1994

Bald Eagle management in Virginia: A comprehensive plan

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The Center for Conservation Biology

THE BALD EAGLE

IN VIRGINIA

An information booklet for land planners

Produced by:
The Center for Conservation Biology
The College of William & Mary
Williamsburg, Virginia

The Center for Conservation Biology is a non-profit organization dedicated to finding practical solutions to current environmental problems by integrating research, education, and management. Only through the exchange of information and ideas may we hope to maintain the rich diversity of the mid-Atlantic region.

THE BALD EAGLE
in Virginia

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June 1994

This publication was funded, in part, by the Department of Environmental Quality's Coastal Resources Management Program through grant #NA270Z0312-01 of the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its subagencies.

Printed on Recycled Paper

ACKNOWLEDGEMENTS

This publication was made possible by a grant from the Virginia Department of Environmental Quality through funding provided by the National Oceanic and Atmospheric Administration (NOAA). We acknowledge these agencies for supporting new initiatives in bald eagle management.

Dana Bradshaw (VDGIF, Nongame and Endangered Wildlife Program), Cindy Schulz (USFWS), and Brett Preston (VDGIF, Planning, Policy, and Environmental Services Division) made helpful comments on the Legal and Management Responsibility section. Shep Moon (VDEQ), Bill Duncanson (Richmond County), and Wayland Bass (James City County) provided insight in shaping the Planning Considerations section. Scott Kudlas (Chesapeake Bay Local Assistance Department) provided legal and planning information. We thank these individuals for sharing their expertise.

Becky Wajda (VDGIF, Fish and Wildlife Information System) and her staff provided base maps for the Bald Eagle Activity Areas. Maps for Bald Eagle Activity Areas were prepared by Marian Urbi Watts. Steve Phillips (VDGIF, Fish and Wildlife Information System) helped to produce the GIS-based habitat suitability maps. Report cover was designed by Marian Urbi Watts. This document is publication number 7 of the Virginia Center for Conservation Biology.

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INTRODUCTION

Historically, the bald eagle was a common breeder along major river systems, lakes and coastal areas throughout the Southeast. The widespread use of persistent pesticides for crop management in the region resulted in dramatic declines over a 30-40 year period. By the late 1960's, most breeding populations had been decimated by eggshell thinning and associated low productivity. Concern for these populations prompted the elevation of the bald eagle to endangered or threatened status (depending on specific population) and led to a national effort to restore historic populations. Since the nationwide ban on most persistent pesticides such in 1972, many populations have experienced gradual recoveries in both productivity and total numbers. In Virginia, the breeding population has steadily increased from an estimated low of approximately 32 pairs in the 1960's to 160 pairs in 1994.

Although the bald eagle population has rebounded very well over the past 15-20 years, current patterns of habitat loss threaten to halt prematurely or even to reverse this recovery. Shoreline development throughout the Chesapeake Bay is rapidly reducing both occupied and potential breeding habitat and poses the single greatest threat to the population. Between 1950 and 1986, the number of people living along the shores of the Chesapeake Bay increased by 50 percent. This population is projected to increase by at least 2.6 million or an additional 20 percent, over the next 30 years.

Long-term management of eagles within Virginia will require not only protection of existing nest sites but also the identification and conservation of future breeding areas. Comprehensive land planning by local governments offers one of the most significant opportunities to protect and conserve habitat. Addressing bald eagle habitat protection issues

at the comprehensive plan level will 1) assure that important habitats are identified during resource inventories and placed on land-use planning maps, 2) allow bald eagle habitat to be incorporated into overall natural resource, open space, and wildlife habitat protection goals and objectives, 3) create more uniform application and enforcement of development regulations and restrictions, 4) help identify conservation measures and strategies available to accomplish bald eagle and other wildlife habitat protection goals.

From a regulatory perspective, nearly all land-use decisions at the regional and local level will result in a review to determine potential impacts on threatened and endangered species. The earlier that bald eagle habitat is considered in the process (and the earlier that regulatory agencies are called in for comment) the more likely that an environmentally acceptable project will be designed and approved.

State and federal regulations that address bald eagles offer little specific guidance to resolve conflicts between habitat protection and development. Appropriate incorporation of bald eagle habitat in the local planning process first requires an understanding of the guidelines used by regulatory agencies during project and permit review. The primary purpose of this booklet is to provide land planners in Virginia, at both the county and regional level, with information needed to incorporate bald eagle habitat conservation in their planning process.

REASONS FOR MANAGEMENT

VIRGINIA BALD EAGLE POPULATION

Historical Population - No specific estimates of the Chesapeake Bay bald eagle population are available prior to the early 1900's. However, given the high productivity and extensive shallow-water foraging areas, it has been speculated that prior to European settlement the Chesapeake Bay may have supported one of the densest breeding populations outside of Alaska (Fraser et al. 1991). The widespread land clearing that occurred during the 17th and 18th centuries likely resulted in a decline in habitat availability followed by a decline in the breeding population.

The first survey of bald eagles in the Bay was a ground survey conducted by Tyrrell in 1936 (Tyrrell 1936). His survey covered about 25% of the available breeding habitat and estimated there were 150-200 nesting pairs (although he knew of only 71 pairs). This survey has been used to speculate that the Chesapeake Bay population was between 600 and 800 breeding pairs at this time (Abbott 1978). The first aerial survey of eagle nests in the Chesapeake Bay was conducted in 1962 by Abbott (Abbott 1963). The survey covered about twice the area covered by Tyrrell in 1936. Survey results suggested that about 150 pairs of bald eagles remained in the Chesapeake Bay in 1962.

A comparison of Tyrrell and Abbotts surveys suggest that not only the breeding population but also productivity had declined dramatically in the 3 intervening decades. Abbott observed only 7 young produced from 37 nests (0.2 young/nest) compared to 64 young produced from 39 nests (1.6 young/nest) in 1936. The population continued to decline

throughout the 1960's reaching an estimated low of 80-90 pairs in 1970 (only 36 of which were in Virginia) (Abbott 1978).

Population Decline and Contaminants - Although several factors contributed to the dramatic population decline between 1930 and 1970, environmental contaminants are believed to be the primary cause. DDT and several related compounds came into widespread use as pesticides in the mid-1940's. This class of compounds is very persistent in the environment and is magnified through the food chain. When concentrations reach high levels in bird tissues they inhibit hormones responsible for calcium release during eggshell formation. As a result, eagles and many other top carnivores laid thin-shelled eggs that broke in the nest or were nonviable. Productivity dropped well below that needed for population maintenance and the population subsequently declined significantly.

Population Recovery - DDT and most related chemical compounds were banned from general use in the United States in 1972. However, the recovery of the Virginia bald eagle population was not immediate. The Virginia Department of Game and Inland Fisheries initiated comprehensive aerial surveys in 1977 to locate and determine productivity for active bald eagle nests. Between 1977 and 1981, the total number of breeding pairs remained between 33 and 39 with a production for the first three years below the estimated maintenance level of 0.70 young per active nest (USFWS 1990). In the years between 1980 and 1991, breeding pairs increased at an average rate of 12 percent per year. In the two years between 1991 and 1993, breeding pairs increased 36 percent (VDGIF 1993), possibly reflecting the large number of young reaching sexual maturity. The increase in breeding pairs has been paralleled by an average increase in productivity. Young have been produced

at a rate that exceeds that estimated for maintenance since 1980. Bald eagles now nest in 28 coastal counties in Virginia.

CURRENT THREATS TO VIRGINIA BALD EAGLES

Habitat Loss - As the Virginia bald eagle population has increased, pairs have reoccupied many of the historic nesting territories. However, as the human population expands in both size and distribution, many historic breeding areas are rapidly being converted to human use. Habitat loss related to shoreline development is now the single greatest threat faced by the bald eagle population in Virginia and throughout the Bay.

Between 1950 and 1986, the number of people living along the shores of the Chesapeake Bay increased by 50 percent. This number is projected to increase by at least 2.6 million or an additional 20 percent, over the next 30 years (Gray et al. 1988). A preliminary review of development occurring around bald eagle nests in Virginia shows that development has occurred in 55 percent of the shoreline areas along the Potomac, Rappahannock, York, and James rivers (USFWS 1990). Similarly, Buehler (1990) found that in northern areas of the Chesapeake Bay 75.6 percent of the shoreline has developments within 500 m of the shoreline. Many of these areas with high housing densities are, for all practical purposes, lost permanently as breeding and roosting sites. Concern for the impact of development on the long-term persistence of the Chesapeake Bay bald eagle population is heightened by the fact the majority of both available breeding habitat and current nests occur on private lands. At the current rate of habitat degradation, it is not difficult to imagine that in the next 50 to 100 years most of the available eagle breeding and roosting habitat on the Chesapeake Bay will be gone.

Disturbance - Associated with the increased urbanization of coastal Virginia is an elevation in human activity. Fishing, boating, and numerous other shoreline activities have increased substantially along with development. In addition to increasing in intensity, recreational activities are spreading over larger areas as people seek out and explore relatively remote areas. Bald eagles are extremely sensitive to disturbance and only moderate elevations in human activity may result in the abandonment of large sections of shoreline that are otherwise ideal for nesting, roosting, or foraging (Stalmaster and Newman 1978, Fraser et al. 1985, Buehler et al. 1991a, 1991b). Some studies suggest that boating and other activities within 800 m may reduce use of foraging perches (McGarigal et al. 1991). Eagles nearly always select remote areas for perching and foraging. Areas used for perching in the northern Chesapeake Bay were found to be away from significant developments (Buehler 1991b).

Contaminants - The majority of compounds that were implicated in the population crash between the 1940's and 1970's have been banned from use in the United States. However, because the bald eagle is a top carnivore that frequently feeds on carrion, it will always be susceptible to chemical pollutants that are present in the food chain. For example, in recent years, organophosphate pesticides have been implicated for causing the deaths of several eagles within the mid-Atlantic region. Similarly, during the 1980's, at least 22 bald eagles are believed to have died from the insecticide/nematocide carbofuran (USFWS 1990). This chemical is now banned within the primary bald eagle use areas in Virginia. As the human population grows and expands across the lower Chesapeake Bay, the magnitude and diversity of pollutants will likely increase. In a related way, an increase in the transport of

toxic materials throughout the Bay will ultimately lead to an increase in accidental releases into the watershed.

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NATURAL HISTORY

NESTING

Habitat Requirements - During the process of territory selection, bald eagles are likely influenced by a complex collage of factors that vary from the structure of a landscape to the size and form of an individual tree. How this suite of factors interact to influence the distribution of breeding pairs is not fully known. However, some basic requirements that are known provide insight into the construction of beneficial land-use policies.

Bald eagles nest adjacent to or in the vicinity of large bodies of water. On the coastal plain of Virginia, eagles are known to nest along the ocean, inland bays, and reservoirs but the majority (>90%) nest along the shoreline of the Chesapeake Bay and its four major tributaries (James River, York River, Rappahannock River, and Potomac River). An examination of 367 historic nests in Virginia showed that greater than 95% of the nests were within 3 km of a channel at least 250 m wide and approximately 60% fall within 1 km of these waterways (Watts et al. 1994). The strong association with large waterways implies that the vast majority of habitats that support the current Virginia population are contained within the narrow ribbon of land along the Chesapeake Bay shoreline.

In Virginia and throughout their range bald eagles typically build nests in live trees (although they may continue to occupy a nest for some time after the nest tree has died). Loblolly pines account for the majority (> 60%) of trees used for nesting, with shortleaf pine, Virginia pine, bald cypress, American beech, tulip poplar and various other deciduous species each receiving relatively minor (<10%) use (Jaffee 1980, Cline 1986). Regardless of species, nest trees are similar in their physical structure. Because bald eagles build very

large nests (often weighing over 1 ton), appropriate trees are needed for structural support. Nest trees are generally the largest trees in a woodlot often towering over the surroundings and allowing the adult birds easy access to the nest.

Bald eagle nests are similar in construction to many other large raptors. The body of the nest itself is built of large sticks, but the top surface and cup is covered with softer plant materials such as pine bows, clumps of grass and fresh leaves. The nest is nearly always constructed on the highest prominent crotch of the tree. A breeding territory may contain a single nest that is used continuously for decades or may contain two to several nests, only one of which is used during a given nesting attempt.

Breeding Activity - The bald eagle is a long-lived species that generally does not breed until reaching 4 to 5 years of age. Birds 5 years of age and older possess the snow white head and tail characteristic of the species. Juvenal and subadult birds have mottled brown plumage throughout. Breeding pairs maintain an exclusive space around the nest that they defend against other eagles. A mated pair may remain together for many breeding seasons.

In Virginia, adults typically remain on or near their breeding territories throughout the year (Buehler et al. 1991a). Nest building and repair begins in November and peaks in mid-winter but may be observed during any month of the year (Fraser et al. 1991). Courtship flights and related behavior are most frequently observed January-February and eggs are laid between mid-January and late March. Clutches vary in size between 1 and 3 eggs (clutches larger than 3 eggs are very rare) and are incubated by the female for 35 days. In Virginia, most eggs hatch between early March and early May and eaglets remain in the nest for 11 to

12 weeks (USFWS 1990). Most young are capable of sustained flight by late July but remain dependent on the parents and in the general vicinity of the nest for several more weeks. After this time, young may wander throughout the Chesapeake Bay and beyond.

Disturbance - Breeding eagles are most sensitive to human disturbance when they are in the early stages of nesting. Disruptive activities that occur when pairs are courting, building nests, laying eggs, or incubating are most likely to result in nest failure or abandonment. As with most animals, eagles are capable of habituating to routine activities such as regular traffic or predictable noises but are disturbed when novel activities occur and are visible from the nest. Incubating birds may be flushed from a nest if activities encroach too close to the nest tree (Fraser et al. 1985). Chronic activities such as logging or construction within sight of a nest may cause the female to remain off the nest for extended periods of time. Eggs exposed to the cold for too long may fail to hatch and result in nest abandonment. Small young, one-to-four-weeks old, are also vulnerable to the cold if adults are kept from the nest for extended periods and unable to brood them. During the later part of the season, when young are seven weeks old or older, encroachment on the nest may cause young to jump prematurely from the nest. Young on the ground that are unable to fly are susceptible to predators or may starve.

