundance of Bald Eagles Based on Results of Driving Surveys, Winter 1984-85.	18

LIST OF FIGURES

	Page
FIGURE 1. Study Area Map	55
FIGURE 2. Bald Eagles Observed During Driving Survey 18 December 1984	56
FIGURE 3. Bald Eagles Observed During Driving Survey 19 December 1984	57
FIGURE 4. Bald Eagles Observed During Driving Survey 02 January 1985	58
FIGURE 5. Bald Eagles Observed During Driving Survey 22 January 1985	59
FIGURE 6. Bald Eagles Observed During Driving Survey 23 January 1985	60
FIGURE 7. Bald Eagles Observed During Driving Survey 24 January 1985	61
FIGURE 8. Bald Eagles Observed During Driving Survey 04 February 1985	62
FIGURE 9. Bald Eagles Observed During Driving Survey 05 February 1985	63
FIGURE 10. Bald Eagles Observed During Driving Survey 06 February 1985	64
FIGURE 11. Bald Eagles Observed During Driving Survey 13 February 1985	65
FIGURE 12. Bald Eagles Observed During Driving Survey 14 February 1985	66
FIGURE 13. Bald Eagles Observed During Driving Survey 15 February 1985	67
FIGURE 14. Bald Eagles Observed During Driving Survey 27 February 1985	68
FIGURE 15. Bald Eagles Observed During Driving Survey 14 March 1985	69
FIGURE 16. Bald Eagles Observed During Aerial Survey 23 January 1985	70
FIGURE 17. Bald Eagles Observed During Aerial Survey 04 February 1985	71

	<u>Page</u>
FIGURE 18. Bald Eagles Observed During Aerial Survey 14 February 1985	72
FIGURE 19. Bald Eagles Observed During Aerial Survey 27 February 1985	73
FIGURE 20. Bald Eagles Observed During Aerial Survey 14 March 1985	74
FIGURE 21. Driving Survey Composite - All Adult Bald Eagles Sighted	75
FIGURE 22. Driving Survey Composite - All Immature Bald Eagles Sighted	76
FIGURE 23. Aerial Survey Composite - All Adult and Immature Bald Eagles Sighted	77

INTRODUCTION

Overview of Past Eagle Surveys at Ballard Wildlife Management Area

Bald eagles (Haliaeetus leucocephalus) are known to use various locations in western Kentucky as wintering areas, one of which centers on the Ballard Wildlife Management Area (BWMA) and adjacent portions of the Ohio River (Eagle News 1979, 1980, 1981, 1982, 1983). The Bald eagles that use BWMA arrive in late November to early December and typically depart by mid-March. Surveys of eagles at BWMA were conducted by the staff of BWMA during the winters of 1978-79 to 1982-83. The Kentucky Nature Preserves Commission conducted the first intensive survey of eagle activity at BWMA during the winter of 1983-84 for the US Army Corps of Engineers (Anderson, Brian D., Marc Evans, and Richard R. Hannan 1984).

The 1978-79 through 1982-83 eagle surveys conducted by the staff of BWMA were generally conducted once a month during the months of December, January, and February. These surveys reported widely varied numbers of eagles, with both Bald eagles and Golden eagles (Aquila chrysaetos) being noted. These surveys did not represent a concerted effort to document the population dynamics of the wintering eagles, rather the effort identified that eagles did in fact use BWMA consistently throughout the period. The BWMA staff surveys also did not indicate whether eagles were observed only within the boundary of BWMA or if eagles were also observed using the adjacent Ohio River. BWMA staff surveys reported populations of eagles generally in the twenties with a peak observed population of 48 eagles in January 1982.

As part of planning studies for the Lower Ohio River Navigation Feasibility Study, the US Army Corps of Engineers, Louisville District contracted with the Kentucky Nature Preserves Commission to conduct an intensive survey of the population of eagles known to use BWMA during winter 1983-84. This study was deemed necessary since one of the principal alternatives under consideration was a new locks and dam facility proximal to the BWMA. This effort provided a picture of total eagle population, seasonal variations in total population, seasonal variations of age ratios within the population, roosting patterns, and feeding patterns. It was clear that a much larger population of wintering Bald eagles centered on BWMA during the winter of 1983-84 than might have been expected from earlier BWMA staff surveys. The winter 1983-84 survey also showed an obvious shift in adult to immature ratio during the course of the winter. This study also found that eagle roost dynamics at BWMA exhibited some tendency for variability during the winter season but a clear tenacity for the primary roost site was obvious.

Intent for the Winter 1984-85 Study

The results of the survey conducted during the winter 1983-84 provided the first comprehensive picture of eagle population characteristics for BWMA. After review of the findings, it was clear that a single year of effort did not provide sufficient information to allow a prediction of population characteristics that may be expected annually at BWMA. Many uncontrollable external variables can affect the wintering eagle population on BWMA in any given year. These variables include seasonal and short-term weather patterns, hunting restrictions at BWMA, and hunter success during the winter waterfowl season for the western Kentucky counties. The effect that these variables might have on eagle feeding and roosting patterns and population dynamics at BWMA during any year was considered highly speculative following a single season of data gathering.

Because the winter 1983-84 survey showed that Bald eagles used the Ohio River fishery as a major food source, concern was expressed that the data and observations of this survey would not be adequate to predict whether the construction and operation of a new locks and dam would be detrimental to this wintering population of Bald eagles because of feeding requirements. The second year of study for the winter 1984-85 was structured somewhat different. The intent of the effort reported here was to establish population dynamics and document feeding patterns and food preferences for the population. However, it was clear that fewer driving surveys would be needed to determine population dynamics. It was determined that a more intensive effort would be placed on attempts to better document the feeding patterns (food types and locations) of this wintering population.

Overview of the Study Area

BWMA is described at some length by Anderson, et al. 1984. A basic summary of conditions are provided here. Figure 1 depicts the approximate bounds of the study area, including BWMA.

The study area included BWMA, the Ohio River, and the Illinois shoreline of the Ohio River proximal to BWMA. BWMA is located in extreme western Kentucky in Ballard County. The land area included in BWMA is approximately 8000 acres of floodplain forest and cropland. BWMA has approximately 6 miles of Ohio River shoreline. BWMA is composed of river terraces that roughly parallel the Ohio River and lakes and sloughs that occupy depressions between the terraces. Many of these water bodies are managed for production of waterfowl. Elevations within the study area range from 285 feet mean sea level at Ohio River summer low water levels to about 330 feet mean sea level at the highest point on BWMA.

BWMA is characterized as a mixture of bottomland hardwood forest, swamp forest, shrub swamps, open water areas, cropland, and fallow or oldfield lands. The forest is second growth, with the forests having been subject to substantial logging in the 1950's. Few areas of mature forest exist on BWMA.

The lakes and sloughs on BWMA typically drain into Humphrey Creek which is located near the southern boundary of the area. Much of BWMA is subject to periodic inundation of floodwaters from the Ohio River, principally during the period of February through April. The Ohio River is approximately 4000 feet wide at the study area at average flow conditions.

Approximately 60 percent (about 4800 acres) of BWMA is forest. About 23 percent (about 1800 acres) is cropland with an additional 5 percent (about 400 acres) of fallow or oldfields. The remaining 12 percent (about 1000 acres not including the Ohio River) is open water.

METHODS

Survey Periods

The survey periods for the winter 1984-85 study were 3-day intervals approximately biweekly from mid-December to mid-March. The schedule allowed for the surveys to be spaced relatively even throughout the winter and provided for coverage of major weather patterns and human activity, including the January waterfowl season in Kentucky. Surveys were conducted on the following dates:

18-20 December 1984
02-04 January 1985
22-24 January 1985
04-06 February 1985
13-15 February 1985
27 February-01 March 1985
13-14 March 1985

Survey Techniques

Since a significant concern at the outset of the study was to better document eagle feeding activity, greater effort was placed on attempts to observe feeding patterns as compared to the previous years effort. The number of driving surveys to establish population estimates were limited per sample period. The data from the previous year indicated that the variation that occurred within a sample period could be accommodated and allow confidence in the population estimates from a more limited number of driving samples. Specific feeding surveys were designed to allow the greatest possibility of observations of feeding activity by highlighting known or obvious feeding locations. These observations were to provide better documentation of feeding locations, feeding times, and food-type preferences throughout the winter season.

Driving Surveys - Driving surveys were conducted in the same general manner as the driving surveys of the previous year to allow comparison of population totals and distribution within BWMA and surrounding areas, including the Ohio River (Anderson, et al. 1984). Since a number of the previous year study participants were also to be included in the winter 1984-85 surveys, a high level of confidence was expected as to the comparability of the driving survey techniques of the two years of study.

As previously noted, driving surveys allowed views of an extensive area of BWMA and the Ohio River, with only the large unbroken forested tracts not clearly visible from roadways. The previous aerial survey results indicated that the edge areas were predominantly used by the eagles at BWMA so no modifications of the

driving technique or survey routes were made to obtain better visibility of contiguous forested blocks by automobile.

Survey routes were driven at about 20-25 miles per hour with periodic stops at observation points. No set time limit was used for routes or observation points, rather time spent was related to eagle activity. Routes were run to optimize coverage of BWMA and the Ohio River as efficiently as possible. Survey start locations, start times, route designs, and route directions were selected at random to the greatest extent possible. Spotting scopes were used at observation points along the Ohio River to allow observation and identification of eagles using the river area.

Aerial Surveys - Aerial surveys were conducted during the survey of winter 1984-85. Logistics and poor weather conditions precluded flights during the first two sample periods but aerial surveys were conducted during the remaining five survey periods. These surveys were conducted in the same manner as the previous year and were again part of the bi-weekly waterfowl survey flights (Anderson, et al. 1984). These surveys were designed to provide a better estimate of total eagle population at BWMA as they were flown coincident with driving surveys. The spotters were, with the exception of one flight, the same as the previous year, thus lending a high level of confidence to the results.

The aerial surveys were designed to determine total population and adult to immature ratios. The aerial surveys allowed for better observation of forested blocks of land and borders of the Ohio River removed from the available observation points in BWMA.

Surveys by air required approximately 30-40 minutes over BWMA and adjacent portions of the Ohio River. Typical surveys were conducted with fixed-wing aircraft at an altitude of approximately 200-300 feet above ground level and an airspeed of approximately 90 miles per hour. Five to six passes were typically made over BWMA along with two passes along each shore of the Ohio River adjacent to BWMA and single pass observations of the shorelines both upstream and downstream of BWMA.

Feeding Surveys - Feeding surveys were designed to provide the greatest possibility of observations of eagle feeding activity. These surveys were conducted by locating observers in areas known or presumed to have high probability for eagle feeding activity. Depending on the number of persons available, teams of two people were stationed at these locations during periods previously observed to include the highest feeding activity.

The intent of the feeding surveys was to better document the feeding patterns and food preferences of the eagles centering on BWMA. It was not clear from the previous years efforts whether a distinct pattern of feeding activity and food preference could be

established. The feeding surveys were designed to provide additional data on a portion of eagle activity that was anticipated to be a difficult item to document.

Other Field Techniques

During this study effort, it was intended that roost sites and perches be examined to document the population's numbers and roosting patterns of eagles centering on BWMA. Roost counts are referred to in this report as efforts to observe eagles from remote locations. Roost examination refers to actual time spent in roost areas, either during daylight or evening hours. Perch examination refers to observations of feeding or loafing perches, as distinguished from locations used for night roosting.

Roost Counts - Roosts were located in manners similar to that employed in the previous years efforts (Anderson, et al. 1984). Observation of flight vectors of eagles at early morning or at dusk provided the best indication of likely locations. The number of eagles sighted during a given day was determined to be an aid in identifying whether a single or multiple roosts were in use. Roost dynamics were also of interest so sample procedures comparable to the previous year were employed.

Roost Examination - After roosts were identified, several were visited to determine characteristics of presumed favorite perch trees, observe guano stains to measure the relative amount and frequency of activity, obtain samples of regurgitated pellets, and to aid in making better estimates of eagle populations using the roosts. To minimize potential disturbance of eagles, observers at roosts that were either entered or observed at a close distance concealed themselves about an hour before the onset of dusk and departed after full darkness without the aid of lights.

Perch Examination - Feeding areas were determined to be key features of this study and examination of perches used to consume prey was included as a study objective. Key feeding areas were identified to be examined for pieces of unconsumed material.

RESULTS

The survey of the winter 1984-85 recorded a composite total of 748 Bald eagles, 3 Golden eagles, and 19 eagles that were sighted but could not be positively identified during both driving or aerial surveys. Detailed listings of the data from each of these surveys are included in the Appendix of this report. Surveys for the winter 1984-85 were influenced on occasion by adverse weather conditions (primarily snow) which reduced visibility and access. High water conditions on the Ohio River resulted in overbank flooding during portions of February and March and decreased access in BWMA because of road flooding.

Driving Surveys

Fourteen daytime driving surveys resulted in the recorded sighting of 558 of the 748 total Bald eagles sighted, all 3 of the Golden eagles observed, and the 19 eagles that were spotted but could not be positively identified. Table 1 indicates the total sightings of Bald and Golden eagles as well as eagles that could not be positively identified that were recorded for each of the driving surveys conducted.

Table 1. Total Sightings of Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded During Driving Surveys, Winter 1984-85.

SURVEY DATE	EAGLES				
	ADULT BALD	IMMATURE BALD	ADULT GOLDEN	IMMATURE GOLDEN	UNIDENTI- FIABLE
18 DEC 84 PM	10	5	0	0	2
19 DEC 84 PM	8	10	0	0	1
02 JAN 85 PM	29	22	0	0	1
22 JAN 85 PM	43	32	0	0	6
23 JAN 85 PM	28	14	0	1	1
24 JAN 85 AM	36	18	0	0	1
04 FEB 85 PM	26	26	0	0	0
05 FEB 85 AM/PM	25	30	0	0	0
06 FEB 85 AM	29	24	0	0	3
13 FEB 85 PM	26	13	0	0	0
14 FEB 85 AM/PM	27	10	0	1	0
15 FEB 85 AM	25	15	0	0	2
27 FEB 85 AM	12	11	1	0	1
14 MAR 85 AM/PM	0	4	0	0	0
Total	324	234	1	2	19

These eagles were observed during 241.6 miles of driving surveys which included a cumulative 35 hours and 14 minutes of observation. Driving surveys were conducted typically upon arrival at BWMA to characterize the patterns of the eagles at the particular point in the season and to establish approximate population numbers. As time and access allowed, additional driving surveys were conducted during a sample period. Figures 2 through 15 are maps indicating the approximate location of Bald eagles observed during each driving survey. In addition, Figures 21 and 22 are composites of all adult and all immature Bald eagles, respectively, observed during the fourteen driving surveys.

Aerial Surveys

Aerial surveys were conducted during five of the seven sample periods. No aerial survey was conducted during the 18-20 December period because of logistical problems and schedule coordination. No aerial survey was conducted during the 2-4 January period because significant snowfall precluded safe flight conditions. On the five surveys, 190 Bald eagles were observed during a total of approximately 3 hours of flight time in the vicinity of BWMA. A tabular display of these surveys is shown in Table 2.

Table 2. Total Sightings of Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded During Aerial Surveys, Winter 1984-85.