In addition to their sensitivity to direct disturbance, eagles tend to nest in isolated areas away from development (Andrew and Mosher 1982). In Virginia, the density of buildings, as well as primary, secondary, and unimproved roads is very low in the immediate vicinity of nests compared to random sites chosen on the coastal plain. Of the 131 nests known to be active in 1992, none had greater than 5 houses within 200 m or greater than 10

houses within 400 m (Watts et al. 1994). Extensive development of lands surrounding active nests may result in permanent abandonment (Therres et al. 1993).

ROOSTING

In addition to the resident breeding population, Virginia supports several known areas where subadult and non-breeding adults congregate. These "concentration" or "roost" areas may form during the summer or winter months and are always associated with an abundant food source (typically a large fish population in summer and overwintering waterfowl in winter). Specific sites may be very stable from year to year, sometimes being used for decades.

In Virginia, summer concentrations tend to be much larger than winter. Although juvenal and adults from the Virginia population make up a portion of these birds, it appears that many of these birds come from outside the state. Increasing evidence suggests that birds from both the southeastern and northeastern states seem to converge on the Chesapeake Bay during mid-summer. This suggests that concentration areas in Virginia may have significance for the entire east coast population.

Habitat Requirements - Bald eagles within concentration areas congregate in communal roosts at night. These roosts provide protection from the weather and disturbance. Trees used for roosting are similar in structure to nest trees (Beuhler et al. 1991b). Large trees with open canopies are preferred because they allow birds direct access to limbs for perching. Most roost sites are situated in clumps of supercanopy trees situated in isolated woodlots with easy access to primary foraging areas. Communal roosts are

located within 0.5 mi (1 km) of water, and are located away from development such as buildings, boat landings and roads (Buehler et al. 1991b).

Roosting Activity - Eagles assemble in concentration areas in both summer and winter, but usually different roosts are used in different seasons. Birds begin to congregate in summer roost areas in mid-April and numbers increase throughout the spring and summer reaching highs from June to August. Numbers drop considerably throughout the early fall but low numbers remain into mid-October. Birds reach peak numbers in winter roost areas from November to January but these areas may support elevated numbers between October and April. The majority of birds typically leave roost areas to forage on or just prior to dawn but may be delayed by fog or poor weather. Some birds may be seen loafing around the roost site any time of day. Birds return to the roost area around dusk to spend the night.

Disturbance - As with nesting pairs, non-routine human activity within sight of roost areas will generally flush birds from roost trees. Chronic activity in the vicinity of a major roost area may result in total abandonment of the site possibly forcing birds to roost in less protected trees further from foraging areas. Since eagles may be present in the roost at any time during the day, disturbance may occur at any time. However, night-time disturbances are particularly detrimental.

FORAGING

Bald eagles are opportunistic foragers preying on fish, birds, and small mammals as well as scavenging carrion of various types (Cline and Clark 1981). In the summer, when availability is high, fish are the primary component of the diet. In the Chesapeake Bay, eagles feed on gizzard shad, channel catfish, Atlantic menhaden, white perch, American eels,

yellow perch, and many other species depending on their seasonal availability (Mersmann 1989). In the fall and winter when the population of overwintering waterfowl increases and fish availability is relatively low, eagles shift their foraging attention to waterfowl and supplement their diet to a greater extent with carrion (Fraser et al. 1991).

Habitat Requirements - Eagles spend most of their foraging time surveying the landscape for prey from a prominent perch along the shoreline of rivers, marshes, and bays. Trees used as foraging perches are very similar to those used for roosting. Perch trees are large with open crowns to allow unobstructed flight access to limbs. Both pine and deciduous trees (live or dead) may be used for foraging perches. Large trees on high shoreline bluffs appear to be selected. Because eagles often take fish on or near the surface, favorite perches are typically along shorelines adjacent to shallow water (Mersmann 1989).

Disturbance - Eagles hunt from perch trees at any time during the daylight hours and may be flushed from their perch if disturbed by human activity. Boating activity close to the shoreline is particularly disruptive to foraging birds (McGarigal 1988). Human activity on the shoreline or adjacent uplands is equally disruptive. Flushed birds will often fly down the shoreline, cross the water, or move inland away from the shoreline. Repeated disturbance may cause foraging birds to abandon the area. Development of waterfront property along the shoreline may also result in the permanent loss of foraging areas. Eagles rarely use shoreline areas within 100 m of buildings or 500 m of human activity (Buehler et al. 1991c).

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BALD EAGLE RECOVERY PLANS

By 1978, all of the discrete bald eagle populations of the lower 48 states were declared either threatened or endangered because of severe population declines. Subsequently, the United States Fish and Wildlife Service appointed a series of recovery teams to devise plans for the recovery of specific bald eagle populations. The goal of the federal recovery program is to facilitate population recovery to the extent that the species is "downlisted" (status changed from endangered to threatened), and working toward complete recovery and eventual "delisting" (removal of the species from the list of threatened and endangered species).

The Chesapeake Bay Bald Eagle Recovery Team completed its first recovery plan in 1982 (a first revision was completed in 1990). As set forth in the plan, the threshold for downlisting is a sustained nesting population of 175-250 pairs, with a productivity rate of 1.1 eaglets per active nest. Active efforts to protect suitable nesting, roosting and foraging habitat must accompany improved productivity. The present breeding population of bald eagles in the Chesapeake Bay is over 300 pairs, with approximately half of these in Virginia, hence the population goal delineated in the plan for downlisting has been achieved.

In order to achieve the full recovery of the species required for delisting, two conditions are specified in the plan: (a) a nesting population of 300-400 bald eagle pairs with an average productivity of 1.1 eaglets per active nest, sustained over 5 years, (2) permanent protection of sufficient, nesting habitat to support 300-400 bald eagle pairs, and enough roosting habitat to accommodate population levels commensurate with increases throughout

the Atlantic region resulting from increased productivity. It is hoped that this publication will provide land planners with the information and incentive to assist in this endeavor.

The ultimate determinant for delisting the Chesapeake Bay bald eagle population will be the amount of available and protected habitat. Adequate nesting, foraging, and roosting habitat must be available in perpetuity to ensure full recovery of this population. Suitable habitat must be identified and evaluated throughout the state. Habitat protection should be pursued through all available mechanisms, including landowner cooperation, land easements, acquisition incentive programs, and a continuing effort to develop shoreline protection strategies through legislation and policy initiatives. It is hoped that this publication will provide land planners with the information and incentive to also assist in this endeavor.

BALD EAGLE ACTIVITY AREAS IN VIRGINIA

In order for a resource to be incorporated into any long-range strategic plan (of any level) it is first necessary for the planners involved to have an overview of the resource's distribution. We are of the firm belief that counties or other jurisdictions can not plan to protect resources or critical lands that they do not know exist. The fact that planners are unaware of critical lands is, in part, the reason that money and time is wasted on the development of site plans and protracted environmental reviews. The purpose of this section is to provide planners with up-to-date information on the distribution of breeding pairs and critical lands within their jurisdiction. **It should be noted that the information provided here represents the state of knowledge through 1994. In order to update this information in subsequent years, planners should contact the Virginia Department of Game and Inland Fisheries.**

OCCUPIED HABITAT

In 1977, the Virginia Department of Game and Inland Fisheries initiated an annual, aerial survey to locate active bald eagle nests on the coastal plain. This survey has documented the recovery of eagles in the state and is the primary database used by regulatory agencies when reviewing proposed projects. As the population has begun to recover over the past several years, bald eagles have reappeared in many historic locations. Breeding territories are now known for 28 counties and 3 cities on the coastal plain (as well as several inland counties).

Over the past 15 years considerable information has also been compiled on the distribution of lands important to non-breeding eagles in Virginia. This includes areas where

concentrations of birds forage and roost (see Natural History section). Information on these locations has not (as a rule) been collected systematically and is therefore of somewhat lower quality compared to information on nesting sites. The information that is currently available has been compiled from scattered surveys and independent research projects. To date, concentration and roost sites have been identified in 10 coastal counties.

The map or maps in Appendix I present the current state of knowledge on the distribution of breeding territories, concentrated foraging areas, and roost sites in 1994. For breeding sites, territories that have been active one or more years between 1990 and 1994 are included. The five year time span was used because regulatory agencies generally consider five years to be the "period of protection" after a nest becomes inactive. Therefore, breeding sites that have been active in the past five years represent those still under protection. Locations are presented using relatively coarse resolution to alert planners that an activity area is in the general vicinity. If a more exact location is needed, planners should contact the Virginia Department of Game and Inland Fisheries.

POTENTIAL BREEDING HABITAT

In the past, eagle management has, for the most part, followed a passive philosophy. Eagle nest trees have been located and protected along with a recommended buffer zone. Although we believe that these actions are essential, we also believe that alone they will not ensure the persistence of a healthy population in the face of rapid development. The Virginia bald eagle population remains in a state of recovery. During the course of this recovery phase, habitat remains unoccupied that is both critical to the continued recovery and maintenance of the population and is under imminent risk of development. Long-term

management of eagles within Virginia will require not only protection of existing nest sites but also the identification and conservation of future breeding areas.

In 1992 the Center for Conservation Biology conducted a comprehensive study to develop a statistical model capable of identifying "potential" breeding habitat within the coastal plain of Virginia (Watts et al. 1993). The multivariate model constructed is capable of delineating lands according to their current value as breeding habitat for bald eagles. In 1993 the Center in cooperation with the Virginia Department of Environmental Quality and the Virginia Department of Game and Inland Fisheries, implemented the habitat model on two of Virginia's largest waterways (Watts et al. 1994). Over 4,000 square kilometers of land were delineated to a spatial resolution of 400 meters. This included a 100 mile reach of the James River and a 75 mile reach of the Rappahannock River.

The map or maps in Appendix II present habitat suitability values for jurisdictions falling within 3 kilometers of the James and Rappahannock River shorelines (and their major tributaries). Suitable breeding habitat that is currently unoccupied has no legal protection. This information is presented to inform jurisdictions about the location of areas that have the potential to provide habitat for breeding eagles and to encourage informed land-use planning. For those many lands that fall outside of the areas currently delineated, the model is available upon request and may be easily used to delineate other lands.

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LEGAL AND MANAGEMENT RESPONSIBILITY

REGULATIONS

The bald eagle in Virginia and the Chesapeake Bay region is a federally listed endangered species (43 FR 6233). In 1940, congress passed the Bald Eagle Protection Act in an attempt to protect Bald Eagles from extinction. Several changes have been made in this Act to strengthen the law protecting bald and golden eagles and their nests. The current Act (16 U.S.C. 668-668c) prohibits anyone from "taking", possessing, selling, purchasing, bartering, offering to sell, transporting, exporting, or importing at any time or in any manner, any bald or golden eagle, alive or dead, or any part, nest, or egg except as specified in the Act.

The Act defines "taking" as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb". It is also illegal to possess, sell, purchase or transport any bald or golden eagle, dead or alive, or any part, nest or egg of an eagle. A violation of the Eagle Protection Act can result in statutory fines of $5,000 to $10,000 or imprisonment for 1-2 years, or both. When treated as a general misdemeanor, fines up to $100,000 may be imposed for the first offense (at the judge's discretion). Multiple offenses may bring fines up to $250,000.

The Bald Eagle is also protected under the Migratory Bird Treaty Act (16 U.S.C. 701-718h), the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.), and Virginia Endangered Species law (Code of Va. Sections 29.1-563 --29.1-570), all with restrictions and penalties similar to the Bald Eagle Protection Act. In addition, Section 7 of the ESA mandates that federal agencies consult with USFWS (or National Marine Fisheries Service

[NMFS] for marine species) before taking action which may jeopardize the continued existence of any federally listed threatened or endangered species, or candidate species. It is through Section 7 that most land-use decisions and actions are reviewed to assess the possible impacts to bald eagles.

It is important to note that if the proposed "downlisting" of the bald eagle in Virginia from endangered to threatened status takes place, the legal protection and penalties of all 3 federal regulations listed above will be unchanged.

THE REVIEW PROCESS

One of the main purposes of this booklet is to encourage regional and local governments, including county planning departments, to incorporate bald eagle habitat in project into reviews and environmental assessments, hopefully, before projects even reach the permit review stage. Failure to consider bald eagle habitat in the planning and design stage of a project could lead to delay or rejection of the project at permit review. The VDGIF through their Environmental Services Section will review proposed projects, not only from regional and local governments but also from private interests, to identify possible impacts on bald eagles and other threatened and endangered animals to help guide project design.

The VDGIF is the primary wildlife and freshwater fish management agency in the Commonwealth, and has legal jurisdiction over state and federally listed endangered and threatened species in Virginia, excluding endangered or threatened insects or plants. The VDGIF, under Section 6 of the ESA, has a Cooperative Agreement with the USFWS that designates VDGIF as the lead agency for the conservation of protected animal species in Virginia.

Under the U. S. Fish and Wildlife Coordination Act, consultation with the USFWS and state fish and wildlife agencies is required where the waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted or otherwise controlled or modified by any agency under a federal permit or license (i.e., U.S. Army Corps of Engineers [COE], Federal Energy Regulatory Commission [FERC]). Consultation is to be undertaken for the purpose of preventing loss of or damage to wildlife resources. The following is a brief discussion of the project review process conducted by the USFWS and VDGIF to determine potential impacts to bald eagles.

COE permits for projects affecting federal waters or wetlands, such as Clean Water Act Section 401 and Section 404 permits and permits under Section 10 of the Rivers and Harbors Act of 1899, are considered federal actions under the ESA. Whenever a project is proposed that may require a COE permit, the COE consults with USFWS and VDGIF to determine if the project may impact bald eagles or other endangered or threatened species. If a proposed project may affect the bald eagle or other federally listed species, the COE requests formal consultation with the USFWS. The result of this consultation is the biological opinion of the USFWS.

COE permit reviews often take place during Joint Permit Application (JPA) reviews for all projects affecting federal or state waters or wetlands. The VDGIF reviews JPA projects for the Virginia Marine Resources Commission (VMRC) (state subaqueous bottoms) and the Virginia Department of Environmental Quality (state waters) to determine possible impacts on bald eagles and other endangered and threatened species. Local Wetlands Boards also occasionally request comments from VDGIF on permit applications under review.

USFWS and VDGIF also provide comments on bald eagle issues to federal agencies required to produce Environmental Assessments (EA) or Environmental Impact Statements under the National Environmental Policy Act. Federal projects such as Federal Energy Regulatory Commission hydropower project licenses and license renewals are subject to USFWS and VDGIF review and recommendations concerning project impacts on endangered and threatened species.

The VDEQ will also solicit VDGIF comments on other types of projects that may impact bald eagles. Waste management permit applications are often subject to review by VDGIF, as are Virginia Pollutant Discharge Elimination System permits. Virginia Department of Transportation projects, whether or not they involve federal funding, are also subject to VDGIF review for comments on possible impacts to endangered and threatened species. Environmental review, including VDGIF comments on wildlife impacts, are also required for "Major State Projects", state construction or land acquisition projects in excess of $100,000.

As may be seen, nearly all land-use decisions at the regional and local level will result in a review to determine the projects impact on bald eagles and other endangered and threatened species. The earlier that bald eagle habitat is considered in the process, and the earlier that the VDGIF is called in to comment and advise, the more likely that the environmentally acceptable project will be designed and approved.

Literature Cited: Legal and Management Responsibility Section

Cline, K. W. 1993. Bald Eagle Nest Management in Virginia: Planning Document. Virginia Department of Game and Inland Fisheries, Agency Document. Va. Dep. Game and Inland Fish., Richmond, Va. 66pp.

MANAGEMENT GUIDELINES

The state and federal regulations that address bald eagles and other threatened and endangered species offer little in specific guidance to resolve habitat vs. development conflicts. In order to consider bald eagle habitat management and protection in the land-use planning process, it is necessary to understand the guidelines used by the regulatory agencies during the project and permit review process.

The bald eagle management guidelines discussed in this section -- and it is important to remember that they are only guidelines, not codified regulations -- have been agreed upon for Virginia by the USFWS and VDGIF (Cline 1993). The management guidelines for roost and foraging sites, however, have seldom been used and do not necessarily represent an agreed upon policy. All of these guidelines should be used as the starting point, or the minimum standards, in making management recommendations or assessing the possible impacts of a project on bald eagles or their habitat.

These guidelines can be used in your land-use planning process to alert you to possible bald eagle/development conflicts, and to help you establish guidelines for land-use plan review. Guidelines should remain flexible, however, since VDGIF and USFWS apply their guidelines on a case-by-case basis: always consult with VDGIF or USFWS to determine if a land-use decision will adversely impact bald eagles or other endangered or threatened species.

Bald eagles nest sites have traditionally received the most attention by the VDGIF and USFWS for protection and management. Habitat requirements and disturbance factors (see Natural History section) are well documented, and specific management techniques have been

used successfully. Other use areas such as roost and foraging sites have received less study, but are equally important in management considerations. Locational information for important roost and foraging areas is also not as complete as for nest sites (see Bald Eagle Activity Areas section).

NEST SITES

Nest site management recommendations are based on management zones around each nest to define areas that need protection from habitat alteration and human disturbance (Cline 1993, Therres et al. 1993). The role of management zones is to 1) preserve the natural features that attract eagles to the area, 2) provide alternate use sites such as nest and perch trees, 3) incorporate adjacent use areas into one management area, 4) prevent human disturbance at nest sites, and 5) to maintain a visual barrier of vegetation between eagles at the nest and nearby human activity (Cline 1993).

Management zone boundaries are drawn to account for variations in topography, vegetative cover, and the eagle's observed response to disturbance. The distances for primary and secondary management zones given below should be used to alert you to possible adverse impacts on bald eagles for development activities within certain distances of a nest. **Always consult with the VDGIF or USFWS for recommendations for a specific nest site.**

The USFWS and VDGIF requires protection for both currently occupied nests and old nest structures or nest trees that are still standing, as long as an area is determined to still be suitable for nesting. If a nest tree is unoccupied for 5 consecutive breeding seasons, the management zone restrictions can usually be lifted (Cline 1993).

Primary Zone - **1)** The boundary of this zone is usually set at a **minimum of 250 yd (228 m)** from the nest tree. In this area eagles are most sensitive to disturbance and the greatest degree of protection is needed. Land-use changes should be prohibited in this zone including: land clearing; clear cutting; mining; and new building, road or trail construction (Cline 1993, Therres et al. 1993, Fraser et al. 1985).

2) Most activities should not be allowed in this during the breeding season from November 15 to July 15. Outside of the breeding season, July 16 to November 14, some activity is possible but should be kept to a minimum: hiking, bird watching, camping, fishing, hunting (Cline 1993, Therres et al. 1993, Fraser et al. 1985). Some routine activities such as farming and travel on existing roads may also be possible without disturbing the nesting eagles.

3) Timber management should be primarily for the preservation of eagle habitat. This could possibly include selective thinning and maintenance of timber stands, outside of the breeding season (Cline 1993).

Secondary Zone - **1)** The secondary zone begins at the boundary of the primary zone and usually extends out a **minimum of 440 yd (402 m)** from the nest tree. Major habitat changes in this zone could adversely impact nesting eagles including: a) development of new commercial and industrial sites, and b) building of multi-story buildings and housing developments (Cline 1993, USFWS 1987).

2) Most other activities are possible in this zone outside of the breeding season. During the breeding season, November 15 to July 15, major activities could disturb the nesting eagles --

activities such as timber cutting, land clearing, building, road or trail construction, and other activities that are within sight of the eagles on the nest (Cline 1993, USFWS 1987).

ROOST SITES

There are fewer bald eagle roost sites than nest sites (see Bald Eagle Use Areas section), but the protection and management of these areas may be more important to the continued recovery of the bald eagle population in Virginia and throughout the East Coast (Buehler et al. 1991b, Fraser et al. 1991). Roost sites are also more impermanent than nest sites and may be abandoned as the habitat becomes less suitable through natural processes, for example the deterioration of dead trees used for perching.

The following management zone distances and recommendations, and do not necessarily represent USFWS and VDGIF agreed upon policy, but should be considered as minimum standards.

1) Existing bald eagle roosts, and roosts that have been abandoned but are still suitable for roosting, may need to be protected by a management zone that extends up to **250 yd (228 m)** in all directions from the perimeter of the roost. This area should be closed to timber cutting, land clearing and construction to maintain the large trees needed for perching and to maintain the buffer of trees between the eagles and the sight of human activities (Cline 1993).

2) This area may also need to be closed to most human activities. Even though use of certain roost sites is concentrated at certain times of the year, roosts are often used off and on throughout the year (Cline 1993, Buehler et al. 1991b, Millsap et al. 1983).

FEEDING SITES

Shorelines frequently used by bald eagles for perching and foraging also need protection and are essential to the continued recovery of the bald eagle (Buehler et al. 1991b, 1991c). The Bald Eagle Use Areas section of this booklet discusses important shoreline areas that have been identified by bald eagle researchers.

The following management zone distances and recommendations for foraging sites are not as consistently applied as nest site recommendations, and do not necessarily represent USFWS and VDGIF agreed upon policy, but should be considered as minimum standards.

1) A management zone, extending up to **250 yd (228 m)** inland from the edge of the shoreline perch trees and along the shoreline in either direction from the edge of the perch trees, may be needed to protect important foraging areas. Clear cutting, land clearing and construction in this zone could cause eagles to abandon the area (Cline 1993, Buehler et al. 1991b, 1991c). Limits on receational boating in a management zone out from the shoreline would also be of benefit in protecting high-use foraging areas. However, there is currently no legal mechanism available to localities to establish such a management zone.

2) The primary forest management in the zone should be to preserve the area for bald eagle use. Selective timber harvest may be warranted to maintain and encourage the growth of large trees for perching: a) if performed at a time of year when eagles are not present, and b) it the screening effect of the woodlot is maintained (Cline 1993, Millsap et al. 1983).

Literature Cited: Management Guidelines Section

Buehler, D. A., T. J. Mersman, J. D. Fraser, and J. K. D. Seeger. 1991b. Nonbreeding bald eagle communal and solitary roosting behavior and roost habitat on the Northern Chesapeake Bay. J. Wildl. Manage. 55:273-281.

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Fraser, J. D., D. A. Buehler, G. D. Therres, and J. K. D. Seeger. 1991. Bald eagle (Halieaeetus leucocephalus). Pages 21.1-21.9 in S. L. Funderburk, S. J. Jordan, J. A. Mihursky, and D. Riley, eds. Habitat requirements for Chesapeake Bay living resources. Dep. Fish and Wildl. Sci., Va. Polytech. Inst. and State Univ., Blacksburg.

_____, L. D. Frenzel, and J. A. Mathisen. 1985. The impact of human activity on breeding bald eagles in north-central Minnesota. J. Wildl. Manage. 49:585-592.

Millsap, B. A., K. W. Cline, and M. J. Gilroy. 1983. Distribution and movements of bald eagles on Aberdeen Proving Ground, Maryland. Natl. Wildl. Fed. Rep. to U.S. Dep. Defense, Army Contract DAAD05-82-F-MO21. Aberdeen Proving Ground, Aberdeen, Md. 54pp.

Therres, G. D., M. A. Byrd, and D. S. Bradshaw. 1993. Effects of development on nesting bald eagles: case studies from the Chesapeake Bay. Trans. 58th N. A. Wildl. and Natur. Resour. Conf. p.62-69.

U.S. Fish and Wildlife Service. 1987. Habitat management guidelines for the bald eagle in the southeast region. Third revision. U.S. Dep. Inter., Fish and Wildl. Serv., Atlanta, Ga. 9pp.

PLANNING CONSIDERATIONS

Bald eagle habitat, as well as other endangered and threatened species habitat, should be given a high priority for protection during comprehensive planning, and development project reviews at the local level. An objective of "protecting existing bald eagle habitat and preserving areas for future bald eagles use" could be one objective within the local comprehensive plan. Addressing this objective will go a long way toward reaching other natural resource protection goals and objectives such as water quality protection, open space preservation, and protection of other significant wildlife habitats. The Virginia Department of Game and Inland Fisheries (VDGIF) is in the process of developing model language for comprehensive plan goals and objectives for bald eagle habitat protection.

State and federal endangered species law offers little in specific guidance for habitat protection and management. As a result, the current approach to bald eagle habitat protection at the local level is probably best described as uncertain, inconsistent and inflexible -- all factors that can result in undue hardships to individual landowners.

Classifying bald eagle habitat as open space or in another similar, regulated landuse category within a comprehensive plan enables the locality to plan for the conservation and protection of this endangered species through clear and consistent policies (White 1990). Land-use regulation to protect bald eagle habitat should incorporate variances, special-use permits, and individual development site plan review to ensure flexibility in the regulations to allow for a case-by-case review (White 1990).

Addressing bald eagle habitat protection issues at the comprehensive plan level will 1) assure that important habitats are identified during resource inventories and placed on land-

use planning maps, 2) allow bald eagle habitat to be incorporated into overall natural resource, open space, and wildlife habitat protection goals and objectives, 3) create more uniform application and enforcement of development regulations and restrictions, 4) help identify conservation measures and strategies available to accomplish bald eagle and other wildlife habitat protection goals.

The Local Assistance Manual, published by the Chesapeake Bay Local Assistance Department (Ches. Bay Local Assist. Dep. 1989), is an excellent source of information on protection of endangered and threatened species habitat during the land-use planning process. The manual discusses not only the provisions for water quality protection in the Chesapeake Bay Preservation Act, but also discusses other state enabling legislation that allows wildlife habitat to be considered in local comprehensive plans and zoning regulations. State law enables localities to use their zoning authority to protect open spaces (Code of Virginia Section 15.1-486), and to provide for the preservation of "lands of significance to the protection of the natural environment" (Code of Virginia Section 15.1-489. State law also cites conservation of natural resources as one of the matters to be considered in drawing and applying zoning ordinances and districts (Code of Virginia Section 15.1-490) (Moon pers. comm.). The legal basis for other land protection strategies such as conservation easements is also discussed (e.g., Code of Virginia Title 10.1, Chapters 10.1, 17, and 18).

BALD EAGLE HABITAT MAPPING

Bald eagle nest, roost and foraging areas, both currently used and potential use areas, should be overlaid on land use planning maps. Maps are provided in this booklet (see

Appendix I and II) to provide you with basic information on existing and potential use areas in your locality.

Location information is maintained by the Department of Game and Inland Fisheries' Nongame and Endangered Species Program and the Biota of Virginia (BOVA) database, and by the Department of Conservation's Natural Heritage Program. The BOVA database may also be able to provide digitized location information for localities using digitized Geographic Information Systems (GIS). The Nongame and Endangered Species Program will also provide localities with information on current and historic eagle use of an area and include specific bald eagle management recommendations. As the lead agency in the state for bald eagle management, all bald eagle management questions should first be directed to VDGIF.

Bald eagle use can fluctuate over time, so yearly updating of the bald eagle habitat map is recommended. Nest sites area the most closely monitors areas; information on new breeding territories, or movement of nests within a breeding territory, are available in the spring of each year. Roost sites and foraging areas are less closely monitored and more likely to change over time as the surrounding habitat changes.

Preserving sufficient nest, roost, and foraging areas to support the continued recovery of our bald eagle population will depend more on protecting larger areas that include two or all three types of use areas, not just small individual sites.

HABITAT PROTECTION

The protection of bald eagle habitat should be included in an overall wildlife habitat protection plan that includes threatened and endangered plants and animals, wildlife corridors, and other significant wildlife habitat. Since bald eagles forage along river

shorelines, and nest and roost within 1/2 mile of open water and wetlands, bald eagle habitat is often located in or immediately adjacent to wetland and riparian areas, areas that may already be identified in comprehensive plans as essential for water quality protection.

The Chesapeake Bay Preservation Act - The overlay map of bald eagle nest, roost, and foraging sites will help to identify areas that lie within and outside Chesapeake Bay Preservation Areas. Bald eagle habitat that lies within Resource Protection Areas (RPA) established by local governments to comply with the Chesapeake Bay Preservation Act receives some protection (Ches. Bay Local Assist. Dep. 1989); land use that is consistent with the Chesapeake Bay Preservation Act mandate to minimize adverse impacts on water quality in the RPA is often also consistent with bald eagle habitat protection. The RPA is an important component in a locality's overall strategy for bald eagle habitat protection.