SURVEY DATE	EAGLES				
	ADULT BALD	IMMATURE BALD	ADULT GOLDEN	IMMATURE GOLDEN	UNIDENTI- FIABLE
23 JAN 85 AM/PM	36	19	0	0	0
04 FEB 85 PM	45	19	0	0	0
14 FEB 85 AM	5	17	0	0	0
27 FEB 85 AM	24	15	0	0	0
14 MAR 85 AM	9	1	0	0	0
Total	119	71	0	0	0

These surveys yielded a considerable number of eagle sightings with the exception of the 14 February and 14 March flights. The 14 February survey was conducted with a first-time pilot and was flown at a higher elevation than all other flights because of pilot preference. The increased altitude made observations and identifications considerably more difficult. The 14 March survey data represent an expected seasonal decrease in eagle population at BWMA. Figures 16 through 20 are maps indicating the approximate

location of Bald eagles observed during each aerial survey. Figure 23 is a composite of all adult and immature Bald eagles observed during all five aerial surveys.

Feeding Surveys

Feeding surveys were conducted to better understand the feeding patterns of Bald eagles that center on BWMA. These surveys were conducted on nine occasions with one to three observation groups for each date. The observations during the feeding surveys are shown in Table 3.

TABLE 3. Observations Recorded During Bald Eagle Feeding Surveys, Winter 1984-85.

SURVEY DATE	LOCATION	NUMBER OF ATTEMPTS	NUMBER OF KILLS	OBSERVATION TIME
19 DEC	OHIO RIVER	4	0	3:00
	MITCHELL LAKE	0	0	3:30
	TURNER LAKE	0	0	2:35
20 DEC	OHIO RIVER	3	0	3:00
	MITCHELL LAKE	0	0	2:05
	ROVING	2	0	3:25
03 JAN	OHIO RIVER	0	0	2:50
	MITCHELL LAKE	2	0	2:55
	TURNER LAKE	1	1	2:50
04 JAN	OHIO RIVER	0	0	1:30
	MITCHELL LAKE	0	0	1:30
	TURNER LAKE	1	0	1:30
24 JAN	OHIO RIVER	1	1	2:30
14 FEB	OHIO RIVER	2	0	1:35
27 FEB	OHIO RIVER	3	2	2:05
	MITCHELL LAKE	1	1	1:50
	BEAVER DAM LAKE	0	0	1:25
28 FEB	MITCHELL LAKE	2	1	2:25
	BEAVER DAM LAKE	0	0	1:45
13 MAR	BEAVER DAM LAKE	1	0	2:30
	MITCHELL LAKE	0	0	2:30
	MITCHELL LAKE	2	1	3:05
TOTAL		25	7	52:40

The results of these surveys were sporadic, with some surveys resulting in a number of sightings and other surveys resulting in no sightings. The surveys recorded a total of 25 attempts to take prey, with seven of the attempts successful. All of the attempts were over water with fish as the attempted food source. No observations of feeding on waterfowl or other animals were noted in the specific feeding surveys primarily because survey stations were near or at water edge. Only sporadic waterfowl carcasses were noted following hunting season and no feeding surveys were aimed to follow scavenging as no patterns could be estimated for this opportunistic form of feeding. The surveys resulted in an average of approximately one attempt to capture food during every two hours of observation.

Other Field Techniques

Roost counts were conducted on occasions when weather conditions and vehicle access permitted. It was clear that the roost tenacity observed during the winter 1983-84 (Anderson, et al. 1984) did not follow for the full winter 1984-85 survey period. The eagles observed tended to use the Round Pond roost heavily during the early winter but the number of roosts increased as winter continued. A tabular summary of the roost count for winter 1984-85 are shown in Table 4.

TABLE 4. Roost Counts of Bald Eagles Recorded in Surveys During Winter 1984-85.

SURVEY DATE	LOCATION	NUMBER OF EAGLES
22 JAN	ROUND POND	34
	TURNER LAKE	23
04 FEB	ROUND POND	35
	TURNER LAKE	7
05 FEB	ROUND POND	35
	TURNER LAKE	5
13 FEB	ROUND POND	9
	TURNER LAKE	6
	LAKE SLOUGH	4
	MUD SLOUGH	7
	EIGHTY-ACRE SLOUGH	23

It became clear by early February that more than one to two roosts were being used so additional observer locations were employed. At peak population in mid February, five distinct roosts were identified and approximate populations estimated. Because of poor access conditions, late winter roost patterns were not observed. Flight vectors of eagles were again observed and it clearly appeared that no eagles were roosting on the Illinois side of the Ohio River in the vicinity of BWMA.

Roosts were examined infrequently to reduce the potential for disturbance of eagles. The roosts were avoided until weather conditions were such that ice formed under the primary roost at Round Pond and the roost area could be entered at mid-day. Observers remained in the Round Pond roost after dark on one occasion. Observers also visited the Turner Lake and the Eighty-acre Slough roosts during both daylight and evening times. The characteristics of the roosts all followed previously reported patterns, that is, large trees with stout horizontal branches, a fairly open canopy to allow landing and takeoff, and over open (or frozen) water. Pellets were obtained on two occasions, 23 January and 5 February. The first set of pellets appeared to consist primarily of mammalian remains while the second set of pellets appeared to be primarily of avian origin.

Few trees were observed that were considered preferred perches. One tree on the Ohio River near Turner Landing had been noted as a frequent perch tree (Anderson, et al. 1984) and was again in the initial portion of the winter 84-85 survey. This tree was lost in a storm near the end of December 1984. The eagles continued to use other trees along this reach of the Ohio River but no clear preference for a single tree was observed. No dropped food was observed prior to the loss of the previously identified perch tree because high water conditions surrounded the base of this tree. Other trees near Turner and Mitchell Lakes were examined but no unconsumed food was found.

DISCUSSION

As described by others (Jonen 1973, Steenhof 1978, Sabine 1981, and Anderson et al. 1984), wintering Bald eagles roost communally at night and spend the daylight hours perching, feeding, soaring, and loafing either singly or in groups. It is assumed that readers of this report and that of the previous years' effort will draw conclusions regarding differences in population and patterns observed. Notes and observations are included in this section to provide a clearer understanding of survey conditions and other variables that likely influenced reported results.

Golden eagles were again observed at BWMA. Their occurrence could not clearly be tied to any meteorological conditions and may be best explained as occasional visitors during the winter season at BWMA.

General Usage Patterns

River edges, lakes, sloughs, and perimeters of forested tracts were the areas most heavily used by Bald eagles during daylight hours. The remaining areas within BWMA were used less intensively and were frequented usually during an eagles transit from one preferred area to another. Corrolation of aerial and driving surveys confirm this observation and verify the minimal daytime use of large, unbroken forested tracts. Several locations within BWMA were used as night roosts with usage variable during the winter season.

Daytime activity centered around the Ohio River and Mitchell, Beaverdam, and Turner Lakes. The relative number of eagles at any of these locations was influenced to a large degree by weather conditions. Cold weather in January and February caused ice formation on lakes and sloughs. Most of the lakes and sloughs were completely covered and only small open areas remained on the lakes mentioned above. The ice condition concentrated the BWMA waterfowl which also had the effect of concentrating eagles. The shoreline of the Ohio River was again consistently used with clear avoidance of riverbanks used as barge fleeting areas. Cold windy days appeared to afford fewer feeding possibilities on the Ohio River and, therefore, resulted in less eagles along the shoreline as compared to relatively calm, clear days.

The greatest concentration of Bald eagles was at night roosts, which occurred most typically at Round Pond. Other concentrations of Bald eagles occurred along portions of the Ohio River, Turner Lake, and Eighty-acre Slough. Additionally, Bald eagles were observed feeding on waterfowl carcasses that were being consumed by groups of, rather than individual, eagles. Eagles were also known to have been feeding on a deer carcass.

The characteristics of preferred perches throughout BWMA agreed with those identified by others; typically large diameter trees and snags with open branching patterns and an unobstructed view and access for landing and takeoff. Bald eagles were occasionally observed using black willows (*Salix nigra*) as perches along the Ohio River shoreline. This occurred in areas where black willows were clearly dominant or the sole tree species available.

Patterns of Activity

Survey notes were made of the particular activity of an eagle when sighted in addition to location and time of day. As noted by Anderson et al. 1984, eagles at BWMA appeared to be less active on overcast days. This was also true for days of significant precipitation, either rain or snow. Eagles appeared to be more active in mid-morning and again in mid-afternoon. Mid-day appeared to be a time for perching, loafing, or soaring if the weather conditions were favorable.

Conditions that seemed to limit loafing, perching, and/or soaring included heavy overcast, moderate to heavy rain, snow, and/or winds in excess of 15-20 miles per hour. Because these surveys did not last for extended periods of time (no more than three consecutive days for each survey), this conclusion may be based on insufficient observation. It is recognized that the need to obtain food may require Bald eagles to perch and hunt in such weather conditions and more observations may have been made if longer observation periods would have been available. It was obvious, however, that relative activity appeared depressed under the described meteorological conditions.

A consistent pattern of the observed Bald eagles at BWMA was a general congregation at or near roosts beginning about an hour before sunset. Another pattern again observed was a tendency for a few eagles to linger near the roosts during any part of the day.

Roosting

Roosts at BWMA had been identified in Anderson, et al. 1984. Significant tenacity for the Round Pond roost was again exhibited early in the winter season but this tenacity was reduced as the winter season continued. The Turner Lake and Eighty-acre Slough roosts received more use during late winter 84-85 as compared to the previous winter. Eighty-acre Slough received particularly heavy use late in the winter. Turner Lake (and a small component immediately east of Turner Lake on a backwater) was sporadically used as a night roost. Lake Slough was not confirmed as a roost site since access was limited by open water or thin ice during the winter season.

Primary roost trees were again observed at all roosts with secondary roost trees used sporadically by few eagles. Eagles were again observed landing on the backs of other eagles in attempts to displace those occupying presumed favored perch locations in the primary roost trees. This displacement behavior resulted in displaced birds moving to secondary, and apparently less preferable, perches. Primary roost trees were again noted to contain up to and on several occasions more than 25 eagles at a time. Secondary roost trees frequently contained no more than two to three eagles.

A consolidation of roosts that appeared to occur last winter failed to occur this winter; rather, the opposite, a scattering of eagles among occupied night roosts, occurred.

Chestnut Hills Nature Preserve was again examined to determine whether it was used as a night roost. This area was entered during the early afternoon so that trees in the preserve could be checked for guano and other signs of possible night roost activity. No signs of roost activity were observed. Late in the afternoon, observers were placed on the bluffs overlooking the Ohio River. These locations afforded a view not only of the Ohio River but also of the riverfront area and the primary ravine of the preserve. The observers remained until full darkness with no sightings of eagles staging or entering this area as a night roost.

Feeding

One of the primary objectives of the winter 1984-85 surveys was to better document the feeding behavior of the Bald eagles that center on BWMA. The observations of the previous winter survey indicated a clear shift in food preference from fish to waterfowl cripples and carcasses immediately following waterfowl season, presumably because of the great availability of the latter at that date. The winter 84-85 survey included specific effort to follow the expected decline in fishing following waterfowl season and the eventual return to fishing as waterfowl cripples and carcasses became scarce. This transition never occurred because of the extremely light kill of waterfowl during the January season. The data noted in Table 3 indicates a relatively continuous use of the waterbodies in and proximal to BWMA. The sightings during these surveys occurred at an average of one every two hours.

This apparent low level of feeding activity can be compared to that observed during driving surveys. Feeding or capture of food prey was noted on eight separate occasions on five surveys. A total of 19 eagles were observed feeding or taking food, including one occasion when ten eagles were observed feeding on one goose carcass. The driving surveys, therefore, yielded eight separate observations during approximately 35 hours of driving surveys or about one observation per four hours of driving survey.

It was apparent that eagle feeding activity did not vary considerably throughout the winter 1984-85. It was also apparent that attempts to observe the feeding patterns of eagles requires large blocks of time. The time devoted to these surveys was not sufficient to follow fully the feeding patterns of these eagles. A successful survey to record a significant number of feeding observations would likely require daily coverage of most feeding locations. The time devoted was sufficient to document the relatively light feeding pressure that a population of up to one hundred or more eagles may have on a given area on a given day. It is clear also that such a large population will put relatively continuous pressure on the resource base to provide sufficient food. The food available at or near BWMA would appear to be more than sufficient to support this observed population. The obvious lack of man's disturbance during feeding is possibly the primary reason that eagles continue to center on BWMA.

Age Ratios

The approximate ratio of adult to immature Bald eagles remained relatively similar throughout the winter season. The number and percentage of adult and immature Bald eagles observed during essentially simultaneous surveys are shown in Table 5.

Table 5. Numbers and Percentages of Adult and Immature Bald Eagles, Golden Eagles, and Unidentifiable Eagles Recorded in Surveys Conducted on Aerial Survey Dates, Winter 1984-85.

EAGLES					
SURVEY DATE	ADULT BALD (%)	IMMATURE BALD (%)	ADULT GOLDEN (%)	IMMATURE GOLDEN (%)	UNIDENTIFIABLE (%)
23 JAN 85					
Aerial	36 (65)	19 (35)			
Driving	28 (64)	14 (32)		1 (2)	1 (2)
04 FEB 85					
Aerial	45 (70)	19 (30)			
Driving	26 (50)	26 (50)			
14 FEB 85					
Aerial	5 (23)	17 (77)			
Driving	27 (69)	10 (25)		1 (3)	1 (3)
27 FEB 85					
Aerial	24 (62)	15 (38)			
Driving	12 (48)	11 (44)	1 (4)		1 (4)
14 MAR 85					
Aerial	9 (90)	1 (10)			
Driving		4 (100)			

The number of adult Bald eagles was generally equal to or greater than the number of immature Bald eagles during each of the driving surveys (Table 1). Results of the aerial surveys (Table 2) agree with the driving survey observations with the exception of one survey.

The data do not show a seasonal shift that appeared the previous winter (Anderson, et al. 1984). The relative age ratio of the population that centered on BWMA during the winter of 1984-85 appeared to remain stable.

Abundance

The surveys of the winter 1984-85 employed both driving and aerial surveys to provide the best estimate of total population and adult/immature ratios of Bald eagles centering on BWMA. Aerial surveys provided visual coverage of the large forested tracts not visible by driving surveys and reaches of the Ohio River not readily visible from driving survey observation points.

Because of the mobility of eagles, driving surveys had the potential for multiple observations of active individuals. In addition, simultaneous driving and aerial surveys clearly would result in a 'double-count' of individual birds.

As a correction for multiple observations during driving surveys, an absolute minimum number of eagles was calculated for each survey. This number was derived by summing the maximum number of adults and the maximum number of immatures observed at one time plus any recognizable individuals. A second figure, the potential maximum number of eagles, was also calculated for each survey. This number was calculated as the maximum number of eagles recorded less any known recounted birds. Similarly, absolute minimum and probable maximum calculations were also completed for all aerial surveys. These figures vary little as the time expended for an aerial survey was short and few recounts typically occurred. These data are shown in Table 6.