The Resource Management Areas (RMA) designation provides little protection. But, the Act's General Performance Criteria for both the RPA and RMA that mandates 1) the preservation of indigenous vegetation, 2) a development review process, and 3) conservation plans for agricultural lands can be used to help ensure that bald eagle habitat conservation issues are addressed (Ches. Bay Local Assist. Dep. 1989).

Open Space Planning - Bald eagle habitat outside the RPA can be protected as open space. Bald eagles tend to use forested areas away from human activity, yet close to breaks in the forest such as farm fields or riparian areas (see Natural History Section). Adding bald eagle habitat to an open space system will help provide a framework for a wildlife habitat corridor system, as well as, farmland and woodland preservation. Regulation of open space and RPA that contain bald eagle habitat should take into consideration the management

recommendations discussed in the Management Guidelines section of this booklet. The VDGIF Nongame and Endangered Species Program biologists will work with local land-use planning agencies to develop specific recommendations for management of these areas to both protect and enhance bald eagle habitat.

Since bald eagle nest, roost, and foraging sites are often located adjacent to each other, linking bald eagle use areas into wildlife habitat corridors as protected open space will help to protect large areas that are likely to contain current, as well as, future habitat.

CONSERVATION STRATEGIES

Once important bald eagle and other wildlife habitat has been identified in the comprehensive plan, a variety of conservation strategies, in addition to zoning, can be adopted. Land purchase, conservation easements, site plan review of development projects, and innovative land planning tools such as cluster development and planned unit developments are all conservation strategies that can be used to preserve important wildlife habitat (White 1990, (Ches. Bay Local Assist. Dep. 1989).

Purchasing Land - Purchasing land may be the best conservation strategy for the most important habitats. Purchase may become necessary when other options for conservation of an area will cause substantial hardship to individual landowners. After an area is identified as a high priority to purchase, several options are available. Local governments can purchase property to be added to local parks, natural areas, or open space systems. Nonprofit conservation organizations could also be encouraged to buy the property and manage it as a natural area preserve, dedicate the property back to the locality for management, or dedicate the property to the Virginia Natural Areas Preserves System,

administered by the Division of Natural Heritage of the Department of Conservation and Recreation.

With increasing shoreline development pressures in the tidewater area, land acquisition may be the best, and the most expensive, method to preserve in perpetuity bald eagle habitat and other valuable natural features.

Conservation Easements - Many land uses and activities are consistent with the protection of bald eagle habitat. Farming, timber harvest, and recreational activities may all be compatible if management recommendations are followed and habitat alteration and disturbance factors are kept to a minimum (Cline 1993)(see Management Guidelines Section). Conservation easements are a valuable, cost effective, and underutilized tool to protect bald eagle habitat from incompatible uses while not restricting other uses of the property.

Through a conservation easement (also referred to as open space easements) the landowner conveys to the donee certain interests in the property, such as development rights, while the landowner retains title to the land and all other rights of ownership. In the case of a conservation easement to protect bald eagle habitat, the landowner gives up the right to develop the land in ways that are inconsistent with habitat preservation (Cline 1993). To the extent that a conservation easement limits the uses and development potential of the property, the market value of the property will decrease. In most cases the granting of a conservation easement constitutes a charitable donation (difference in fair market value of the property before and after the easement) and affords the landowner certain tax benefits (Cline 1993, Barnett 1989).

Localities have a number of options available to see that easements are acquired to preserve bald eagle habitat and accomplish other natural resource protection goals of a comprehensive plan. Local governments and other public resource agencies are authorized to accept conservation easements through the Open-Space Land Act of 1966 (Code of Virginia Sections 10.1-1700 to 1705). The Virginia Outdoors Foundation, VDGIF, and Division of Natural Heritage are all state organizations that may accept easements to protect bald eagle habitat. Nonprofit conservation organizations such as the Nature Conservancy and Chesapeake Bay Foundation also accept easements to protect endangered species habitat (Cline 1993, Ches. Bay Local Assist. Dep. 1989).

Localities should take advantage of any and all of these conservation agencies and organizations to protect bald eagle habitat. Localities should also take advantage of the services offered by the VDGIF, Nongame and Endangered Species Program to provide bald eagle management plans for conservation easements that have been, or are being considered for acquisition.

Other Land-Use Planning Tools - There are several effective and innovative tools that can be incorporated into land-use regulations to protect bald eagle habitat. Land-use regulations that allow for flexibility in development design can be used to protect eagle habitat and accomplish other resource protection goals and objectives. Tools such as cluster developments and Planned Unit Developments can be used to allow development that better conforms to the natural features of a site (Ches. Bay Local Assist. Dep. 1989). Clustering development on the less environmentally sensitive portions of a site can result in habitat protection, while maintaining the overall density of the site. Planned Unit Developments are

mixed-use developments that also allow for the design and placement of development to preserve valuable natural features of a site. Since bald eagle habitat is closely associated with other valuable and sensitive natural features, such as wetlands, shorelines, and woodlands, allowing these tools to be used for bald eagle habitat protection will result in a more environmentally acceptable project.

The transfer of development rights (TDR) may also be an effective bald eagle habitat protection tool, but TDR is currently not available to localities in Virginia; state enabling legislation would be required. In a system of development rights transfer, the right to develop a parcel may be prohibited, to protect bald eagle habitat for example, but that right can be transferred to another parcel where development is considered more appropriate. Net density of an area could remain the same while development is clustered in suitable areas and valuable habitat is preserved.

The development site plan review process allows the locality to determine if the landowner or developer has considered and incorporated bald eagle habitat protection in the development plan. At this stage, the locality also has the opportunity to consult with the VDGIF Nongame and Endangered Species Program and Environmental Services Section to identify bald eagle and other environmental issues that could impact the project design.

Zoning regulations should include requirements that wildlife inventories, in addition to other natural resource inventories, be conducted on the properties proposed for development; bald eagle and other threatened and endangered species habitat may be discovered during the inventory stage. Failure to identify and incorporate bald eagle habitat at this initial stage could result in project delays resulting from denial of federal, state or

local permits (see Legal and Management Responsibility section). The plan review process also allows the locality to ensure that the developer is aware of and has incorporated zoning restrictions intended to protect eagle habitat, such as building densities or time of year restrictions on construction.

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Barnett, T. 1989. Role of conservation easements in raptor habitat protection. Pages 194-196 in Proc. northeast raptor management symposium and workshop. Natl. Wildl. Fed., Washington, D.C.

Chesapeake Bay Local Assistance Department. 1989. Local assistance manual: a guide for the development of local programs in order to comply with the Chesapeake Bay Preservation Act. Ches. Bay Local Assist. Dep. Richmond, VA. 449 pp.

Cline, K. W. 1993. Bald Eagle Nest Management in Virginia: Planning Document. Virginia Department of Game and Inland Fisheries, Agency Document. Va. Dept. Game and Inland Fish., Richmond, Va. 66 pp.

White, D. 1990. Conserving wildlife habitat through comprehensive land-use planning. Pages 165-170 in Southeast raptor management symposium and workshop. Natl. Wildl. Fed. Washington, D.C.

CONSERVATION AGENCIES AND ORGANIZATIONS

Organization	Address	Phone
Federal		
U.S. Fish and Wildlife Service	Field Office Ecological Services P.O. Box 480 White Marsh, VA 23183	804-693-6694
U.S. Army Corp. of Engineers	District Office 803 Front Street Norfolk, VA 23510	804-441-7650
State		
Va. Dept. of Game and Inland Fisheries	Nongame and Endangered Species Program P.O. Box 11104 Richmond, VA 23230-1104	804-367-6913
	Fish & Wildl.Info. Syst. Biota of Va. Database P.O. Box 11104 Richmond, VA 23230-1104	804-367-8351
Va. Div. of Natural Heritage	Va. Dept. Conservation and Recreation 1500 East Main St. Suite 312 Richmond, VA 23219	804-786-7951
Va. Dept. Environ. Quality	629 East Main St. Richmond, VA 23219	804-762-4000
Chesapeake Bay Local Assistance Dept.	805 East Broad St. Suite 701 Richmond, VA 23219	800-243-7229
Va. Outdoors Foundation	221 Governor St. Richmond, VA 23219	804-786-5539

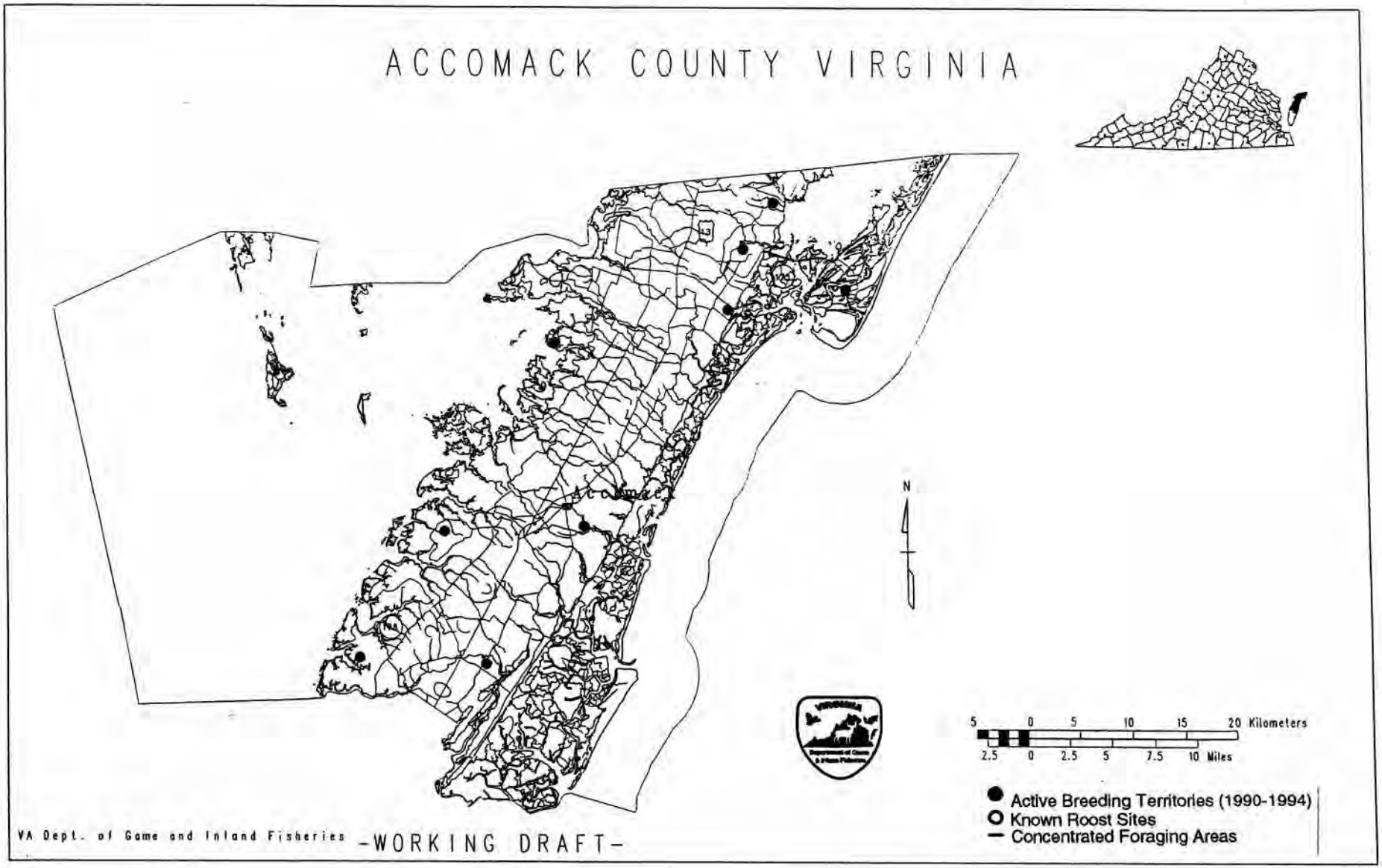
Nonprofit

The Chesapeake Bay Foundation, Inc.	Va. Land Coordinator 1001 East Main St. Suite 815 Richmond, VA 23219	804-780-1392
The Nature Conservancy	Virginia Chapter 1110 Rose Hill Dr. Suite 200 Charlottesville, VA 22903	804-295-6106

APPENDIX I:

Map or maps of bald eagle activity areas (information through 1994)

BALD EAGLE ACTIVITY AREAS



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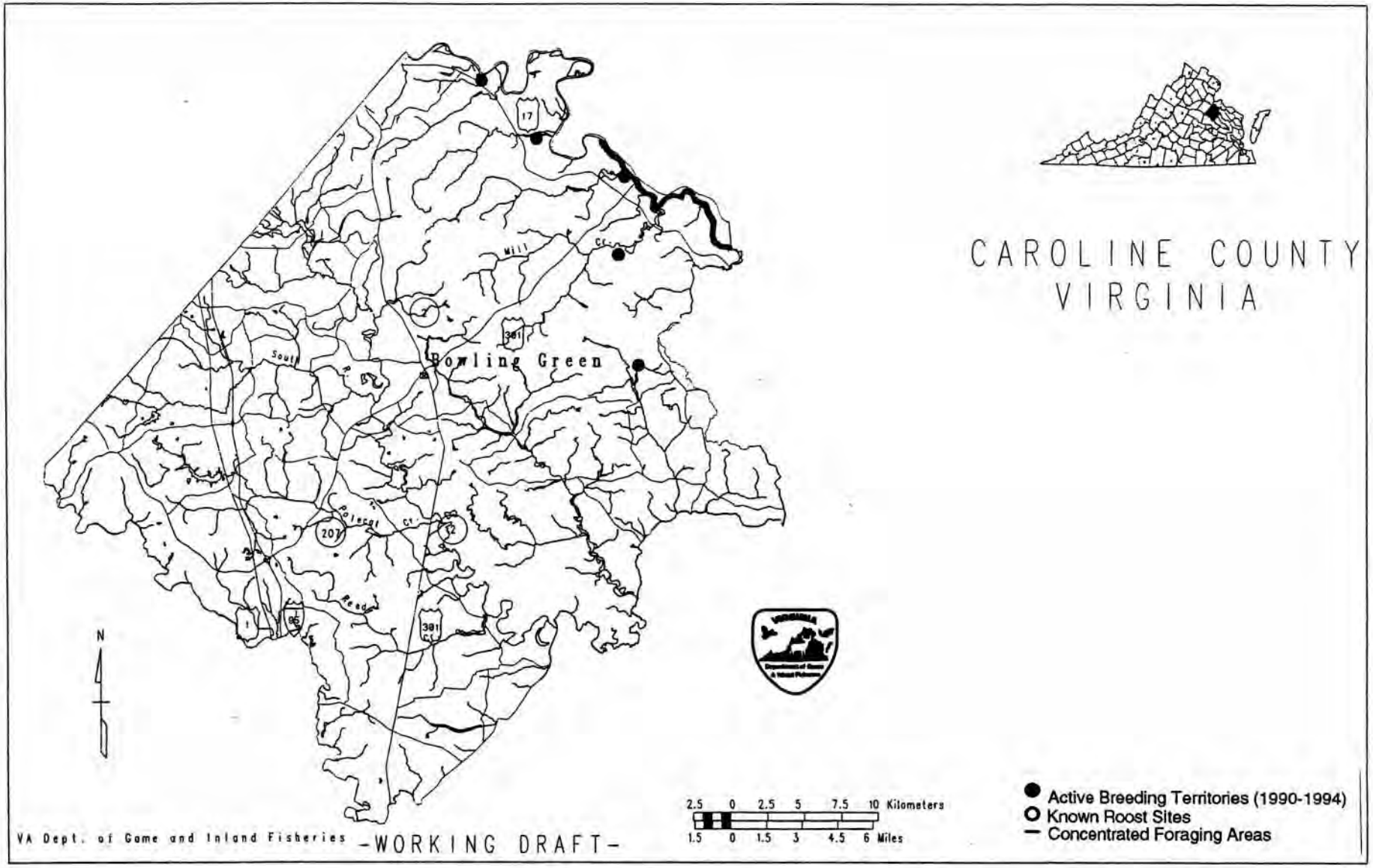

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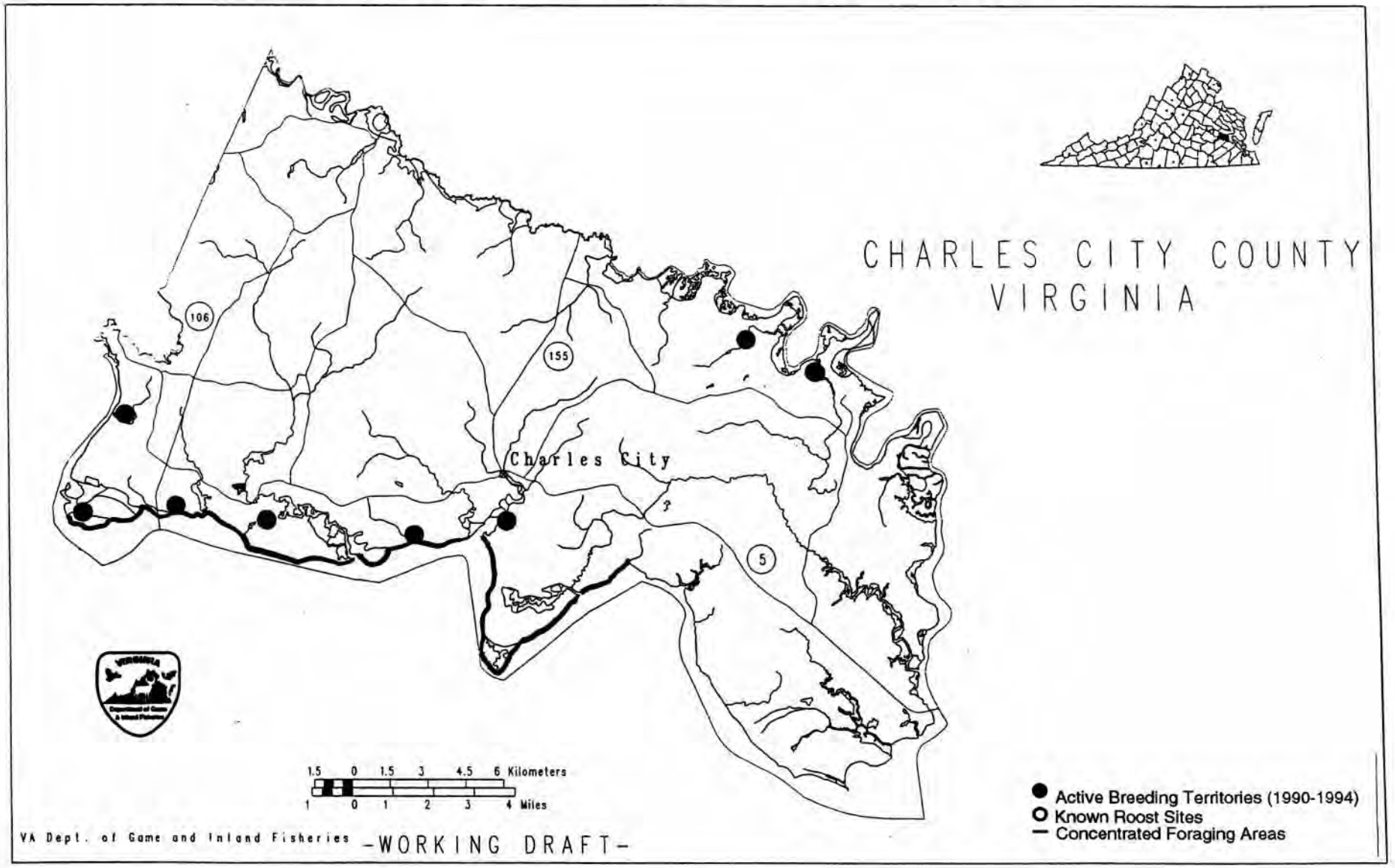

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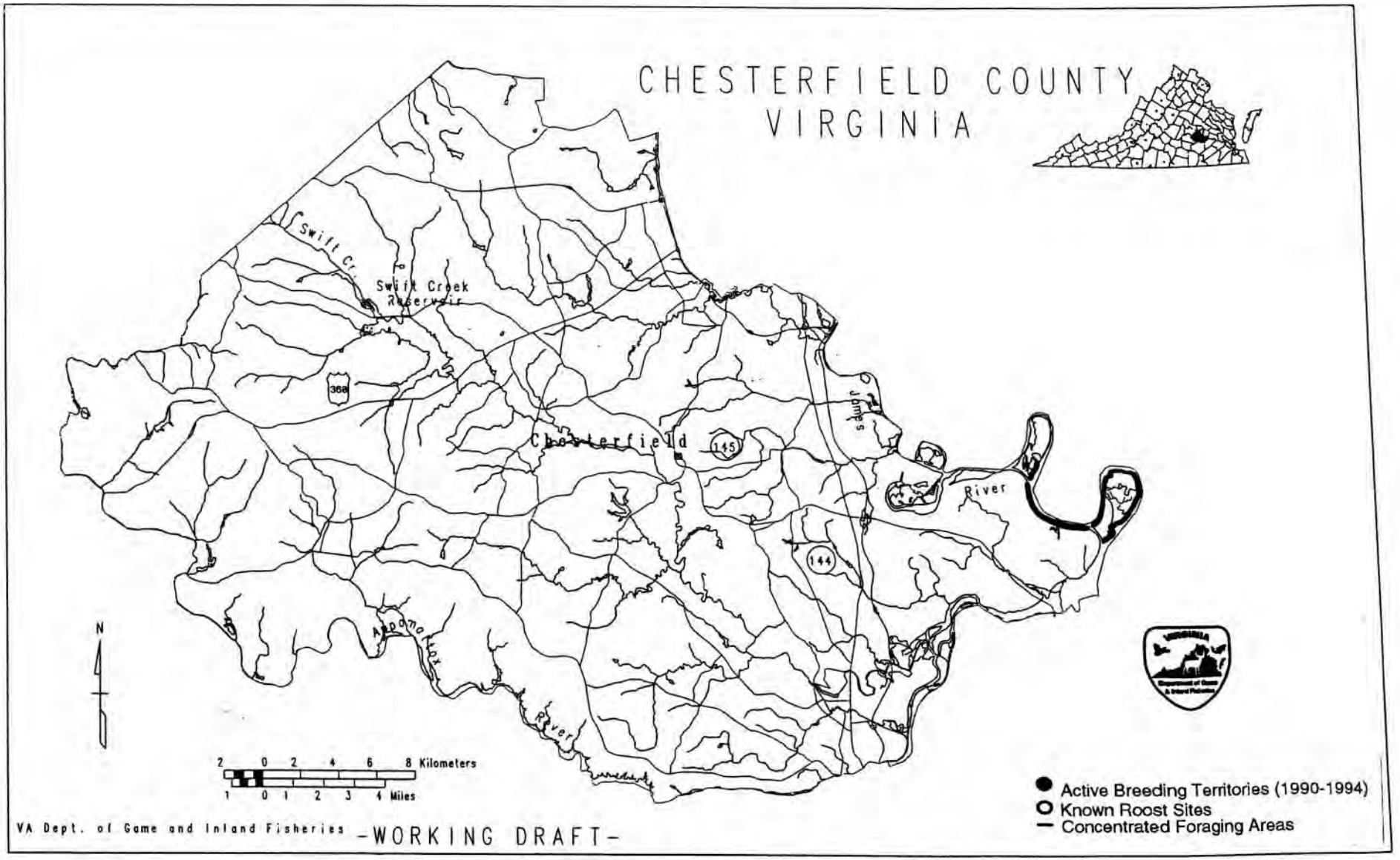

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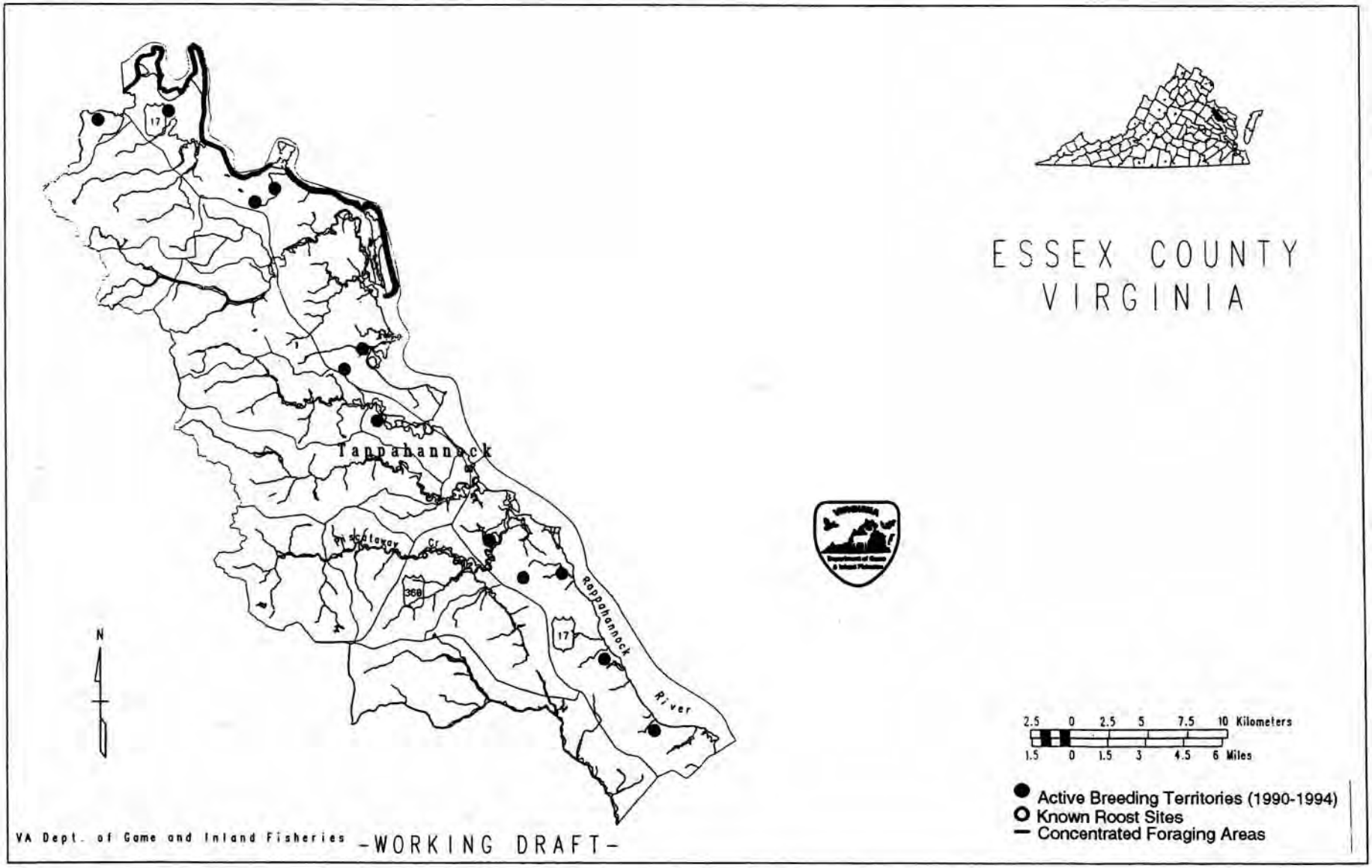