Further, the coincident driving and aerial survey results were compared for each period to develop a potential maximum number of eagles for each survey period. The field data sheets were examined to determine obvious overlapping observations and calculate a combined maximum population estimate for each survey period. For the two survey periods when no aerial survey was conducted, the potential maximum for the period was determined as the greatest potential maximum number of eagles observed during a driving survey. As noted in Table 7, the greatest number of eagles centering on BWMA was estimated to be 103 in early February. Also obvious from this table is the anticipated seasonal increase and eventual decline.

Table 6. Absolute Minimum and Potential Maximum Number of Bald Eagles Calculated for Each Driving or Aerial Survey, Winter 1984-85.

BALD EAGLES		
SURVEY DATE (*)	ABSOLUTE MINIMUM	POTENTIAL MAXIMUM
18 DEC 84 PM (D)	10	17
19 DEC 84 PM (D)	8	19
02 JAN 85 PM (D)	19	52
22 JAN 85 PM (D)	35	81
23 JAN 85 AM/PM (A)	52	55
23 JAN 85 PM (D)	32	44 (+1 IG)
24 JAN 85 AM (D)	38	51
04 FEB 85 PM (D)	41	51
04 FEB 85 PM (A)	61	64
05 FEB 85 AM/PM (D)	40	55
06 FEB 85 AM (D)	47	56
13 FEB 85 PM (D)	31	39
14 FEB 85 AM/PM (D)	23	38 (+1 IG)
14 FEB 85 AM (A)	16	22
15 FEB 85 AM (D)	28	42
27 FEB 85 AM (A)	37	39
27 FEB 85 AM (D)	17	24 (+1 AG)
14 MAR 85 AM (A)	10	10
14 MAR 85 AM/PM (D)	2	4

* SURVEY METHODS: (D) - DRIVING
(A) - AERIAL

Table 7. Potential Maximum Number of Bald Eagles Calculated for Each Survey Period, Winter 1984-85.

Survey Period	Potential Maximum Bald Eagle Population*
18-20 DEC	19
02-04 JAN	52
22-24 JAN	72 (+ 1 Golden Eagle)
04-06 FEB	103
13-15 FEB	58 (+ 1 Golden Eagle)
27 FEB-01 MAR	49 (+ 1 Golden Eagle)
13-14 MAR	11

* Calculated from coincident driving and aerial surveys when available

A further estimate of relative abundance can be measured from comparisons of the number of eagle sightings per mile driven and the number of eagle sightings per hour of driving survey. A composite calculation of eagles per mile driven per hour of driving survey was also developed. These calculations are shown in Table 8.

Table 8. Estimates of Relative Abundance of Bald Eagles Based on Results of Driving Surveys, Winter 1984-85.

SURVEY DATE	EAGLES/MI	EAGLES/HR	EAGLES/MI/HR
18 DEC 84 PM	0.80	6.77	0.36
19 DEC 84 PM	0.82	6.21	0.28
02 JAN 85 PM	1.70	18.21	0.61
22 JAN 85 PM	4.75	30.61	1.94
23 JAN 85 PM	2.66	23.12	1.46
24 JAN 85 AM	2.18	21.47	0.87
04 FEB 85 PM	3.49	22.44	1.51
05 FEB 85 AM/PM	2.72	13.04	0.65
06 FEB 85 AM	2.75	20.65	1.07
13 FEB 85 PM	3.48	23.88	2.13
14 FEB 85 AM/PM	1.62	8.77	0.38
15 FEB 85 AM	1.98	15.79	0.78
27 FEB 85 AM	1.14	6.30	0.31
14 MAR 85 AM/PM	0.38	2.09	0.20

The time expended and miles driven varied considerably over the course of the winter because of high river stages, snowfall that blocked roads and made walking to observation points necessary, and variable driving speeds during the surveys.

SUMMARY

Population Estimates

Driving and aerial survey techniques were employed to estimate daily and seasonal population and patterns of Bald eagles centering on Ballard Wildlife Management Area (BWMA) during the winter of 1984-85. Fourteen driving and five aerial surveys were conducted. The surveys were conducted approximately bi-weekly from mid-December to mid-March. Snow, ice, and high Ohio River flows occasionally limited access to points within BWMA.

A total of 748 adult and immature Bald eagles were recorded during both driving and aerial surveys. This total included 324 adult and 234 immature Bald eagles observed during driving surveys for a total of 558 Bald eagles recorded by this survey method. Additionally, 119 adult and 71 immature Bald eagles were observed during aerial surveys for a total of 190 Bald eagles recorded by this survey method. Three Golden eagles were also observed along with 19 sightings of eagles that could not be positively identified.

Total population of Bald eagles peaked in early February with an approximate population of 103 Bald eagles. The relative ratio of adults to immature Bald eagles remained similar throughout the winter season.

Night Roosts

Night roosts were variable at BWMA during the winter season. Round Pond was again a primary roost but the dominance of this roost was not as great as was apparent the previous winter. Ohio River flooding restricted access to roosts in late winter so observations for late season are not available. Roost consolidation that occurred the previous winter did not occur, instead a diffusion to alternate roosts was observed. Roosts at Turner Lake and Eighty-acre Slough were used to varying degrees throughout the winter. Chestnut Hills Nature Preserve was again examined as a potential night roost site but no sign of night roost activity was found.

Feeding Observations

The winter 1984-85 survey included specific effort to follow the expected decline in fishing following waterfowl season and the eventual return to fishing as waterfowl cripples and carcasses became scarce. Driving surveys also included observations of feeding activity.

The expected shift in feeding patterns following waterfowl hunting season did not materialize because of a significantly light kill of geese. The observations indicated that eagles made relatively continuous use of the waterbodies in and proximal to BWMA, the Ohio River and inland lakes, by fishing from shoreline perches. All observations of eagles attempting to take live prey were fishing attempts. It was clear that eagles that perched along the Ohio River and presumably were fishing avoided shoreline areas with moored barges, particularly if people were present. Few observations of scavenging on carcasses were noted during driving surveys but for those seen, numerous eagles (as many as ten at one time) were attempting to feed on individual carcasses.

Regurgitated pellets were obtained on two occasions from the Round Pond roost. Pellets gathered on 23 January appeared to consist primarily of mammalian remains while pellets obtained on 5 February appeared to be primarily of avian origin.

The food available at or near BWMA would appear to be more than sufficient to support this observed population. The obvious lack of man's disturbance during feeding is possibly the primary reason that eagles continue to center on BWMA.

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APPENDIX

**SUMMARY OF EAGLE SIGHTINGS RECORDED
DURING DRIVING AND AERIAL SURVEYS**

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 18 DECEMBER 1984

TEMP: 38 F WIND: <5 MPH CLOUD COVER: 100% O.R. ELEVATION: 301.5

PRECIP: LIGHT RAIN SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, SOLE, ANDERSON, MACGREGOR, INGRAM, S. EVANS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	2:34	37 10'55"	89 01'50"
2	AB	S	2:34	37 10'52"	89 01'55"
3	AB	P	2:35	37 10'52"	89 01'56"
4	IB	S	2:50	37 11'01"	89 03'10"
5	IB	P	2:53	37 10'25"	89 03'13"
6	AB	P	2:53	37 10'23"	89 03'12"
7	UE	P	3:47	37 09'17"	89 04'18"
8	IB	P	3:47	37 09'17"	89 04'18"
9	IB	P	3:47	37 09'17"	89 04'18"
10	UE	P	3:47	37 09'17"	89 04'18"
11	AB	P	4:02	37 08'02"	89 03'43"
12	AB	P	4:09	37 08'14"	89 03'37"
13	AB	P	4:09	37 08'15"	89 03'37"
14	AB	P	4:13	37 08'37"	89 03'22"
15	AB	P	4:13	37 08'38"	89 03'22"
16	AB	S	4:17	37 08'41"	89 03'14"
17	AB	S	4:17	37 08'42"	89 03'13"

SURVEY SUMMARY

Time: 2 Hrs. 13 Min.

Distance: 18.8 Miles

Absolute Minimum: 10

Potential Maximum: 17 (Including 2 UE)

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 19 DECEMBER 1984

TEMP: 45 F WIND: 10-15 MPH CLOUD COVER: 100% O.R. ELEVATION: 302.8

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: ANDERSON, INGRAM, S. EVANS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	1:11	37 09'32"	89 02'20"
2	AB	P	1:13	37 09'27"	89 02'57"
3	IB	S	1:30	37 08'40"	89 03'28"
4	AB	P	1:32	37 08'11"	89 03'36"
5	IB	P	1:32	37 08'13"	89 03'36"
6	IB	P	2:02	37 09'03"	89 04'27"
7	UE	S	2:24	37 11'51"	89 02'12"
8	AB	P	2:24	37 10'08"	89 04'15"
9	AB	S	3:00	37 11'09"	89 01'42"
10	IB	P	3:02	37 10'55"	89 01'50"
11	AB	S	3:04	37 10'53"	89 01'53"
12	IB	S	3:04	37 10'52"	89 01'56"
13	IB	S	3:10	37 10'48"	89 02'09"
14	IB	S	3:10	37 10'48"	89 02'10"
15	AB	S	3:10	37 10'48"	89 02'10"
16	IB	P	3:10	37 10'44"	89 02'08"
17	AB	S	3:12	37 10'49"	89 02'01"
18	IB	S	3:49	37 10'08"	89 02'45"
19	AB	P	3:51	37 09'52"	89 02'52"

SURVEY SUMMARY

Time: 2 Hrs. 54 Min.

Distance: 21.9 Miles

Absolute Minimum: 8

Potential Maximum: 19 (Including 1 UE)

3

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 02 JANUARY 1985

TEMP: 28 F WIND: 10-15 MPH CLOUD COVER: 40% O.R. ELEVATION: 315.3

PRECIP: LIGHT SNOW SNOW COVER: >1" SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, SOLE, M.EVANS, YOUNG

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	UE	S	2:17	37 09'07"	89 02'45"
2	IB	P	2:17	37 09'16"	89 02'22"
3	AB	P	2:25	37 08'27"	89 03'20"
4	AB	P	2:25	37 08'28"	89 03'22"
5	IB	P	2:25	37 08'30"	89 03'20"
6	IB	P	2:28	37 08'22"	89 03'22"
7	IB	S	2:31	37 08'35"	89 03'23"
8	AB	P	2:32	37 08'32"	89 03'24"
9	AB	P	2:34	37 08'40"	89 03'27"
10	AB	P,F	2:35	37 08'31"	89 03'37"
11	IB	S	2:36	37 08'23"	89 03'38"
12	IB	P	2:55	37 10'02"	89 02'58"
13	IB	P	2:55	37 10'06"	89 02'55"
14	AB	P,F	2:55	37 10'09"	89 02'53"
15	IB	P	2:58	37 10'26"	89 02'24"
16	IB	P,S	2:58	37 10'27"	89 02'22"
17	AB	P	3:04	37 10'47"	89 02'12"
18	AB	P	3:04	37 10'47"	89 02'12"
19	AB	P	3:04	37 10'47"	89 02'12"
20	AB	P	3:04	37 10'47"	89 02'12"
21	AB	P,F	3:04	37 10'47"	89 02'12"
22	AB	P,F	3:04	37 10'50"	89 02'12"
23	AB	P	3:04	37 10'51"	89 02'11"
24	IB	P	3:04	37 10'47"	89 02'12"
25	IB	P	3:04	37 10'47"	89 02'12"
26	IB	P	3:04	37 10'50"	89 02'12"
27	IB	P,F	3:04	37 10'50"	89 02'12"
28	IB	P	3:04	37 10'51"	89 02'11"
29	IB	P	3:04	37 10'52"	89 02'10"
30	AB	P	3:18	37 11'14"	89 01'40"
31	AB	P	3:18	37 11'14"	89 01'40"
32	IB	S	3:22	37 10'56"	89 02'15"
33	AB	P	3:40	37 09'12"	89 04'40"
34	IB	S	4:41	37 10'21"	89 02'32"
35	IB	S	4:41	37 10'21"	89 02'32"
36	IB	P	4:44	37 10'47"	89 02'12"
37	IB	P	4:44	37 10'47"	89 02'12"
38	IB	P	4:44	37 10'50"	89 02'12"
39	IB	P	4:44	37 10'50"	89 02'11"
40	AB	P	4:44	37 10'50"	89 02'11"

41	AB	P	4:44	37 10'47"	89 02'12"
42	AB	P	4:44	37 10'47"	89 02'12"
43	AB	P	4:44	37 10'47"	89 02'12"
44	AB	P	4:44	37 10'48"	89 02'12"
45	AB	P	4:44	37 10'48"	89 02'12"
46	AB	P	4:44	37 10'50"	89 02'11"
47	AB	P	4:44	37 10'50"	89 02'11"
48	AB	P	4:44	37 10'50"	89 02'11"
49	AB	P	4:44	37 10'50"	89 02'11"
50	AB	P	4:44	37 10'50"	89 02'10"
51	AB	P	4:44	37 10'51"	89 02'09"
52	AB	P	4:44	37 10'51"	89 02'09"

SURVEY SUMMARY

Time: 2 Hrs. 48 Min.
Distance: 30.0 Miles

Absolute Minimum: 19
Potential Maximum: 52 (Including 1 UE)

1984-85 EAGLE SURVEY
 LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 22 JANUARY 1985

TEMP: 30 F WIND: 0-5 MPH CLOUD COVER: 0% O.R. ELEVATION: 295.2

PRECIP: NONE SNOW COVER: 2" MIN SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, SOLE, S.EVANS, ANDREWS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	2:32	37 09'46"	89 02'11"
2	AB	P,S	2:35	37 09'50"	89 02'26"
3	AB	P,S	2:36	37 09'44"	89 02'27"
4	AB	S	2:37	37 09'40"	89 02'26"
5	IB	P	2:37	37 09'17"	89 02'19"
6	AB	P	2:37	37 09'17"	89 02'19"
7	AB	P	2:38	37 09'25"	89 02'21"
8	AB	P	2:42	37 09'10"	89 02'33"
9	IB	P	2:43	37 09'11"	89 02'29"
10	AB	S	2:46	37 09'21"	89 02'45"
11	AB	S	2:46	37 09'21"	89 02'45"
12	AB	S	2:46	37 09'21"	89 02'45"
13	AB	S	2:46	37 09'21"	89 02'45"
14	AB	P	2:47	37 08'51"	89 03'05"
15	AB	P	2:47	37 08'51"	89 03'05"
16	AB	P	2:50	37 09'36"	89 02'05"
17	AB	P	2:50	37 09'36"	89 02'05"
18	IB	S	2:56	37 08'52"	89 02'37"
19	UE	S	2:56	37 08'42"	89 03'11"
20	UE	S	2:56	37 08'42"	89 03'11"
21	AB	S	2:57	37 08'57"	89 02'57"
22	IB	S	2:57	37 08'57"	89 02'57"
23	IB	P	2:58	37 08'36"	89 02'57"
24	IB	S	2:58	37 08'35"	89 02'56"
25	IB	S	2:58	37 08'35"	89 02'56"
26	AB	P	2:58	37 08'36"	89 02'57"
27	AB	S	2:58	37 08'35"	89 02'56"
28	AB	P	3:00	37 08'25"	89 02'57"
29	AB	P	3:05	37 08'36"	89 03'19"
30	AB	P	3:05	37 08'36"	89 03'19"
31	AB	P	3:05	37 08'36"	89 03'19"
32	UE	P	3:05	37 08'36"	89 03'19"
33	IB	P	3:08	37 08'40"	89 03'17"
34	IB	P	3:08	37 08'40"	89 03'17"
35	AB	P	3:09	37 08'34"	89 03'19"
36	AB	P	3:09	37 08'35"	89 03'19"
37	IB	P	3:09	37 08'35"	89 03'20"
38	IB	P	3:09	37 08'35"	89 03'20"
39	IB	P	3:09	37 08'20"	89 03'11"
40	IB	S	3:09	37 08'20"	89 03'11"