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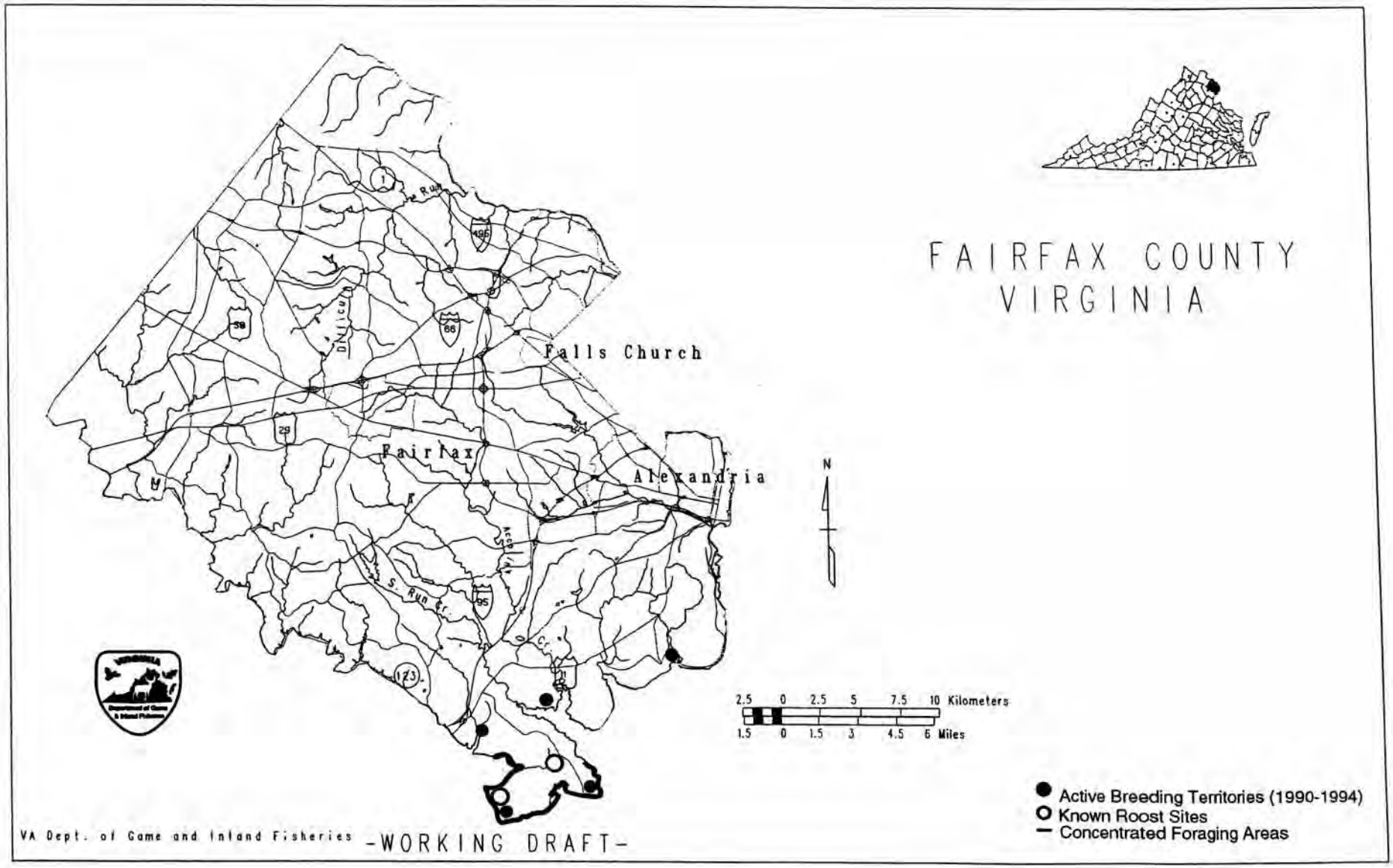

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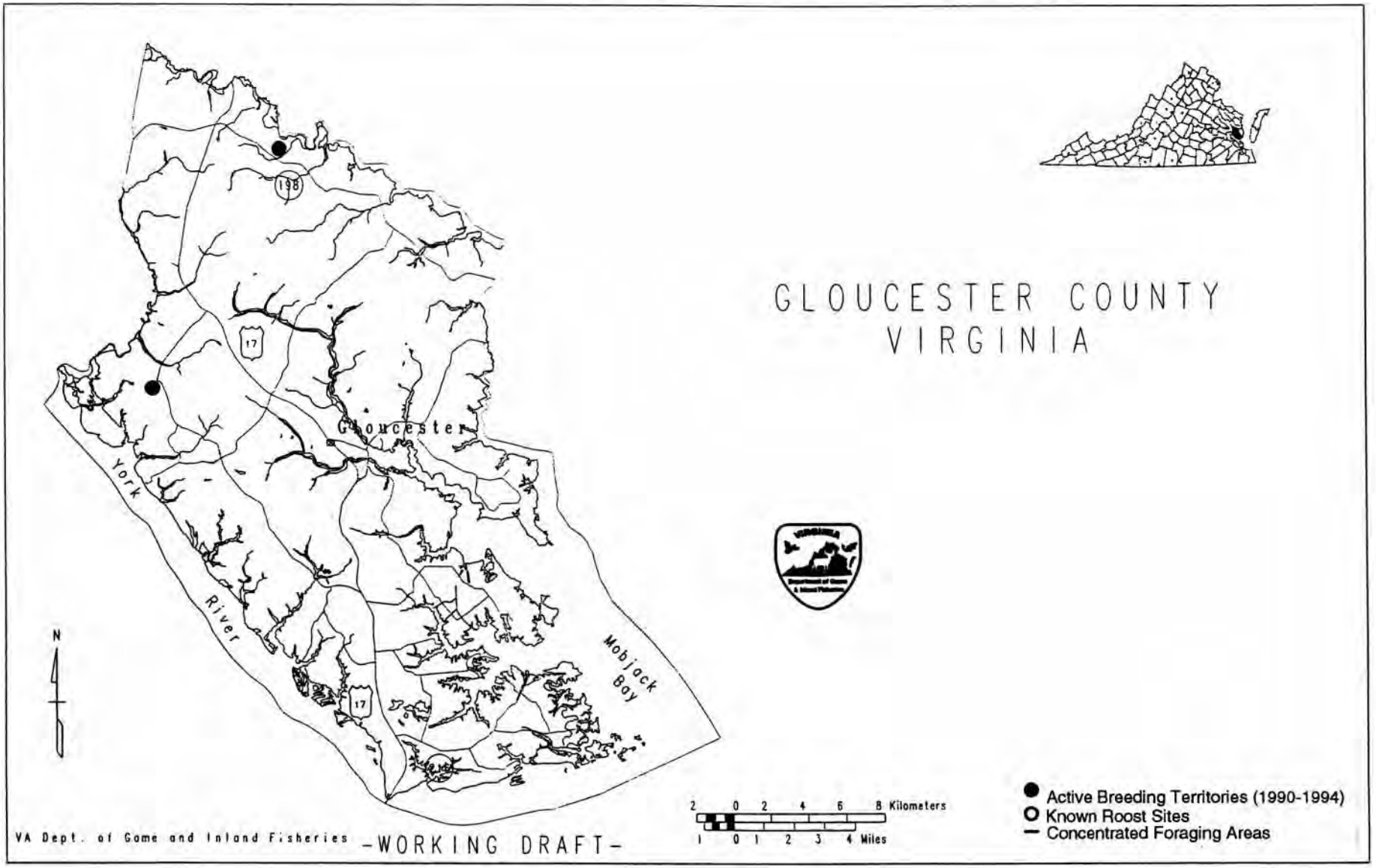
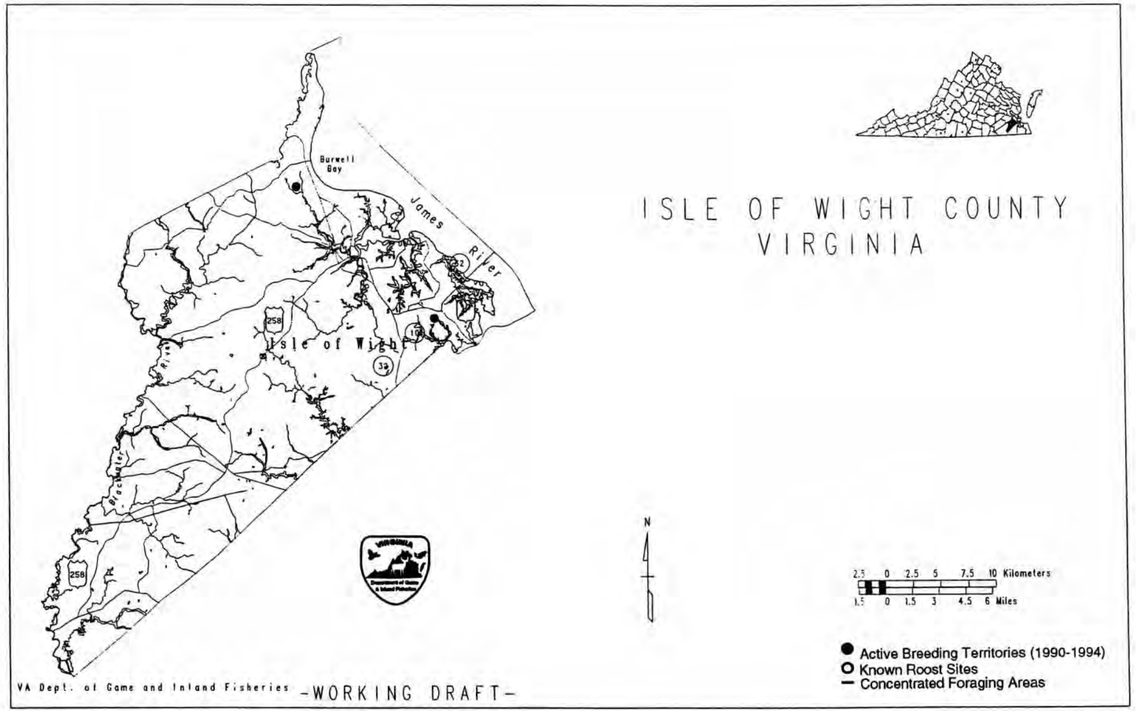
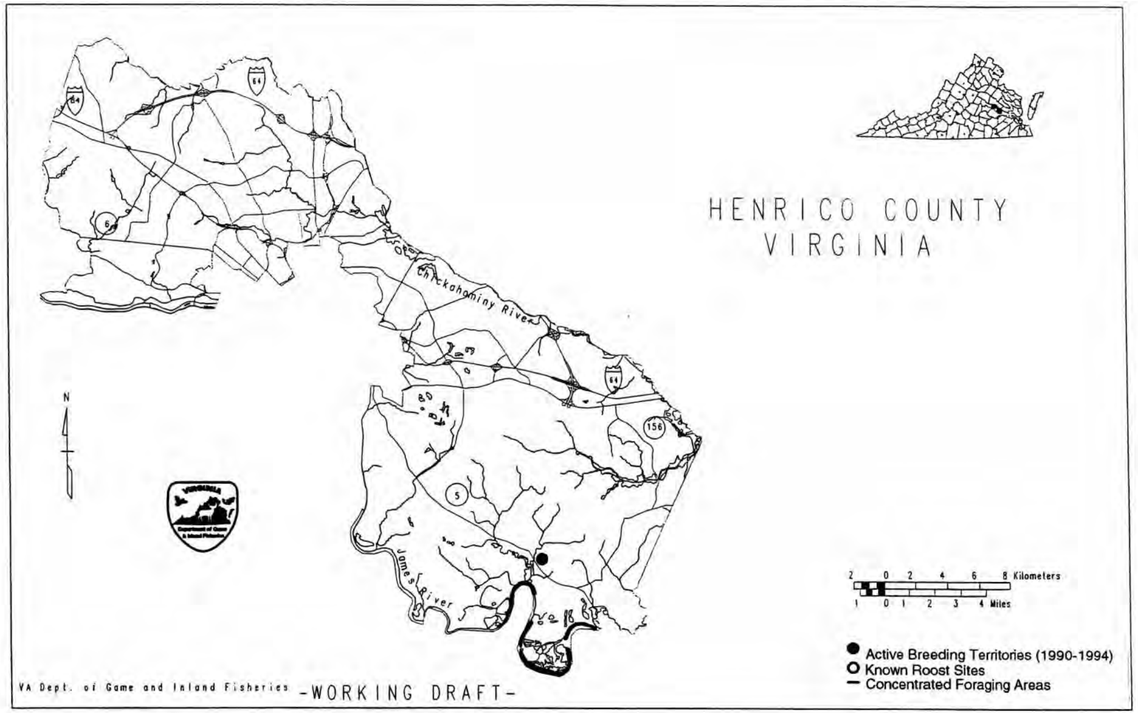


BALD EAGLE ACTIVITY AREAS



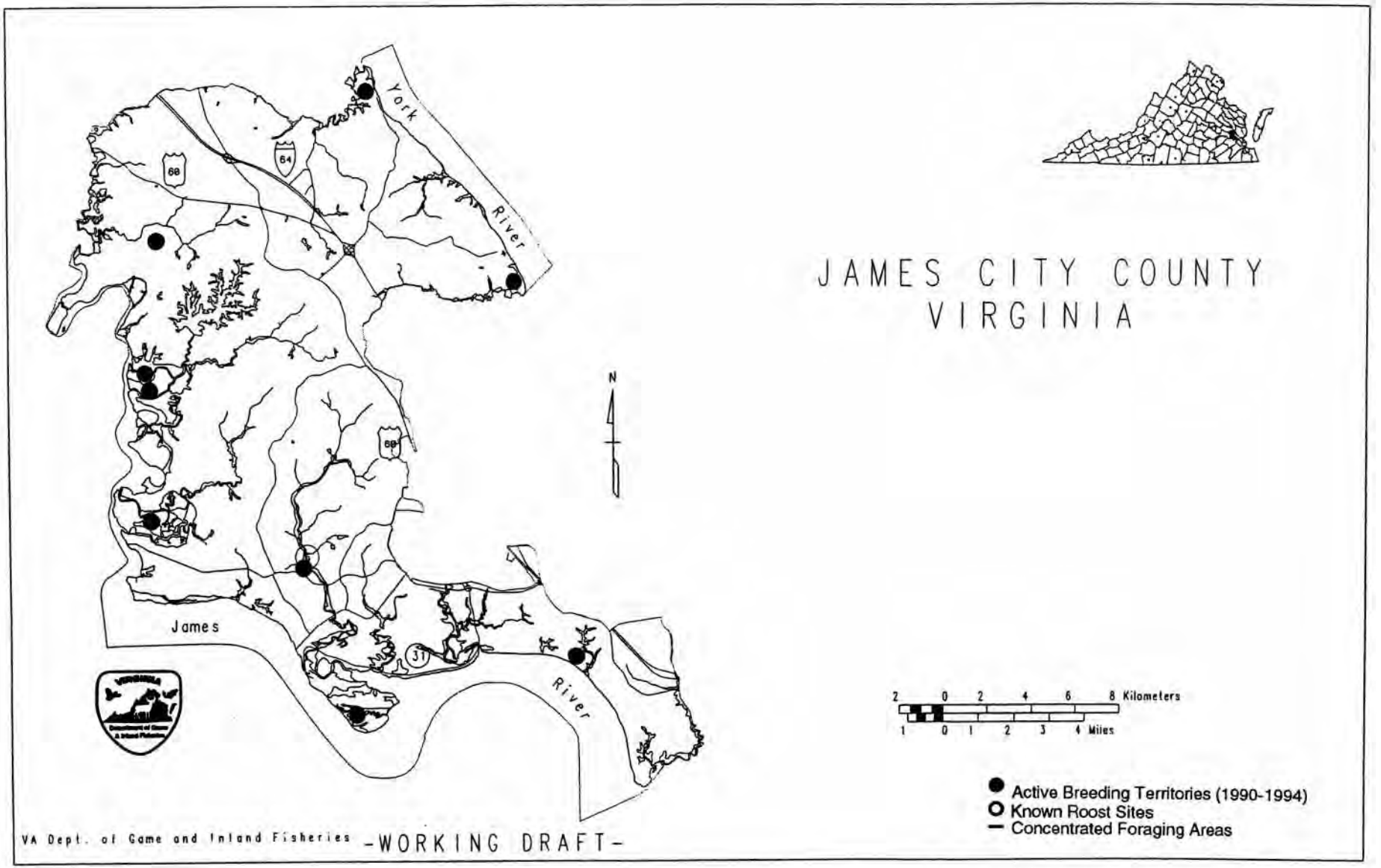
ISLE OF WIGHT COUNTY
VIRGINIA

BALD EAGLE ACTIVITY AREAS



HENRICO COUNTY
VIRGINIA

BALD EAGLE ACTIVITY AREAS



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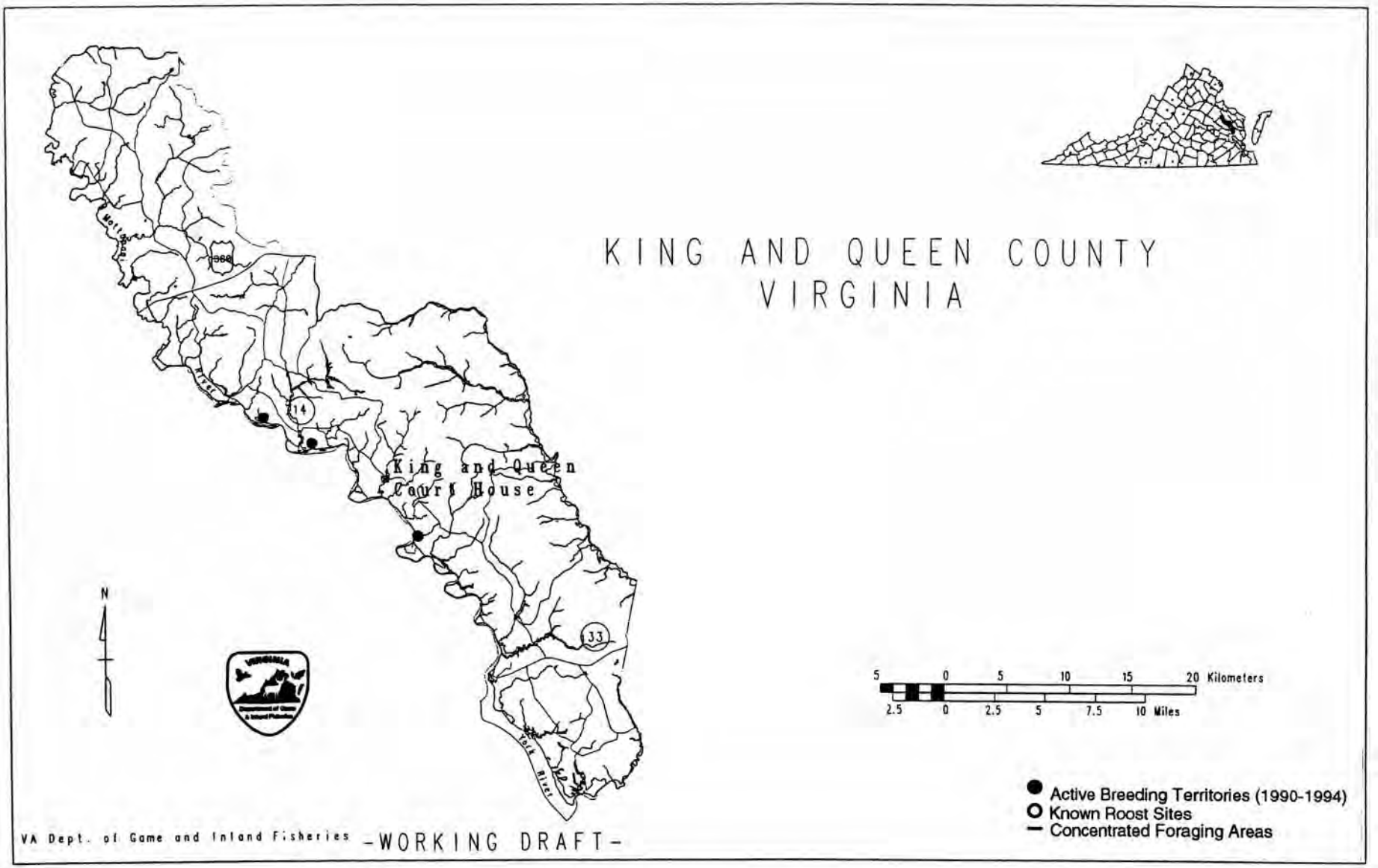

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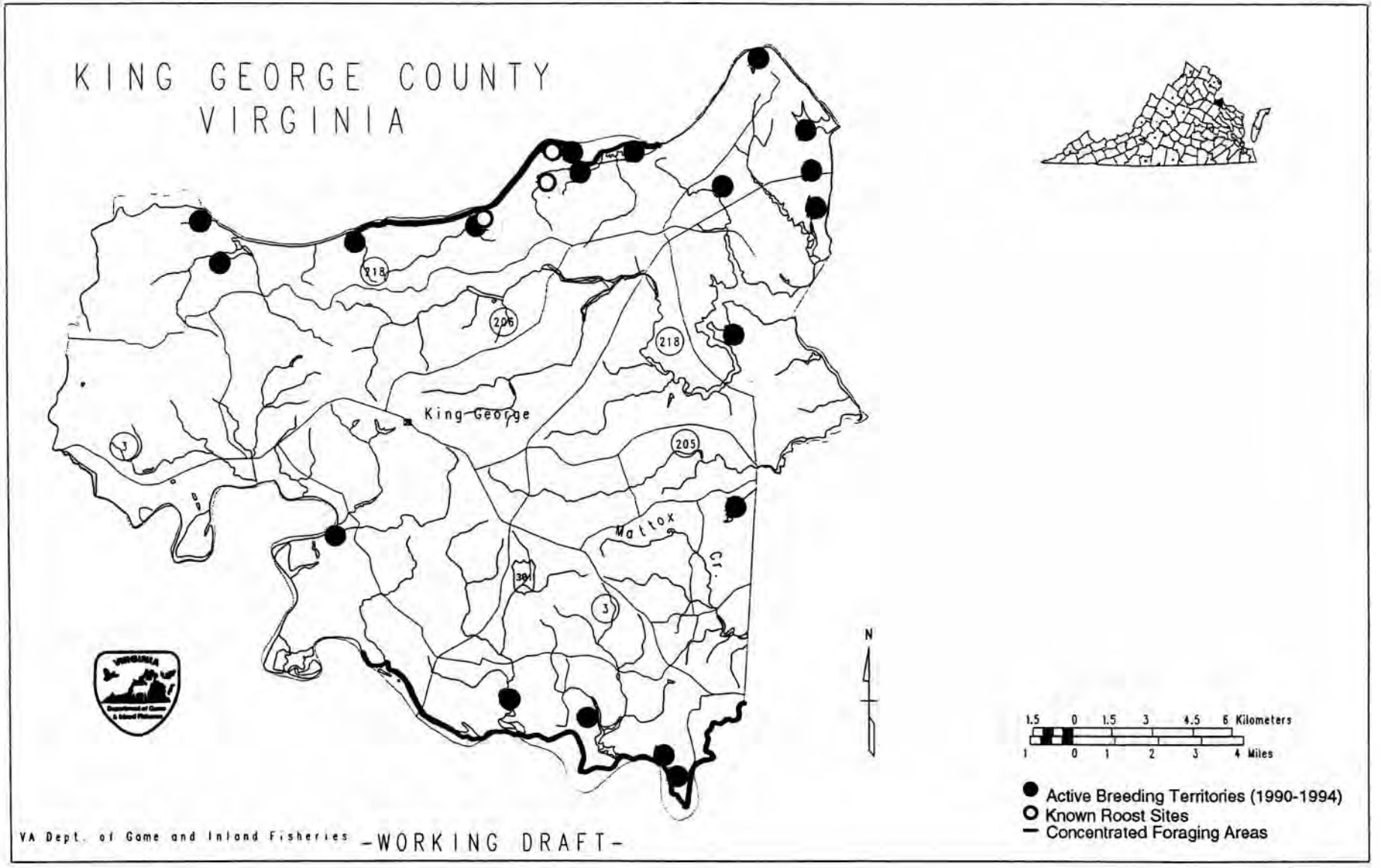

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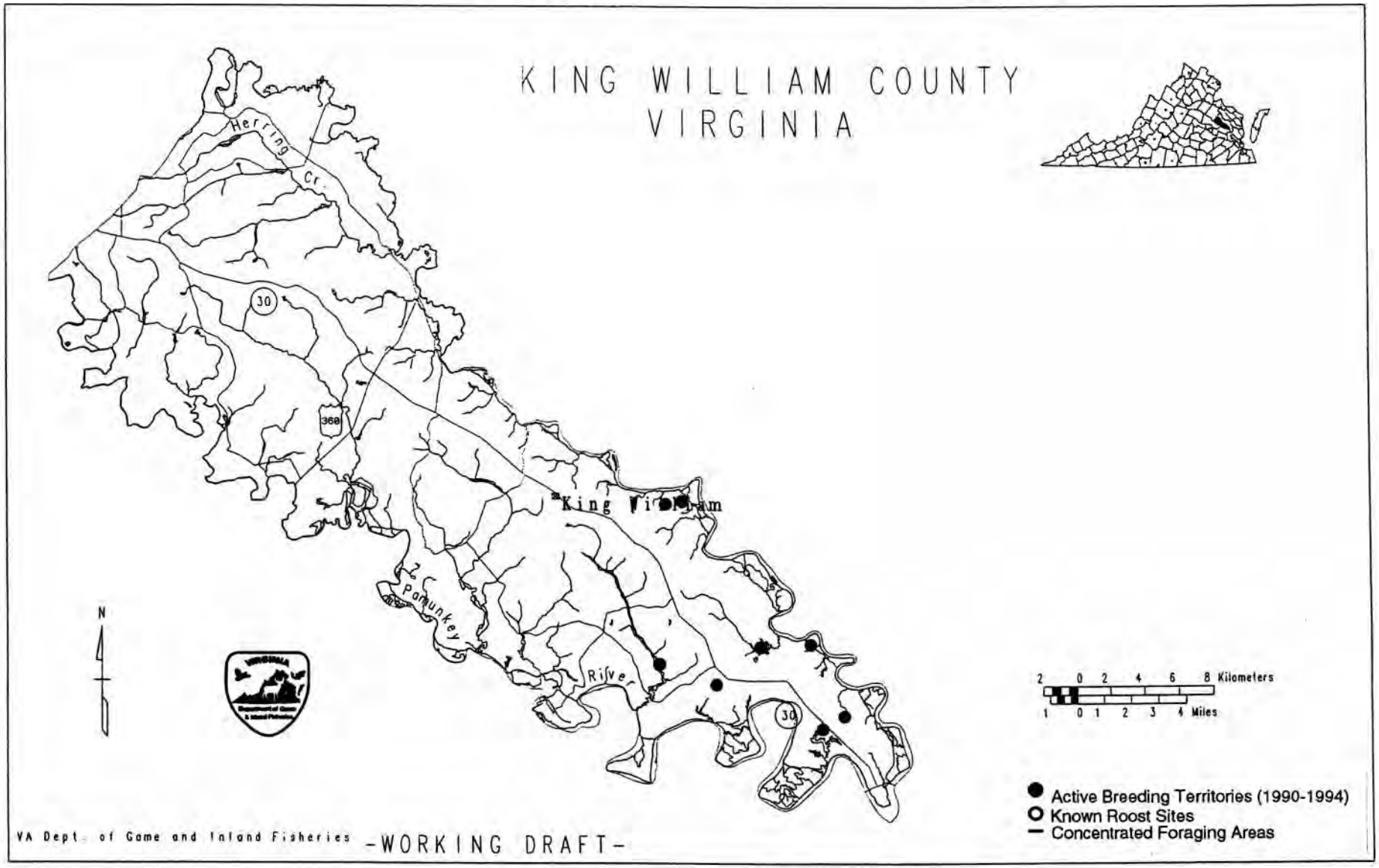