41	AB	P	3:10	37 08'18"	89 02'57"
42	IB	P	3:10	37 08'18"	89 02'57"
43	IB	P	3:10	37 08'18"	89 02'57"
44	AB	S	3:14	37 08'06"	89 03'16"
45	IB	P	3:14	37 08'05"	89 03'15"
46	AB	P	3:14	37 08'05"	89 03'15"
47	IB	P	3:15	37 08'19"	89 03'33"
48	IB	P	3:15	37 08'19"	89 03'33"
49	IB	P	3:15	37 08'19"	89 03'33"
50	AB	P	3:16	37 08'24"	89 03'32"
51	AB	P	3:16	37 08'24"	89 03'32"
52	IB	P	3:16	37 08'24"	89 03'32"
53	IB	P,F	3:19	37 08'18"	89 03'21"
54	IB	P,F	3:19	37 08'18"	89 03'21"
55	IB	P,F	3:19	37 08'18"	89 03'21"
56	IB	P,F	3:19	37 08'18"	89 03'21"
57	IB	P,F	3:19	37 08'18"	89 03'21"
58	IB	P,F	3:19	37 08'18"	89 03'21"
59	AB	P,F	3:19	37 08'18"	89 03'21"
60	AB	P,F	3:19	37 08'18"	89 03'21"
61	AB	P,F	3:19	37 08'18"	89 03'21"
62	AB	P,F	3:19	37 08'18"	89 03'21"
63	UE	S	3:25	37 08'52"	89 03'13"
64	AB	P	3:27	37 08'21"	89 03'02"
65	IB	P	3:27	37 08'21"	89 03'02"
66	AB	P	3:27	37 08'21"	89 03'02"
67	IB	P	3:27	37 08'21"	89 03'02"
68	AB	P,S	3:35	37 08'33"	89 03'16"
69	UE	S	3:41	37 08'05"	89 03'44"
70	AB	P	3:42	37 08'08"	89 03'51"
71	AB	P	3:42	37 08'08"	89 03'51"
72	AB	S	4:05	37 08'24"	89 05'17"
73	AB	S	4:05	37 08'24"	89 05'17"
74	AB	P	4:11	37 09'15"	89 04'40"
75	IB	P	4:13	37 09'05"	89 04'02"
76	IB	P	4:13	37 09'05"	89 04'02"
77	AB	P	4:13	37 09'05"	89 04'02"
78	AB	P,F	4:30	37 10'24"	89 03'46"
79	IB	S	4:45	37 11'22"	89 02'05"
80	AB	S	4:45	37 11'27"	89 01'43"
81	UE	S	4:48	37 11'22"	89 01'23"

SURVEY SUMMARY

Time: 2 Hrs. 27 Min.

Distance: 15.8 Miles

Absolute Minimum: 35

Potential Maximum: 81 (Including 6 UE)

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 23 JANUARY 1985

TEMP: 31 F WIND: 5-10 MPH CLOUD COVER: 80% O.R. ELEVATION: 295.5

PRECIP: NONE SNOW COVER: 2" MIN SURV METHOD: AERIAL

OBSERVERS: J.D. SOLE

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	11:42	37 12'04"	89 01'22"
2	AB	P	11:42	37 12'00"	89 01'23"
3	AB	P	11:43	37 11'54"	89 01'36"
4	AB	P	11:43	37 11'54"	89 01'36"
5	AB	P	11:43	37 11'54"	89 01'36"
6	IB	P	11:43	37 11'54"	89 01'36"
7	AB	P	11:44	37 11'48"	89 01'46"
8	AB	P	11:44	37 11'48"	89 01'46"
9	AB	P	11:44	37 11'38"	89 02'03"
10	AB	P	11:46	37 10'20"	89 03'45"
11	AB	P	11:46	37 10'21"	89 03'56"
12	AB	P	11:46	37 10'21"	89 03'56"
13	IB	S	11:46	37 10'10"	89 03'46"
14	AB	P	11:47	37 08'50"	89 05'15"
15	AB	P	11:47	37 08'50"	89 05'15"
16	AB	P,S	11:47	37 08'50"	89 05'15"
17	IB	P,S	11:47	37 08'50"	89 05'15"
18	IB	P	11:48	37 08'20"	89 05'23"
19	AB	P	11:49	37 07'19"	89 05'52"
20	AB	P	11:49	37 07'10"	89 06'04"
21	AB	P	11:50	37 06'55"	89 06'16"
22	IB	P	11:50	37 10'46"	89 02'15"
23	AB	P	11:50	37 10'04"	89 02'58"
24	AB	S	11:59	37 09'52"	89 03'08"
25	IB	P	12:01	37 08'26"	89 03'25"
26	IB	P	12:07	37 11'07"	89 00'38"
27	AB	S	12:08	37 10'06"	89 01'54"
28	AB	P	12:09	37 08'44"	89 02'53"
29	IB	P	12:09	37 08'44"	89 02'53"
30	IB	P	12:09	37 08'44"	89 02'53"
31	AB	P	12:11	37 10'12"	89 02'51"
32	AB	P	12:12	37 11'32"	89 01'12"
33	IB	P	12:15	37 08'23"	89 02'27"
34	AB	P	12:18	37 08'29"	89 03'42"
35	AB	P	12:18	37 08'29"	89 03'42"
36	IB	P	12:18	37 08'29"	89 03'42"
37	IB	P	12:18	37 08'29"	89 03'42"
38	IB	P	12:18	37 08'29"	89 03'42"

39	IB	P	12:18	37 08'29"	89 03'42"
40	IB	P	12:18	37 08'29"	89 03'42"
41	AB	P	12:26	37 12'25"	89 02'10"
42	AB	P	12:26	37 12'25"	89 02'10"
43	AB	P	12:26	37 12'25"	89 02'10"
44	IB	P	12:26	37 12'25"	89 02'10"
45	AB	P	12:28	37 11'57"	89 02'42"
46	AB	P	12:28	37 11'57"	89 02'42"
47	AB	P	12:28	37 11'57"	89 02'42"
48	AB	P	12:28	37 11'57"	89 02'42"
49	AB	P	12:28	37 11'57"	89 02'42"
50	IB	P	12:28	37 11'57"	89 02'42"
51	AB	P	12:29	37 11'46"	89 02'56"
52	AB	P	12:29	37 11'46"	89 02'56"
53	IB	P	12:30	37 10'14"	89 04'57"
54	IB	P	12:30	37 09'58"	89 05'15"
55	AB	P	12:31	37 08'59"	89 05'54"

SURVEY SUMMARY

Absolute Minimum: 52
Potential Maximum: 55

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 23 JANUARY 1985

TEMP: 35 F WIND: 15-20 MPH CLOUD COVER: 10% O.R. ELEVATION: 295.5

PRECIP: NONE SNOW COVER: 1.5"+ SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, DAVIS, S. EVANS, ANDREWS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	S	1:55	37 09'36"	89 02'00"
2	IB	P	2:02	37 09'20"	89 02'20"
3	IB	P	2:10	37 09'12"	89 02'32"
4	IB	S	2:10	37 09'12"	89 02'32"
5	AB	P	2:10	37 09'12"	89 02'32"
6	AB	P	2:17	37 08'30"	89 02'43"
7	AB	P	2:22	37 08'15"	89 03'18"
8	AB	P	2:29	37 08'41"	89 03'19"
9	IB	P	2:30	37 08'33"	89 03'23"
10	IB	P	2:30	37 08'33"	89 03'23"
11	IB	P	2:33	37 08'24"	89 03'24"
12	IB	P	2:33	37 08'24"	89 03'24"
13	AB	P	2:35	37 08'20"	89 03'00"
14	AB	P,S	2:35	37 08'21"	89 03'01"
15	IB	P,S	2:35	37 08'21"	89 03'01"
16	IB	S	2:48	37 08'08"	89 04'56"
17	AB	S	2:49	37 08'15"	89 05'27"
18	AB	S	2:49	37 08'15"	89 05'27"
19	UE	P	2:56	37 08'44"	89 06'02"
20	AB	P	3:10	37 09'05"	89 04'03"
21	AB	P	3:10	37 09'05"	89 04'03"
22	IB	S	3:10	37 08'53"	89 04'02"
23	IG	S	3:10	37 08'53"	89 04'02"
24	AB	P	3:16	37 10'04"	89 04'23"
25	IB	S	3:24	37 09'52"	89 03'33"
26	AB	P	3:26	37 09'44"	89 03'03"
27	AB	P	3:32	37 10'02"	89 03'02"
28	AB	P	3:32	37 10'02"	89 03'02"
29	AB	P	3:32	37 10'02"	89 03'02"
30	AB	P	3:32	37 10'02"	89 03'02"
31	AB	P	3:32	37 10'00"	89 03'00"
32	AB	P	3:32	37 10'00"	89 03'00"
33	AB	P	3:32	37 10'04"	89 02'59"
34	AB	P	3:32	37 10'04"	89 02'59"
35	AB	P	3:32	37 10'04"	89 02'59"
36	AB	P	3:33	37 10'07"	89 02'43"
37	AB	P	3:35	37 10'20"	89 02'36"
38	IB	P	3:39	37 10'38"	89 02'23"
39	IB	P	3:39	37 10'40"	89 02'22"
40	AB	P	3:39	37 10'40"	89 02'22"

41	AB	P	3:39	37 10'45"	89 02'18"
42	AB	P	3:39	37 10'46"	89 02'16"
43	AB	P	3:39	37 10'46"	89 02'16"
44	AB	P	3:39	37 10'48"	89 02'15"

SURVEY SUMMARY

Time: 1 Hr. 49 Min.
 Distance: 15.8 Miles

Absolute Minimum: 32
 Potential Maximum: 44 (Including 1 UE and 1 IG)

1984-85 EAGLE SURVEY
 LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 24 JANUARY 1985

TEMP: 25 F WIND: 15-20 MPH CLOUD COVER: 100% O.R. ELEVATION: 295.0

PRECIP: NONE SNOW COVER: 1.5"+ SURV METHOD: DRIVING

OBSERVERS: SOLE, ANDREWS, DAVIS, S. EVANS, SIEMSEN

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P,S	8:45	37 12'03"	89 02'40"
2	AB	S	8:56	37 11'18"	89 01'44"
3	AB	S	9:00	37 11'07"	89 03'45"
4	IB	S	9:02	37 11'05"	89 03'46"
5	UE	S	9:04	37 11'06"	89 02'54"
6	IB	S	9:04	37 09'48"	89 01'44"
7	AB	P	9:06	37 09'48"	89 02'03"
8	AB	P	9:06	37 09'37"	89 02'05"
9	AB	P	9:09	37 09'27"	89 02'31"
10	IB	S	9:17	37 08'41"	89 02'54"
11	IB	P	9:19	37 08'40"	89 03'02"
12	AB	P	9:19	37 08'25"	89 02'57"
13	AB	P	9:19	37 08'25"	89 02'57"
14	IB	P	9:19	37 08'25"	89 02'57"
15	IB	S	9:19	37 08'36"	89 02'53"
16	AB	P	9:21	37 08'49"	89 03'00"
17	AB	S	9:22	37 09'03"	89 03'12"
18	AB	P	9:22	37 08'40"	89 03'11"
19	AB	P	9:25	37 08'21"	89 03'14"
20	AB	P	9:25	37 10'36"	89 04'29"
21	AB	P	9:25	37 10'32"	89 04'34"
22	AB	P	9:26	37 11'27"	89 03'22"
23	IB	P	9:29	37 09'58"	89 05'13"
24	AB	P	9:31	37 09'42"	89 05'29"
25	AB	P	9:32	37 09'34"	89 05'34"
26	AB	P	9:38	37 08'38"	89 03'31"
27	AB	P	9:38	37 08'38"	89 03'31"
28	IB	P	9:38	37 08'38"	89 03'31"
29	IB	P	9:38	37 08'38"	89 03'31"
30	IB	P,S	9:38	37 08'38"	89 03'31"
31	IB	P,S	9:38	37 08'38"	89 03'31"
32	AB	P	9:39	37 08'18"	89 03'34"
33	AB	P	9:39	37 08'25"	89 03'35"
34	IB	S	9:41	37 08'10"	89 03'23"
35	IB	S	9:41	37 08'10"	89 03'23"
36	AB	S	9:44	37 08'12"	89 03'49"
37	IB	S	9:44	37 08'12"	89 02'49"
38	AB	S	9:50	37 11'08"	89 03'23"
39	AB	P,S	9:56	37 08'02"	89 05'25"
40	AB	P	10:05	37 08'54"	89 05'56"

41	AB	P	10:12	37 09'44"	89 05'27"
42	IB	P	10:21	37 09'28"	89 04'48"
43	IB	P	10:21	37 09'35"	89 04'50"
44	AB	P	10:36	37 10'00"	89 03'01"
45	AB	P, S	10:36	37 10'00"	89 03'01"
46	AB	P	10:36	37 10'00"	89 03'01"
47	AB	P	10:36	37 10'00"	89 03'01"
48	IB	P	10:36	37 10'00"	89 03'01"
49	IB	P	10:43	37 10'43"	89 02'22"
50	AB	P	10:45	37 10'17"	89 02'19"
51	AB	P	10:45	37 08'25"	89 06'09"
52	AB	S	10:47	37 10'29"	89 01'49"
53	AB	P	10:47	37 08'45"	89 06'01"
54	AB	P	10:47	37 08'45"	89 06'01"
55	AB	P	11:13	37 09'56"	89 04'32"

SURVEY SUMMARY

Time: 2 Hr. 31 Min.
Distance: 24.7 Miles

Absolute Minimum: 38
Potential Maximum: 51 (Including 1 UE)

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 04 FEBRUARY 1985

TEMP: 34 F WIND: 5-10 MPH CLOUD COVER: 20% O.R. ELEVATION: 300.2

PRECIP: NONE SNOW COVER: 6" SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, STEPHENS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	2:49	37 09'18"	89 02'22"
2	IB	P	2:52	37 09'08"	89 02'29"
3	IB	P	3:34	37 08'32"	89 03'20"
4	AB	P	3:38	37 09'19"	89 03'24"
5	IB	P	3:38	37 08'19"	89 03'24"
6	IB	P	3:38	37 08'19"	89 03'24"
7	IB	P	3:38	37 08'19"	89 03'24"
8	IB	P	3:38	37 08'19"	89 03'24"
9	IB	P	3:38	37 08'19"	89 03'24"
10	IB	P	3:38	37 08'19"	89 03'24"
11	IB	P	3:38	37 08'19"	89 03'24"
12	AB	P	3:40	37 08'06"	89 03'22"
13	IB	P	3:42	37 08'07"	89 03'32"
14	AB	P	3:43	37 08'20"	89 03'30"
15	IB	P	3:43	37 08'20"	89 03'30"
16	IB	P	3:43	37 08'29"	89 03'32"
17	IB	P	3:43	37 08'29"	89 03'32"
18	IB	P	3:43	37 08'29"	89 03'32"
19	AB	P	3:43	37 08'35"	89 03'31"
20	IB	P	3:46	37 07'56"	89 03'34"
21	IB	P	3:48	37 08'04"	89 03'46"
22	AB	P	4:02	37 09'04"	89 04'02"
23	IB	P	4:02	37 09'04"	89 04'02"
24	IB	S	4:03	37 08'56"	89 04'10"
25	IB	S	4:03	37 08'56"	89 04'10"
26	AB	P	4:08	37 09'21"	89 04'53"
27	AB	P	4:08	37 09'16"	89 04'56"
28	AB	P	4:11	37 09'43"	89 04'37"
29	AB	P	4:12	37 09'55"	89 04'25"
30	AB	P	4:12	37 09'55"	89 04'25"
31	AB	P	4:15	37 10'21"	89 03'50"
32	AB	P	4:15	37 10'21"	89 03'50"
33	AB	P	4:15	37 10'21"	89 03'50"
34	AB	P	4:15	37 10'21"	89 03'50"
35	IB	P	4:17	37 10'07"	89 04'17"
36	IB	P	4:18	37 10'15"	89 04'00"
37	AB	P	4:20	37 10'48"	89 04'15"
38	AB	P	4:21	37 10'50"	89 03'37"
39	IB	P	4:21	37 10'50"	89 03'37"
40	AB	P	4:22	37 10'31"	89 03'37"

41	AB	P	4:22	37 10'31"	89 03'37"
42	IB	P	4:22	37 10'31"	89 03'37"
43	AB	P	4:24	37 10'36"	89 03'31"
44	AB	P	4:24	37 10'36"	89 03'31"
45	AB	P	4:35	37 10'05"	89 02'58"
46	AB	P	4:35	37 10'05"	89 02'58"
47	IB	P	4:35	37 10'05"	89 02'58"
48	AB	S	4:35	37 10'07"	89 02'52"
49	IB	P	4:36	37 10'12"	89 02'51"
50	AB	P	4:41	37 10'47"	89 02'17"
51	AB	P	4:41	37 10'47"	89 02'17"
52	AB	P	4:41	37 10'47"	89 02'17"

SURVEY SUMMARY

Time: 2 Hrs. 19 Min.
Distance: 14.9 Miles

Absolute Minimum: 41
Potential Maximum: 52

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 04 FEBRUARY 1985

TEMP: 34 F WIND: 5-10 MPH CLOUD COVER: 20% O.R. ELEVATION: 300.2

PRECIP: NONE SNOW COVER: 6" SURV METHOD: AERIAL

OBSERVERS: MACGREGOR, V. ANDERSON

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	1:40	37 12'25"	89 00'50"
2	AB	P	1:40	37 12'24"	89 00'51"
3	AB	P	1:40	37 12'24"	89 00'52"
4	AB	P	1:40	37 12'22"	89 00'54"
5	AB	P	1:41	37 12'22"	89 00'54"
6	AB	P	1:41	37 12'21"	89 00'55"
7	AB	P	1:41	37 12'20"	89 00'55"
8	AB	P	1:41	37 12'18"	89 01'01"
9	AB	P	1:41	37 12'18"	89 01'01"
10	AB	P	1:42	37 12'16"	89 01'02"
11	AB	P	1:42	37 12'16"	89 01'02"
12	AB	P	1:43	37 12'14"	89 01'05"
13	AB	P	1:43	37 12'14"	89 01'05"
14	AB	P	1:44	37 12'13"	89 01'06"
15	AB	P	1:44	37 12'13"	89 01'08"
16	IB	P	1:44	37 12'12"	89 01'09"
17	AB	P	1:45	37 12'12"	89 01'10"
18	AB	P	1:45	37 12'12"	89 01'10"
19	AB	P	1:45	37 12'10"	89 01'12"
20	AB	P	1:45	37 12'10"	89 01'13"
21	AB	P	1:46	37 12'00"	89 01'27"
22	IB	P	1:46	37 11'28"	89 02'12"
23	IB	P	1:46	37 11'25"	89 02'22"
24	AB	P	1:46	37 11'26"	89 02'35"
25	AB	P	1:46	37 11'16"	89 02'40"
26	AB	P	1:47	37 11'06"	89 02'50"
27	IB	P	1:47	37 11'04"	89 02'55"
28	AB	P	1:47	37 11'00"	89 03'01"
29	AB	P	1:47	37 10'51"	89 03'07"
30	IB	P	1:47	37 10'49"	89 03'13"
31	AB	P	1:47	37 10'45"	89 03'16"
32	IB	P	1:47	37 10'45"	89 03'22"
33	IB	P	1:47	37 10'45"	89 03'22"
34	AB	P	1:47	37 10'44"	89 03'22"
35	IB	P	1:47	37 10'37"	89 03'27"
36	AB	P	1:47	37 10'37"	89 03'27"
37	IB	P	1:48	37 09'58"	89 04'28"
38	AB	P	1:48	37 09'38"	89 04'38"
39	IB	P	1:49	37 08'29"	89 05'20"
40	AB	P	1:49	37 08'22"	89 05'22"

41	AB	P	1:49	37 08'09"	89 05'22"
42	AB	P	1:49	37 08'04"	89 05'29"
43	IB	P	1:50	37 07'14"	89 05'58"
44	IB	P	1:50	37 07'01"	89 06'07"
45	IB	P	1:50	37 07'01"	89 06'07"
46	AB	P	1:50	37 06'57"	89 06'12"
47	AB	P	1:50	37 06'57"	89 06'12"
48	IB	P	1:51	37 06'52"	89 06'14"
49	IB	P	1:51	37 06'51"	89 06'15"
50	AB	P	1:51	37 06'48"	89 06'19"
51	IB	S	1:51	37 06'38"	89 06'25"
52	AB	S	1:51	37 06'38"	89 06'25"
53	IB	P	2:04	37 08'54"	89 04'49"
54	AB	P	2:06	37 10'47"	89 02'19"
55	AB	P	2:07	37 11'37"	89 01'26"
56	AB	P	2:08	37 12'35"	89 02'05"
57	IB	S	2:09	37 07'57"	89 02'56"
58	AB	P	2:15	37 07'25"	89 06'11"
59	AB	P	2:17	37 11'20"	89 03'30"
60	AB	P	2:17	37 11'29"	89 03'20"
61	AB	P	2:17	37 11'37"	89 03'09"
62	IB	P	2:17	37 11'56"	89 02'49"
63	AB	P	2:20	37 09'06"	89 04'56"
64	AB	P	2:20	37 09'00"	89 05'01"

SURVEY SUMMARY

Absolute Minimum: 61
 Potential Maximum: 64

1984-85 EAGLE SURVEY
 LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 05 FEBRUARY 1985

TEMP: 29 F WIND: 5 MPH CLOUD COVER: 100% O.R. ELEVATION: 302.0

PRECIP: NONE SNOW COVER: 3" SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, STEPHENS, MACGREGOR, HANNAN, SMITHERS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	S	8:15	37 11'01"	89 02'16"
2	IB	P	8:27	37 11'19"	89 03'54"
3	AB	P	8:28	37 10'21"	89 03'52"
4	IB	P	8:28	37 10'21"	89 03'52"
5	IB	S	8:29	37 10'12"	89 04'13"
6	IB	P	8:30	37 10'16"	89 04'04"
7	IB	P	8:30	37 10'16"	89 04'04"
8	AB	P,S	8:54	37 09'51"	89 04'36"
9	IB	P	9:00	37 09'47"	89 04'40"
10	AB	P,S	9:15	37 09'43"	89 04'48"
11	AB	S	9:18	37 09'50"	89 05'05"
12	IB	S	9:18	37 09'50"	89 05'05"
13	AB	P	9:22	37 09'43"	89 05'27"
14	IB	P	9:22	37 09'43"	89 05'27"
15	IB	P	9:27	37 09'43"	89 05'27"
16	IB	P	9:34	37 09'04"	89 05'07"
17	IB	P	9:40	37 09'08"	89 04'03"
18	IB	S	10:00	37 08'19"	89 05'19"
19	IB	S	10:00	37 08'19"	89 05'19"
20	IB	S	10:00	37 08'19"	89 05'19"
21	IB	P	10:05	37 08'05"	89 05'29"
22	AB	P	10:10	37 09'08"	89 05'48"
23	AB	P	10:10	37 09'08"	89 05'48"
24	AB	P	10:10	37 08'51"	89 05'57"
25	AB	P	10:15	37 08'16"	89 06'13"
26	AB	P	10:15	37 08'16"	89 06'13"
27	AB	P	10:50	37 07'56"	89 04'18"
28	IB	S	10:51	37 08'19"	89 03'53"
29	IB	S	10:51	37 08'19"	89 03'53"
30	AB	P,S	10:53	37 08'01"	89 04'00"
31	IB	P	10:56	37 08'13"	89 03'36"
32	IB	P	10:58	37 08'20"	89 03'36"
33	AB	P	10:58	37 08'20"	89 03'36"
34	IB	P	11:00	37 08'37"	89 03'28"
35	IB	P	11:01	37 08'34"	89 03'29"
36	IB	P	11:01	37 08'34"	89 03'29"
37	AB	P	11:04	37 08'42"	89 03'24"
38	AB	P	11:04	37 08'42"	89 03'24"
39	AB	S	11:12	37 09'02"	89 03'31"
40	IB	S	11:12	37 09'02"	89 03'31"

41	AB	P	11:18	37 09'30"	89 02'18"
42	IB	P	11:19	37 09'37"	89 02'16"
43	IB	P	11:33	37 10'18"	89 02'53"
44	IB	P	11:35	37 10'14"	89 02'45"
45	AB	P	11:35	37 10'14"	89 02'45"
46	AB	P	11:40	37 10'52"	89 02'10"
47	AB	P	11:51	37 10'18"	89 03'15"
48	AB	P	11:52	37 10'20"	89 03'12"
49	AB	P	11:53	37 10'20"	89 03'12"
50	AB	P	11:57	37 11'03"	89 02'25"
51	IB	S	11:58	37 11'14"	89 02'22"
52	IB	P	11:58	37 11'10"	89 02'16"
53	AB	P	12:03	37 11'22"	89 01'38"
54	IB	P	12:07	37 11'36"	89 02'01"
55	AB	P	12:09	37 11'49"	89 01'44"

SURVEY SUMMARY

Time: 4 Hrs. 13 Min.
Distance: 20.2 Miles

Absolute Minimum: 40
Potential Maximum: 55

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 06 FEBRUARY 1985

TEMP: 20 F WIND: 5 MPH CLOUD COVER: 0% O.R. ELEVATION: 303.5

PRECIP: NONE SNOW COVER: 3" SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, MACGREGOR, HANNAN, STEPHENS, SMITHERS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	9:24	37 10'13"	89 02'48"
2	IB	P	9:24	37 10'08"	89 02'56"
3	AB	P	9:24	37 10'08"	89 02'56"
4	IB	P	9:24	37 10'08"	89 02'56"
5	AB	P	9:35	37 09'05"	89 02'36"
6	IB	P	9:35	37 09'05"	89 02'36"
7	IB	P	9:36	37 09'32"	89 02'20"
8	IB	S	9:36	37 09'29"	89 02'22"
9	AB	S,P	9:41	37 08'35"	89 03'30"
10	AB	P	9:44	37 08'24"	89 03'21"
11	IB	P	9:44	37 08'24"	89 03'21"
12	UE	P	9:44	37 08'24"	89 03'21"
13	UE	P	9:44	37 08'24"	89 03'21"
14	IB	P	9:46	37 08'16"	89 03'20"
15	UE	S	9:46	37 08'16"	89 03'20"
16	AB	P	9:49	37 08'20"	89 03'34"
17	AB	P	9:49	37 08'20"	89 03'34"
18	AB	P	9:49	37 08'20"	89 03'34"
19	IB	P	9:49	37 08'20"	89 03'34"
20	IB	P	9:49	37 08'20"	89 03'34"
21	AB	P	9:50	37 08'01"	89 03'28"
22	IB	P	10:08	37 07'58"	89 05'29"
23	IB	P	10:10	37 08'16"	89 05'27"
24	IB	P	10:10	37 08'16"	89 05'27"
25	AB	S	10:11	37 08'10"	89 05'40"
26	AB	P	10:13	37 08'47"	89 06'00"
27	IB	P	10:13	37 08'47"	89 06'00"
28	AB	P	10:15	37 09'29"	89 05'37"
29	AB	P	10:15	37 09'29"	89 05'37"
30	AB	P	10:17	37 08'22"	89 06'12"
31	IB	P	10:34	37 09'16"	89 04'40"
32	IB	P	10:34	37 09'16"	89 04'40"
33	IB	P	10:34	37 09'16"	89 04'40"
34	AB	P	10:39	37 09'00"	89 03'06"
35	IB	P	10:39	37 09'00"	89 05'06"
36	AB	S	10:40	37 09'07"	89 05'07"
37	AB	S	10:40	37 09'07"	89 05'07"
38	AB	P	10:50	37 09'56"	89 05'14"
39	AB	P	10:52	37 09'11"	89 05'29"
40	IB	P	10:52	37 09'11"	89 05'29"

41	IB	P	10:52	37 09'11"	89 05'29"
42	AB	P	10:52	37 09'48"	89 04'09"
43	AB	S	11:06	37 10'35"	89 03'05"
44	AB	P	11:07	37 10'20"	89 03'54"
45	IB	P	11:07	37 10'20"	89 03'54"
46	IB	P	11:12	37 10'09"	89 04'15"
47	IB	P	11:12	37 10'09"	89 04'15"
48	AB	S	11:13	37 10'24"	89 04'10"
49	AB	P	11:14	37 11'02"	89 03'50"
50	AB	P	11:15	37 11'36"	89 03'10"
51	AB	P	11:16	37 12'01"	89 02'41"
52	AB	P	11:17	37 10'37"	89 03'30"
53	AB	P	11:17	37 19'51"	89 03'12"
54	AB	P	11:17	37 11'05"	89 02'55"
55	AB	P	11:17	37 11'15"	89 02'42"
56	IB	P	11:48	37 10'03"	89 01'36"

SURVEY SUMMARY

Time: 2 Hrs. 34 Min.

Distance: 19.3 Miles

Absolute Minimum: 47

Potential Maximum: 56 (Including 3 UE)

31

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 13 FEBRUARY 1985

TEMP: 34 F WIND: 5-10 MPH CLOUD COVER: 0 % O.R. ELEVATION: 304.3

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, SOLE, ANDERSON, DAVIS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	3:34	37 08'43"	89 03'22"
2	IB	S	3:34	37 08'36"	89 03'23"
3	IB	P,S	3:55	37 08'41"	89 03'25"
4	AB	P	3:58	37 09'04"	89 04'04"
5	IB	P	3:58	37 09'04"	89 04'04"
6	AB	P	3:58	37 09'07"	89 04'03"
7	AB	S	4:00	37 09'20"	89 03'52"
8	IB	P	4:01	37 09'00"	89 04'17"
9	AB	P	4:12	37 09'33"	89 05'35"
10	AB	P	4:12	37 09'33"	89 05'35"
11	AB	P	4:15	37 09'16"	89 05'45"
12	AB	P	4:15	37 09'16"	89 05'45"
13	IB	P	4:15	37 09'16"	89 05'45"
14	IB	P	4:15	37 09'16"	89 05'45"
15	AB	S	4:17	37 09'21"	89 05'38"
16	AB	P	4:23	37 09'48"	89 04'30"
17	AB	P	4:26	37 10'11"	89 04'14"
18	AB	P	4:27	37 10'16"	89 04'01"
19	AB	P	4:30	37 10'25"	89 03'46"
20	AB	P	4:30	37 10'25"	89 03'46"
21	IB	P	4:30	37 10'25"	89 03'46"
22	IB	P	4:30	37 10'25"	89 03'46"
23	IB	P	4:30	37 10'25"	89 03'46"
24	IB	S	4:31	37 10'20"	89 03'56"
25	AB	S,F	4:33	37 11'03"	89 02'55"
26	IB	S	4:45	37 10'28"	89 03'34"
27	AB	P	4:51	37 10'00"	89 03'02"
28	AB	P	4:51	37 10'00"	89 03'02"
29	IB	P	4:51	37 10'00"	89 03'02"
30	AB	P	4:56	37 10'26"	89 02'27"
31	AB	P	4:56	37 10'26"	89 02'27"
32	AB	P	4:56	37 10'26"	89 02'27"
33	IB	P	4:56	37 10'26"	89 02'27"
34	AB	P	4:59	37 10'52"	89 02'07"
35	AB	P	4:59	37 10'52"	89 02'07"
36	AB	P	4:59	37 10'52"	89 02'07"
37	AB	P,S	4:59	37 10'52"	89 02'07"
38	AB	P,S	4:59	37 10'52"	89 02'07"
39	AB	P,S	4:59	37 10'52"	89 02'07"

SURVEY SUMMARY

Time: 1 Hr. 38 Min.
Distance: 11.2 Miles

Absolute Minimum: 31
Potential Maximum: 39

8

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 14 FEBRUARY 1985

TEMP: 26 F WIND: 0-5 MPH CLOUD COVER: 0% O.R. ELEVATION: 306.2

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, ANDERSON, DAVIS

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	9:22	37 11'25"	89 02'06"
2	AB	P	9:22	37 11'25"	89 02'06"
3	AB	P	9:23	37 11'32"	89 01'55"
4	AB	P	9:41	37 11'17"	89 01'24"
5	AB	P	9:41	37 11'17"	89 01'24"
6	AB	P	9:41	37 11'22"	89 00'57"
7	IB	S	9:41	37 11'49"	89 00'57"
8	IB	S	9:41	37 11'49"	89 00'57"
9	IB	P	9:56	37 11'00"	89 01'05"
10	IB	P	9:56	37 11'00"	89 01'05"
11	IB	P	9:56	37 11'00"	89 01'05"
12	IB	P	9:56	37 11'00"	89 01'05"
13	AB	P	9:56	37 11'00"	89 01'05"
14	AB	P	9:56	37 11'00"	89 01'05"
15	AB	P	9:56	37 11'00"	89 01'05"
16	IB	F,P	9:56	37 11'02"	89 00'56"
17	AB	P	11:17	37 09'58"	89 02'51"
18	AB	P	11:17	37 09'58"	89 02'51"
19	AB	S	11:32	37 10'04"	89 03'09"
20	AB	S	11:32	37 10'04"	89 03'09"
21	IB	P	11:40	37 10'24"	89 03'09"
22	AB	P	11:40	37 10'24"	89 03'09"
23	AB	P	12:08	37 12'05"	89 03'40"
24	IB	P,S	12:09	37 11'31"	89 03'27"
25	AB	S	12:09	37 11'16"	89 03'49"
26	AB	P	12:09	37 10'20"	89 03'55"
27	AB	P	12:09	37 10'20"	89 03'55"
28	UE	S	12:15	37 09'51"	89 04'25"
29	AB	P	12:17	37 09'33"	89 04'49"
30	AB	P	12:28	37 09'03"	89 05'52"
31	AB	P	12:28	37 09'03"	89 05'52"
32	IB	P	12:28	37 08'27"	89 06'08"
33	AB	S	12:33	37 09'07"	89 04'03"
34	AB	S	12:34	37 09'20"	89 04'09"
35	AB	P	12:42	37 09'04"	89 04'04"
36	AB	P	12:42	37 09'04"	89 04'04"
37	AB	P	12:42	37 09'04"	89 04'04"
38	AB	P	1:17	37 08'01"	89 04'16"
39	IG	S	1:17	37 08'24"	89 04'07"

SURVEY SUMMARY

Time: 4 Hrs. 13 Min.

Distance: 22.9 Miles

Absolute Minimum: 23

Potential Maximum: 39 (Including 1 UE and 1 IG)

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 14 FEBRUARY 1985

TEMP: 22 F WIND: 0-5 MPH CLOUD COVER: 0% O.R. ELEVATION: 306.2

PRECIP: NONE SNOW COVER: NONE SURV METHOD: AERIAL

OBSERVERS: SOLE

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	9:39	37 06'53"	89 06'10"
2	IB	S	9:42	37 10'17"	89 04'01"
3	AB	P	9:42	37 10'22"	89 03'52"
4	AB	P	9:42	37 10'22"	89 03'52"
5	IB	P	9:45	37 11'37"	89 02'06"
6	IB	P	9:45	37 11'37"	89 02'06"
7	IB	P	9:45	37 12'00"	89 01'29"
8	IB	P	9:50	37 09'04"	89 04'00"
9	IB	P	9:50	37 09'04"	89 04'00"
10	AB	P	9:52	37 10'06"	89 02'57"
11	IB	P	9:52	37 10'06"	89 02'57"
12	IB	S	9:52	37 10'12"	89 02'53"
13	IB	S	9:52	37 10'12"	89 02'53"
14	IB	S	9:52	37 10'12"	89 02'53"
15	IB	S	9:53	37 10'46"	89 02'17"
16	IB	S	9:53	37 10'54"	89 02'10"
17	IB	P	10:02	37 08'58"	89 05'54"
18	AB	P	10:04	37 11'08"	89 03'48"
19	IB	P	10:04	37 11'20"	89 03'29"
20	IB	P	10:04	37 11'20"	89 03'29"
21	IB	P	10:04	37 11'20"	89 03'29"
22	IB	P	10:04	37 11'20"	89 03'29"

SURVEY SUMMARY

Absolute Minimum: 16
Potential Maximum: 22

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 15 FEBRUARY 1985

TEMP: 25 F WIND: 0-5 MPH CLOUD COVER: 5% O.R. ELEVATION: 307.1

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, ANDERSON

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	8:33	37 11'30"	89 02'01"
2	AB	S	8:39	37 11'21"	89 02'58"
3	AB	S	8:39	37 11'21"	89 02'58"
4	IB	S	8:47	37 10'28"	89 04'03"
5	AB	P	8:48	37 10'21"	89 03'39"
6	AB	P	8:49	37 10'20"	89 03'41"
7	IB	S	8:50	37 10'25"	89 04'06"
8	AB	P	8:52	37 10'08"	89 04'09"
9	IB	S	8:52	37 10'07"	89 04'18"
10	AB	P	8:53	37 09'54"	89 04'32"
11	IB	P	9:04	37 10'16"	89 04'01"
12	IB	S	9:04	37 11'16"	89 02'41"
13	AB	P	9:04	37 10'56"	89 04'06"
14	AB	P	9:04	37 11'06"	89 03'50"
15	AB	P	9:04	37 11'09"	89 03'47"
16	AB	P	9:04	37 11'18"	89 03'30"
17	AB	P	9:04	37 11'41"	89 03'06"
18	AB	P	9:04	37 11'55"	89 02'49"
19	IB	P	9:15	37 10'14"	89 02'43"
20	AB	P	9:42	37 09'45"	89 04'35"
21	IB	S	10:07	37 08'00"	89 05'15"
22	IB	S	10:07	37 08'00"	89 05'15"
23	IB	S	10:07	37 08'00"	89 05'15"
24	UE	S	10:08	37 07'45"	89 05'16"
25	AB	P	10:23	37 08'23"	89 06'05"
26	AB	P	10:23	37 08'26"	89 06'07"
27	AB	P	10:23	37 08'17"	89 06'11"
28	AB	P	10:23	37 08'10"	89 06'13"
29	AB	P	10:23	37 08'04"	89 06'15"
30	AB	P	10:23	37 07'55"	89 06'21"
31	AB	P	10:23	37 07'43"	89 06'28"
32	IB	S	10:23	37 08'17"	89 05'38"
33	IB	S,F	10:23	37 08'17"	89 05'38"
34	IB	S	10:23	37 07'36"	89 05'56"
35	AB	S	10:40	37 08'37"	89 03'33"
36	AB	S	10:40	37 08'37"	89 03'33"
37	AB	S	10:40	37 08'37"	89 03'33"
38	IB	S	10:44	37 08'30"	89 03'28"
39	UE	S	10:49	37 08'02"	89 03'14"
40	IB	P	10:54	37 09'36"	89 02'21"

41	IB	P	10:55	37 09'47"	89 02'07"
42	AB	S	10:58	37 10'05"	89 01'29"

SURVEY SUMMARY

Time: 2 Hrs. 32 Min.

Distance: 20.2 Miles

Absolute Minimum: 28

Potential Maximum: 42 (Including 2 UE)

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 27 FEBRUARY 1985

TEMP: 33 F WIND: 5-10 MPH CLOUD COVER: 25% O.R. ELEVATION: 317.9

PRECIP: NONE SNOW COVER: NONE SURV METHOD: AERIAL

OBSERVERS: SOLE, PALMER-BALL

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	8:18	37 12'04"	89 01'21"
2	AB	P	8:18	37 12'04"	89 01'21"
3	IB	P	8:19	37 12'01"	89 01'23"
4	AB	P	8:19	37 12'01"	89 01'23"
5	AB	P	8:19	37 11'55"	89 01'36"
6	AB	P	8:20	37 11'42"	89 01'32"
7	AB	P	8:22	37 11'52"	89 01'43"
8	AB	P	8:22	37 11'48"	89 01'47"
9	AB	P	8:22	37 11'38"	89 02'03"
10	AB	P	8:23	37 10'23"	89 03'48"
11	AB	P	8:24	37 10'04"	89 04'21"
12	IB	P	8:25	37 08'25"	89 05'23"
13	IB	S	8:26	37 07'30"	89 05'43"
14	AB	P	8:26	37 07'22"	89 05'49"
15	IB	P	8:32	37 10'20"	89 03'13"
16	IB	P	8:32	37 10'20"	89 03'13"
17	IB	P	8:36	37 09'14"	89 02'33"
18	AB	P	8:49	37 12'33"	89 02'03"
19	AB	P	8:49	37 12'24"	89 02'16"
20	AB	P	8:49	37 12'21"	89 02'20"
21	AB	P	8:49	37 11'58"	89 02'46"
22	AB	P	8:49	37 11'51"	89 02'53"
23	IB	P	8:49	37 11'44"	89 03'01"
24	AB	P	8:49	37 11'37"	89 03'10"
25	IB	P	8:49	37 11'29"	89 03'20"
26	AB	P	8:50	37 11'26"	89 03'23"
27	IB	P	8:50	37 11'26"	89 03'23"
28	IB	P	8:50	37 11'26"	89 03'23"
29	AB	P	8:51	37 10'37"	89 04'29"
30	AB	P	8:51	37 10'08"	89 05'00"
31	AB	P	8:51	37 10'02"	89 05'11"
32	IB	P	8:51	37 09'47"	89 05'23"
33	AB	P	8:51	37 09'47"	89 05'23"
34	AB	S	8:52	37 09'21"	89 05'19"
35	IB	P	8:53	37 08'12"	89 06'12"
36	IB	P	8:53	37 08'12"	89 06'12"
37	AB	P	8:53	37 08'12"	89 06'12"
38	IB	P	8:53	37 08'05"	89 06'16"
39	IB	P	8:53	37 07'56"	89 06'21"

8

SURVEY SUMMARY

Absolute Minimum: 37
Potential Maximum: 39

8

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 27 FEBRUARY 1985

TEMP: 33 F WIND: 5-10 MPH CLOUD COVER: 20% O.R. ELEVATION: 317.9

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, WINFORD, KING, COUPWOOD

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	P	8:38	37 09'09"	89 02'30"
2	IB	P	8:44	37 08'44"	89 03'07"
3	IB	P	8:50	37 08'18"	89 03'17"
4	IB	S	8:50	37 08'12"	89 03'18"
5	IB	P,S	9:00	37 08'22"	89 03'27"
6	AB	P	9:02	37 08'27"	89 03'33"
7	IB	P	9:03	37 08'33"	89 03'31"
8	IB	P	9:16	37 09'43"	89 02'09"
9	IB	S	9:18	37 08'42"	89 03'24"
10	IB	P	9:24	37 09'58"	89 02'01"
11	IB	P,S	9:24	37 09'58"	89 02'01"
12	IB	S	9:40	37 10'11"	89 03'14"
13	UE	S	9:40	37 10'21"	89 02'59"
14	AG	S	10:05	37 11'28"	89 01'47"
15	AB	P	10:45	37 10'21"	89 03'53"
16	AB	P	10:45	37 11'09"	89 02'50"
17	AB	P	10:45	37 11'04"	89 03'51"
18	AB	P	10:45	37 11'30"	89 03'18"
19	AB	P	10:45	37 11'50"	89 02'52"
20	AB	P	10:45	37 10'20"	89 04'47"
21	AB	P	10:48	37 10'02"	89 04'25"
22	AB	P	11:30	37 09'52"	89 05'19"
23	AB	P	11:30	37 09'34"	89 05'33"
24	AB	P	11:30	37 08'43"	89 06'02"
25	AB	P	11:30	37 08'43"	89 06'02"

SURVEY SUMMARY

Time: 3 Hrs. 39 Min.
Distance: 20.1 Miles

Absolute Minimum: 17
Potential Maximum: 25 (Including 1 UE and 1 AG)

8

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 14 MARCH 1985

TEMP: 45 F WIND: 0-5 MPH CLOUD COVER: 100% O.R. ELEVATION: 318.8

PRECIP: NONE SNOW COVER: NONE SURV METHOD: AERIAL

OBSERVERS: SOLE

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	AB	P	8:20	37 12'04"	89 01'20"
2	IB	P	8:22	37 10'24"	89 03'22"
3	AB	P	8:30	37 10'12"	89 02'50"
4	AB	P	8:41	37 12'29"	89 02'07"
5	AB	P	8:42	37 12'24"	89 02'15"
6	AB	P	8:43	37 11'51"	89 02'53"
7	AB	P	8:45	37 08'49"	89 05'57"
8	AB	P	8:45	37 08'49"	89 05'57"
9	AB	P	8:47	37 07'18"	89 05'53"
10	AB	P	8:51	37 09'47"	89 02'56"

SURVEY SUMMARY

Absolute Minimum: 10
Potential Maximum: 10

1984-85 EAGLE SURVEY
LOWER OHIO RIVER NAVIGATION FEASIBILITY STUDY

DATE: 14 MARCH 1985

TEMP: 50 F WIND: 0-5 MPH CLOUD COVER: 0% O.R. ELEVATION: 318.8

PRECIP: NONE SNOW COVER: NONE SURV METHOD: DRIVING

OBSERVERS: SIEMSEN, MACGREGOR, SOLE

<u>Sighting No.</u>	<u>Age Code</u>	<u>Activity Code</u>	<u>Time (CST)</u>	<u>Latitude & Longitude</u>	
1	IB	S	10:09	37 10'07"	89 03'02"
2	IB	P	2:14	37 09'25"	89 02'28"
3	IB	S	2:42	37 10'10"	89 03'33"
4	IB	P	4:09	37 09'14"	89 02'34"

SURVEY SUMMARY

Time: 1 Hr 55 Min. (PM)
Distance: 10.5 Miles (PM)

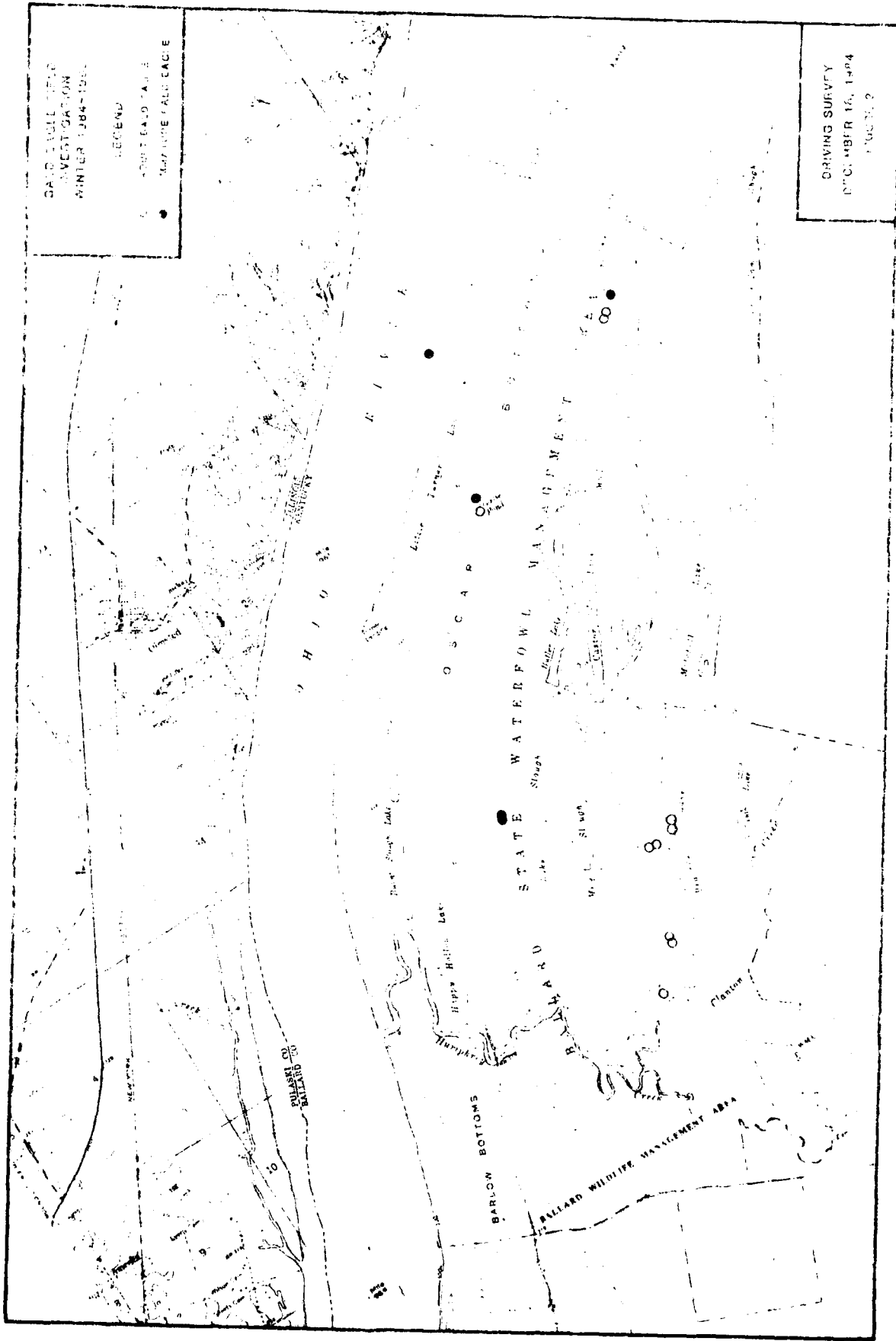
Absolute Minimum: 2
Potential Maximum: 4

DAVID F. COLLIER
INVESTIGATION
WINTER 1964-1965

LEGEND

- COURT HOUSE TAVERN
- MAP HOUSE FALLS CAGE

DRAWING SURVEY
NUMBER 16, 1964
PAGE 2



BALDWIN TOWN
DIVISION
MAPS 164-500

LEGEND

● BIRD SIGHTING
○ BIRD SIGHTING

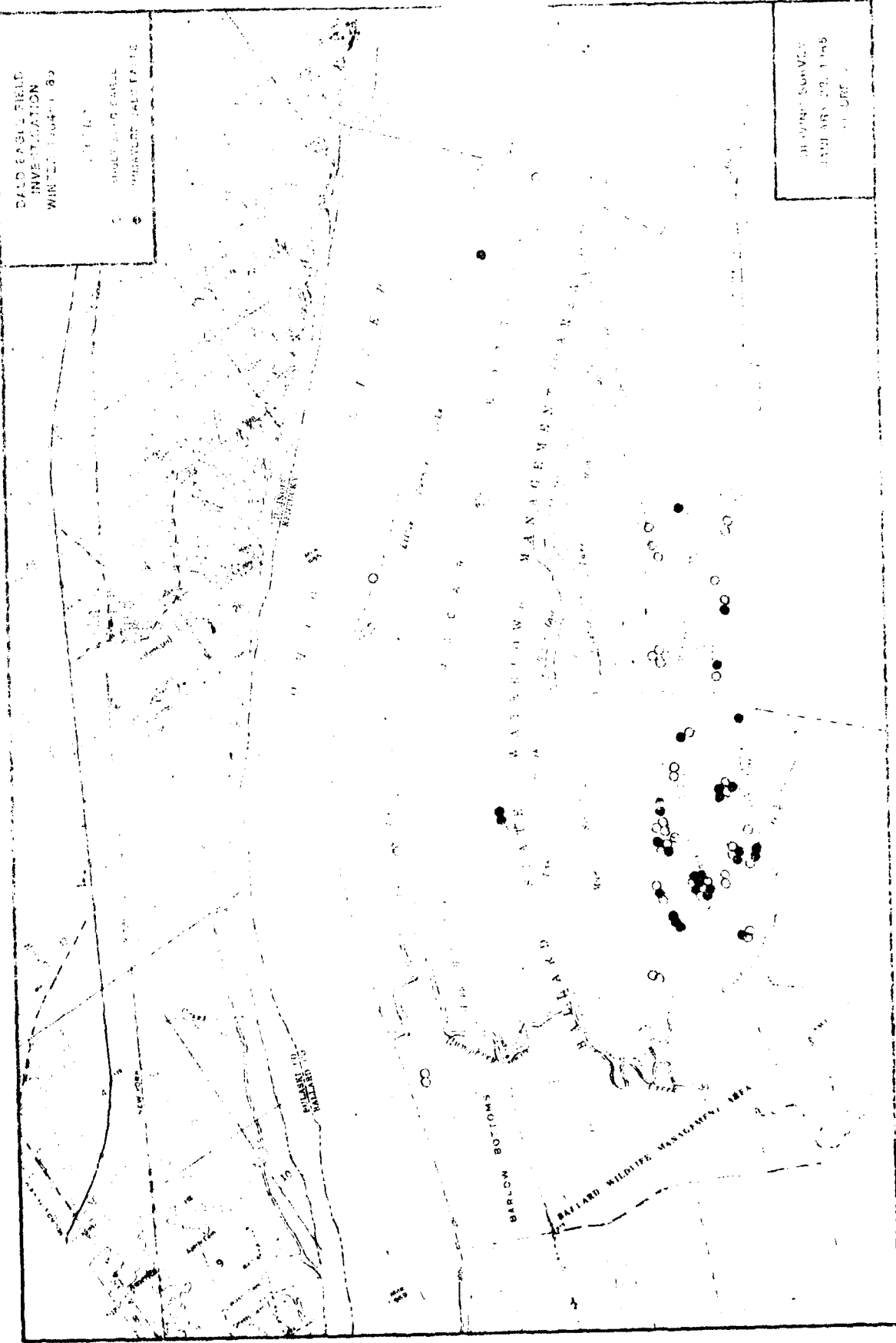
BIRD SURVEY
JANUARY 02, 1945
P. 11

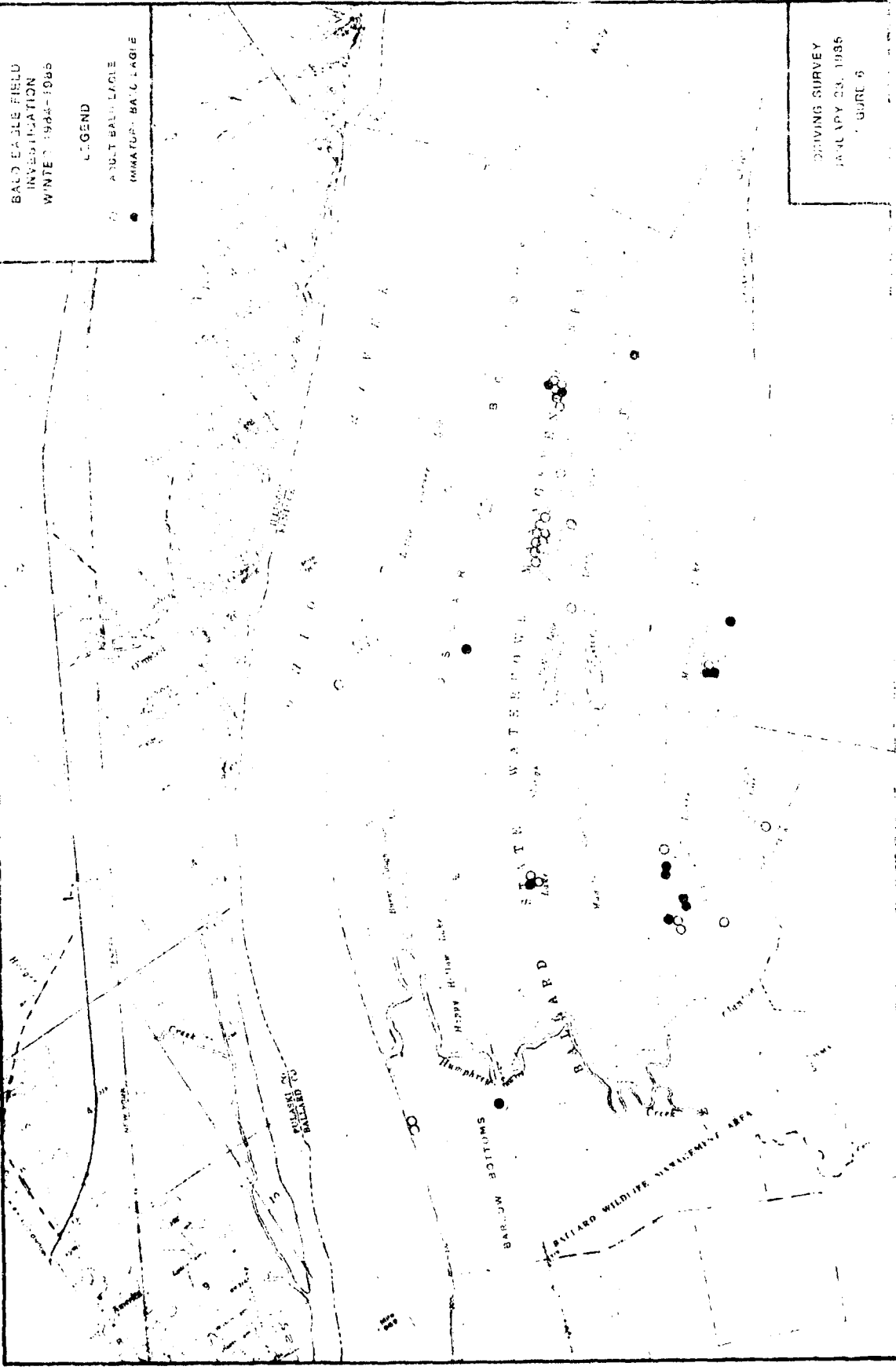


CALD EASH FIELD
INVESTIGATION
WINTER 1964-65

WATER TABLE
MEASURED DATA

DRIVING SURVEY
JANUARY 29, 1965
L. J. BURR







DRIVING SURVEY
 FEBRUARY 04, 1965
 1 SHEET

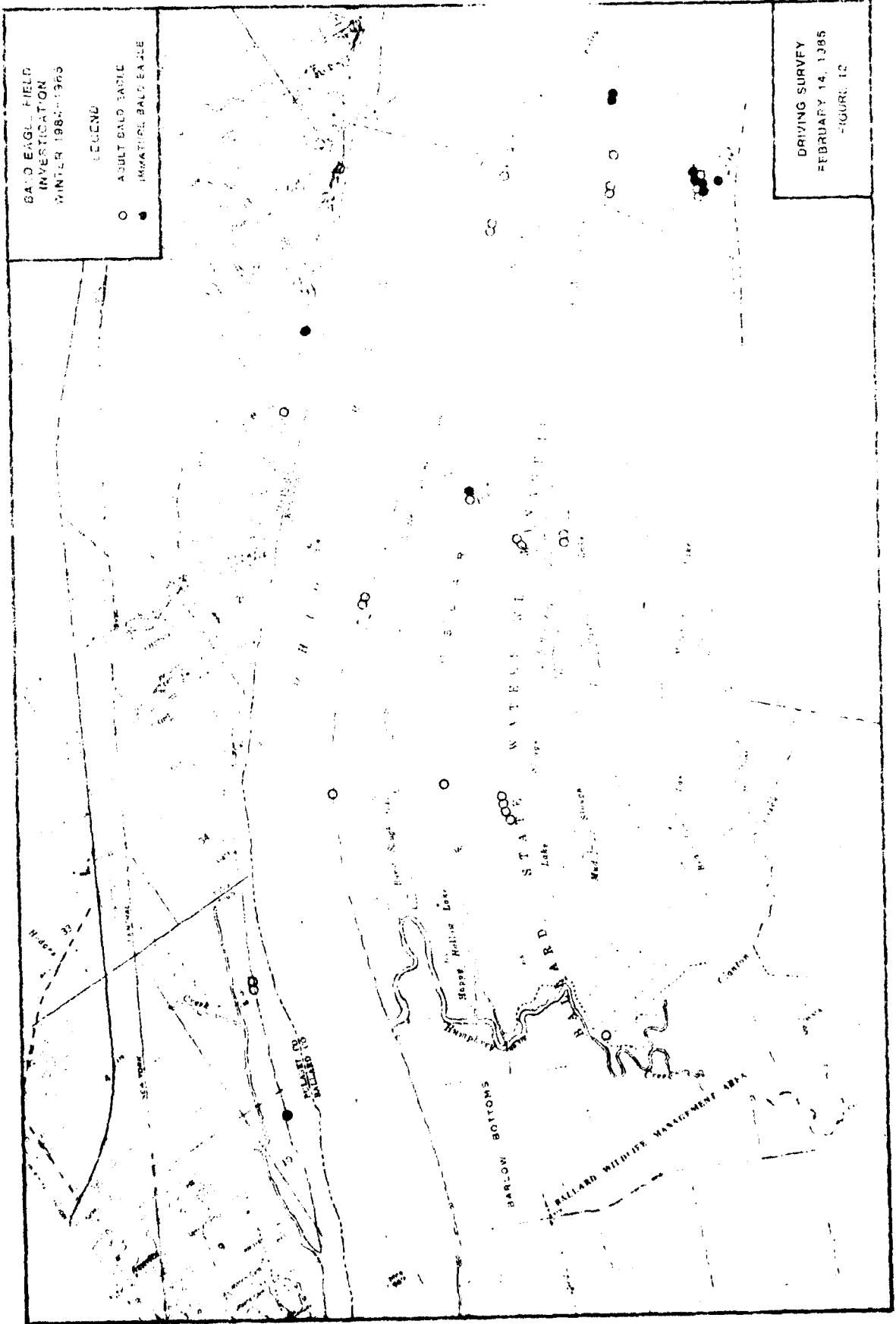


BA'D EAGLE FIELD
INVESTIGATION
WINTER 1984-1985

LEGEND

- ADULT BALD EAGLE
- IMMATURE BALD EAGLE

DRIVING SURVEY
FEBRUARY 14, 1985
FIGURE 1C



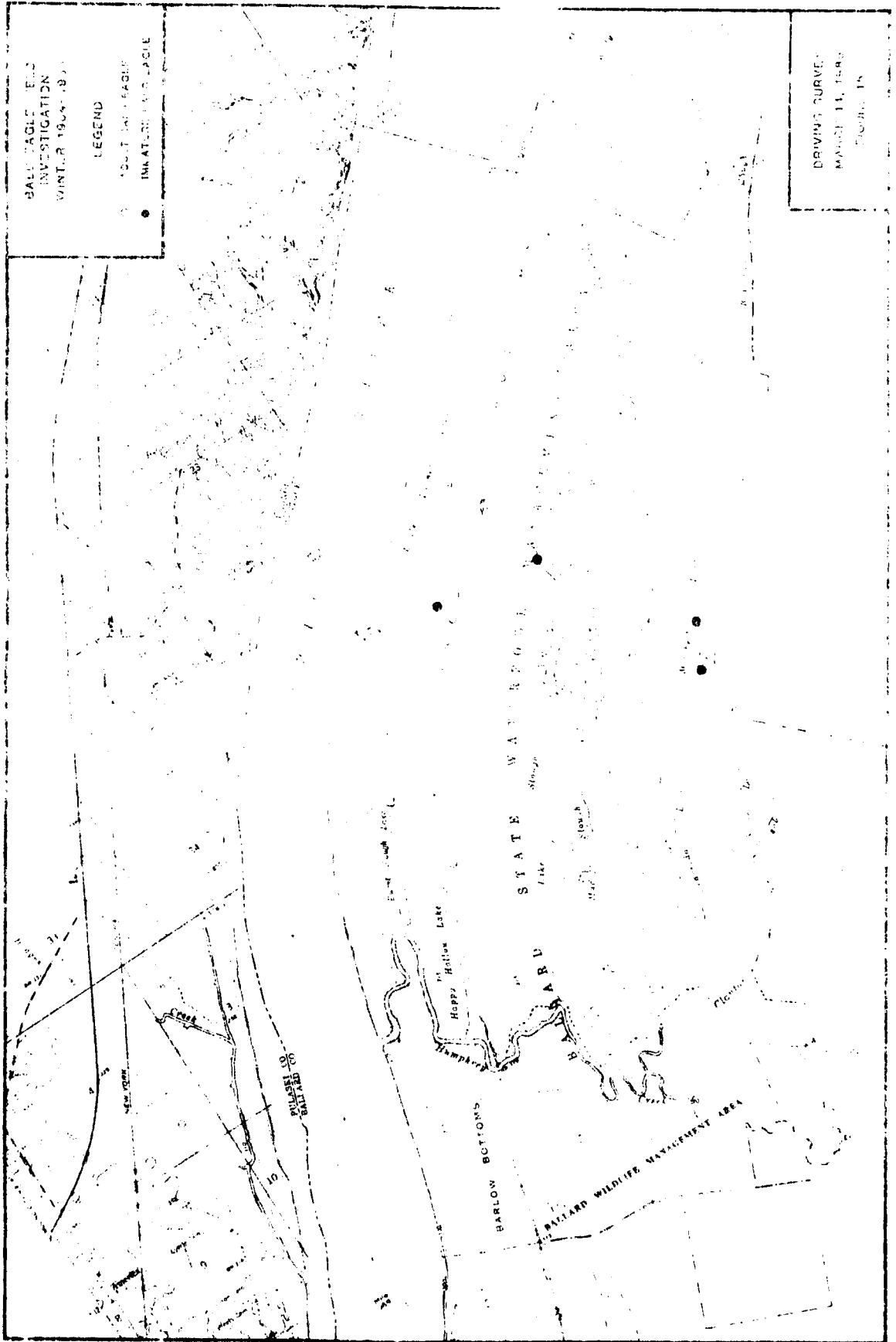


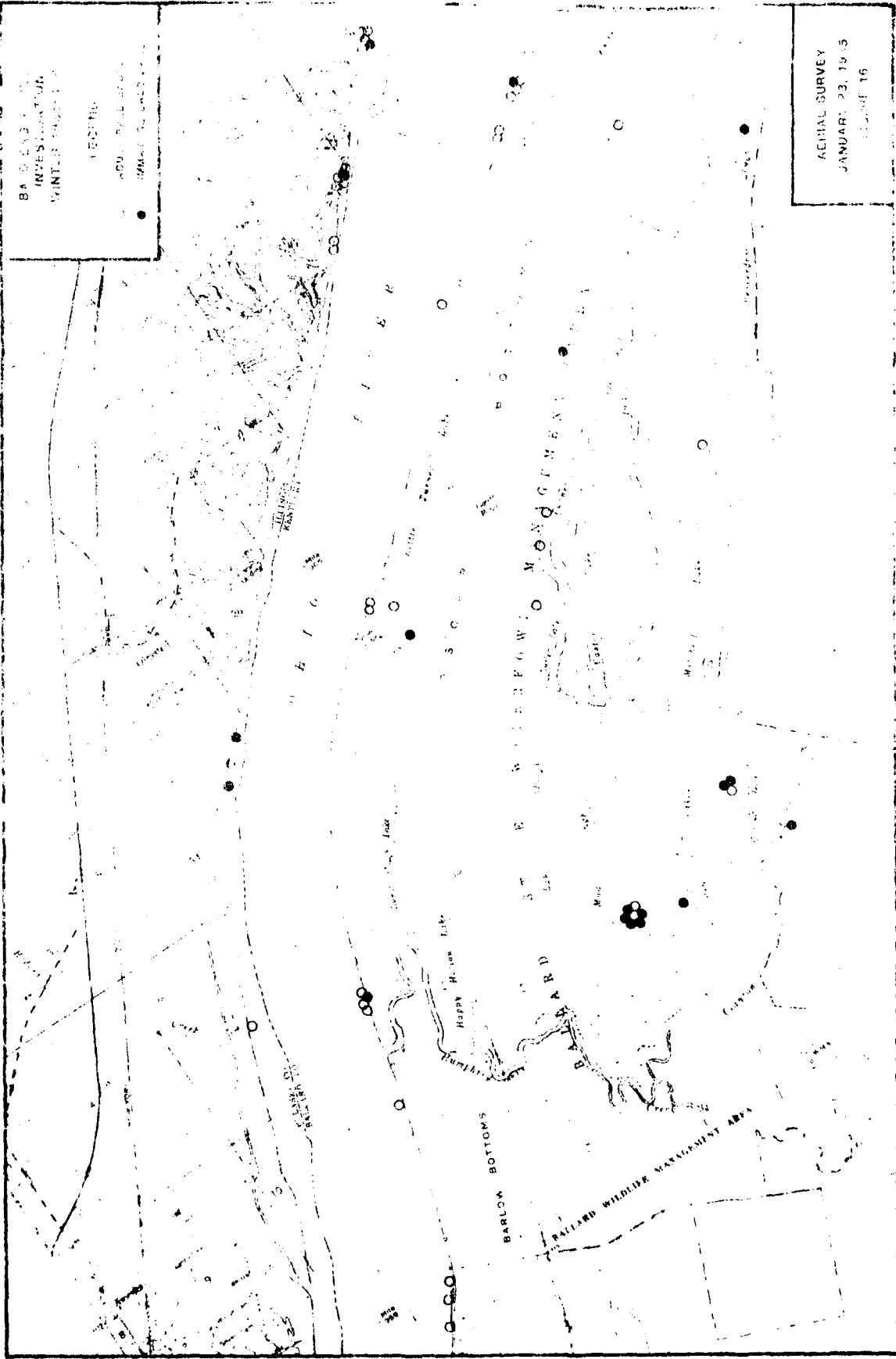
BALL EAGLE TENDS
INVESTIGATION
WINTER 1964-1965

LEGEND

- ADULT BALL EAGLE
- IMMATURE BALL EAGLE

DRIVING SURVEY
MARCH 11, 1966
FIGURE 15





BARLOW BOTTOMS
INVESTIGATION
WINTER 1955

LEGEND

- ADULT BIRD SIGHTS
- IMMATURE BIRD SIGHTS

AERIAL SURVEY
JANUARY 23, 1955
JUNE 16

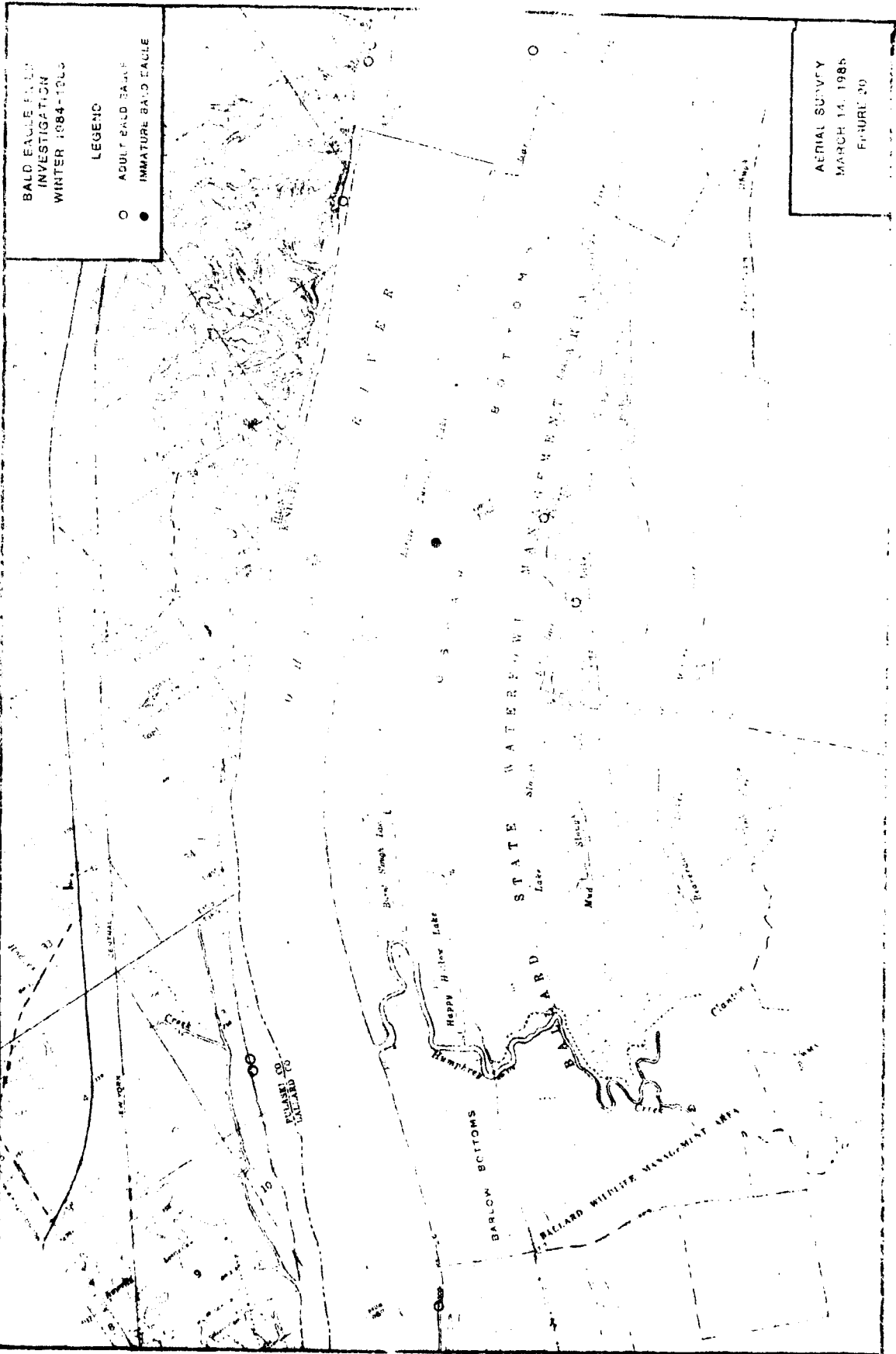
BALD EAGLE FIELD
INVESTIGATION
WINTER 1984-1985

LEGEND

- ADULT BALD EAGLE
- IMMATURE BALD EAGLE

ALTRIAL SURVEY
FEBRUARY 24, 1985
FIGURE 17





BALD EAGLE RIVER
INVESTIGATION
WINTER 1984-1985

LEGEND

- ADULT BALD EAGLE
- IMMATURE BALD EAGLE

AERIAL SURVEY
MARCH 14, 1985
FIGURE 20

BALD EAGLE FIELD
INVESTIGATION
WINTER 1984-1985

LEGEND

- ADULT BALD EAGLE
- IMMATURE BALD EAGLE

DRIVING SURVEY
COMPILED BY
JILL ADULT BALD EAGLES
1984-1985



GAD BUCKLE
INVESTIGATION
WINTER 1951-1952

LEGEND

- ADULT BATTLE
- DEPARTURE PLACE

DEFENSE SURVEY
COMPONENT
ALL NUMBERS REFER
TO PAGE 20441



DATE
FILMED
- 8