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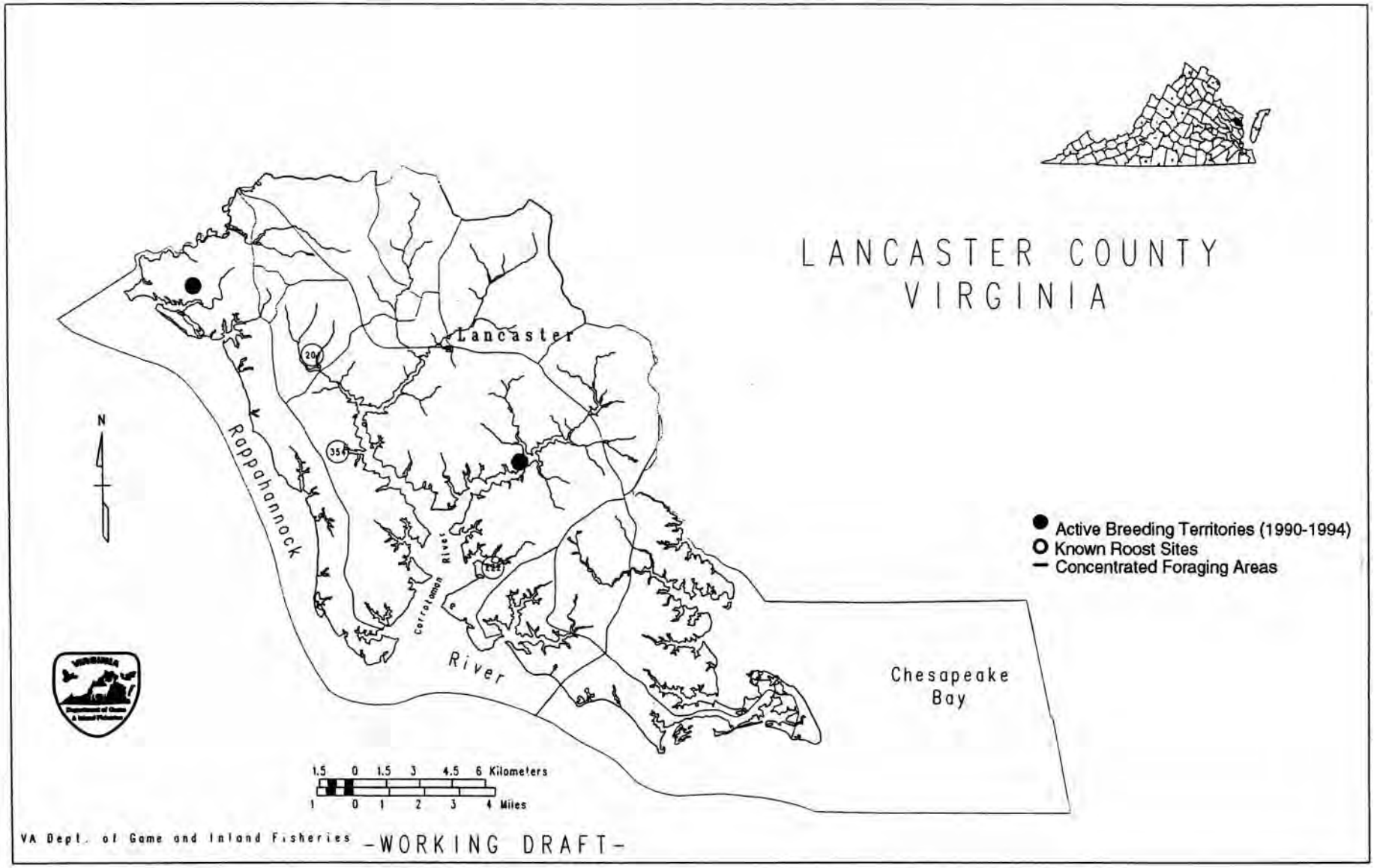

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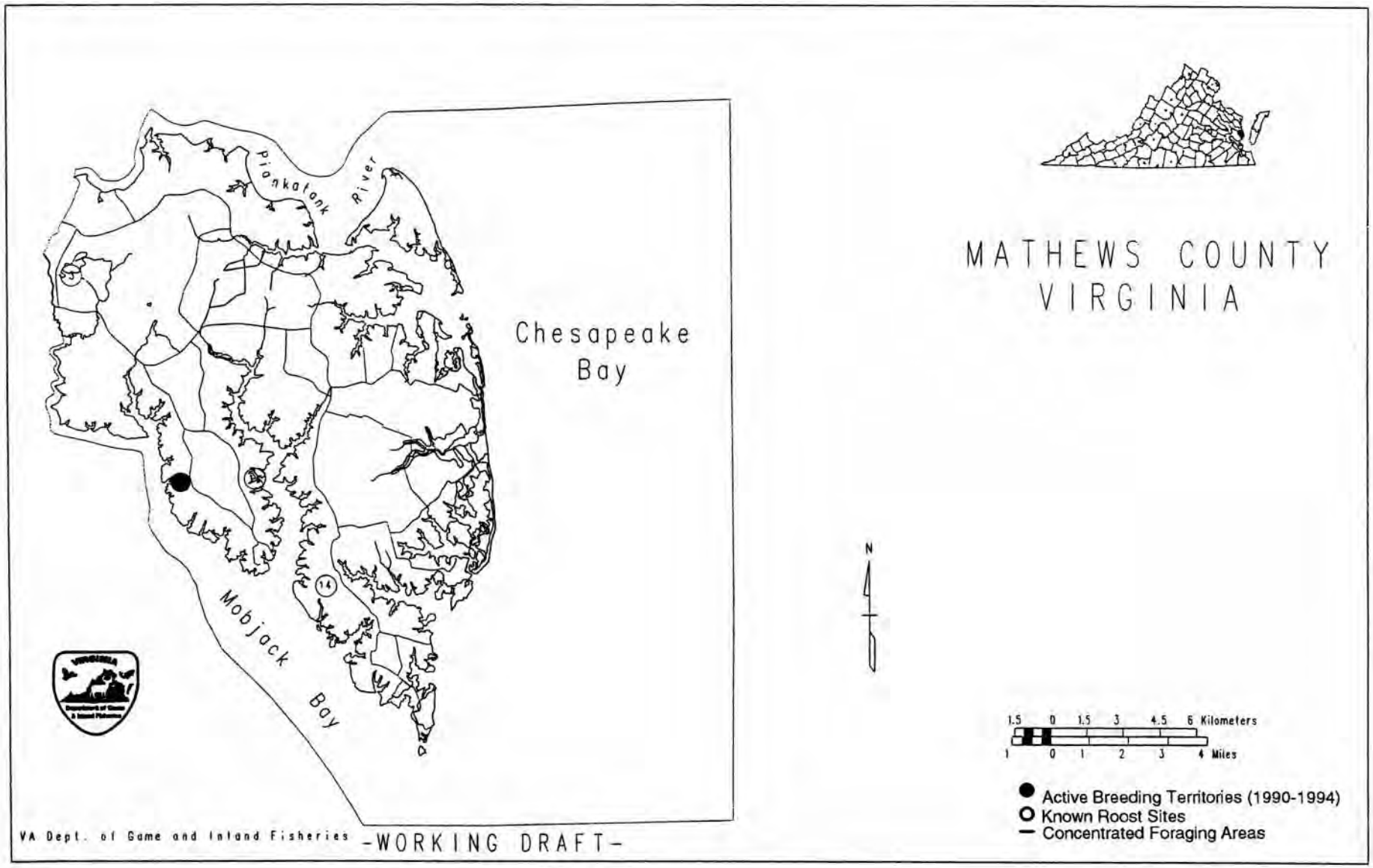

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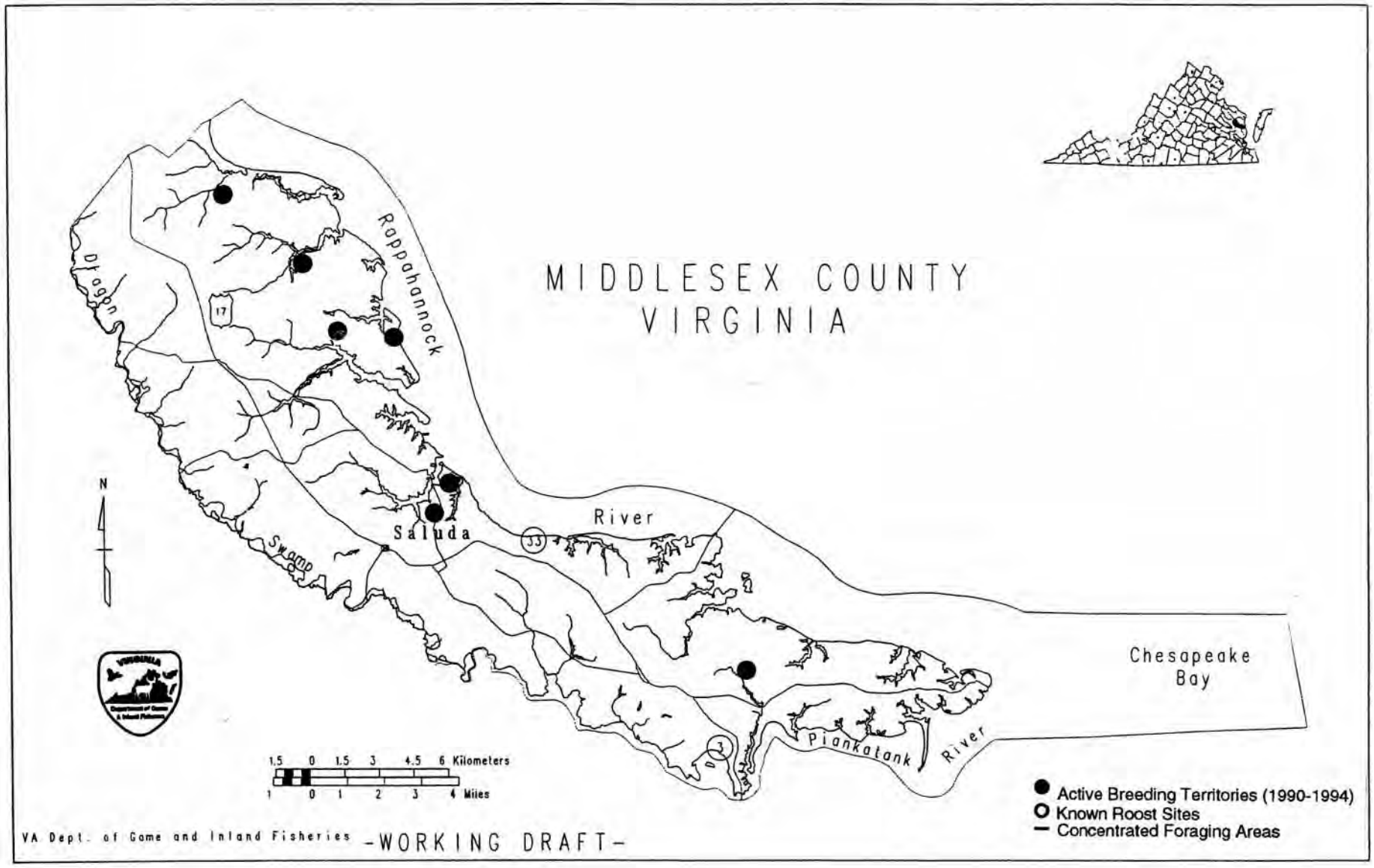

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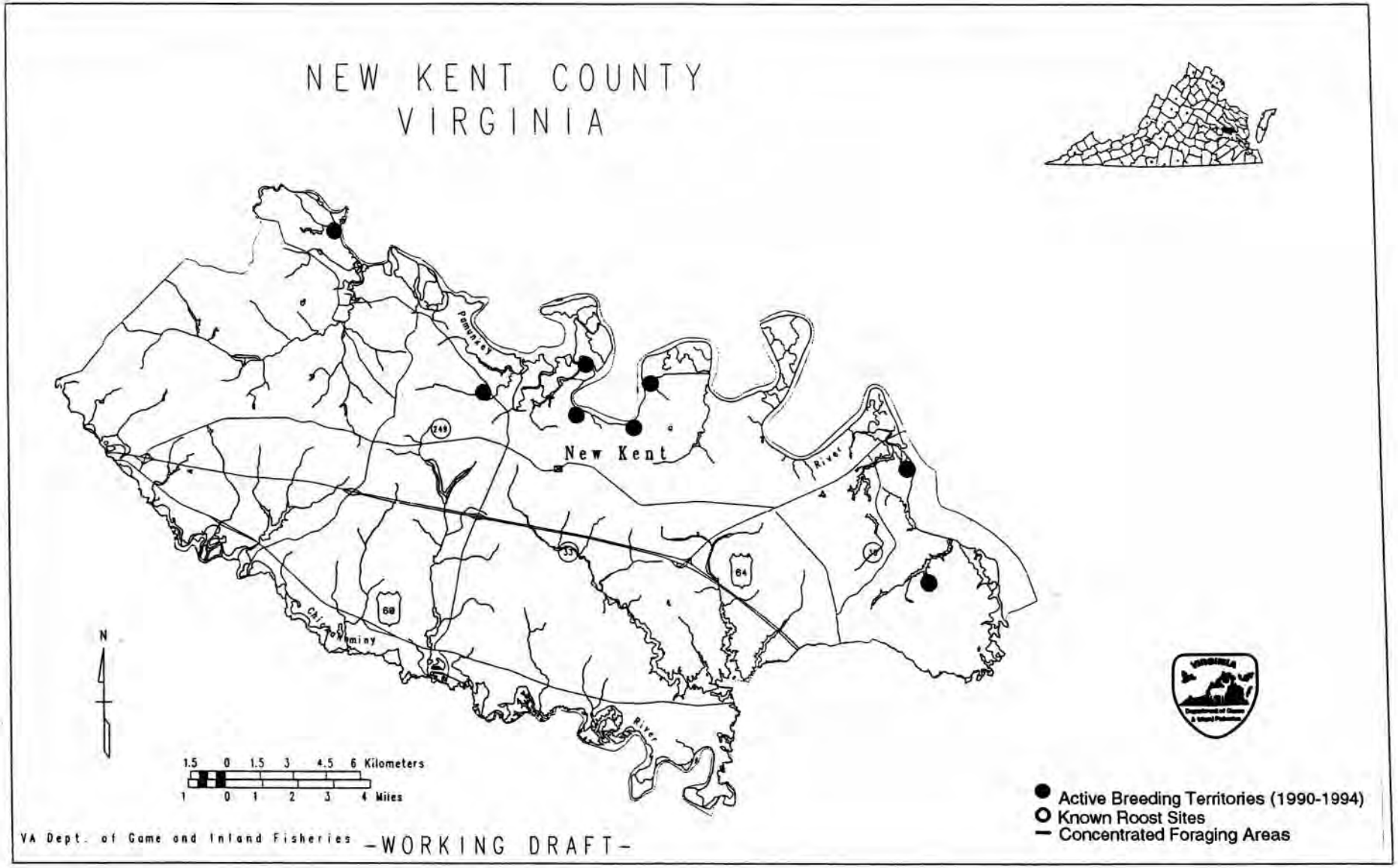

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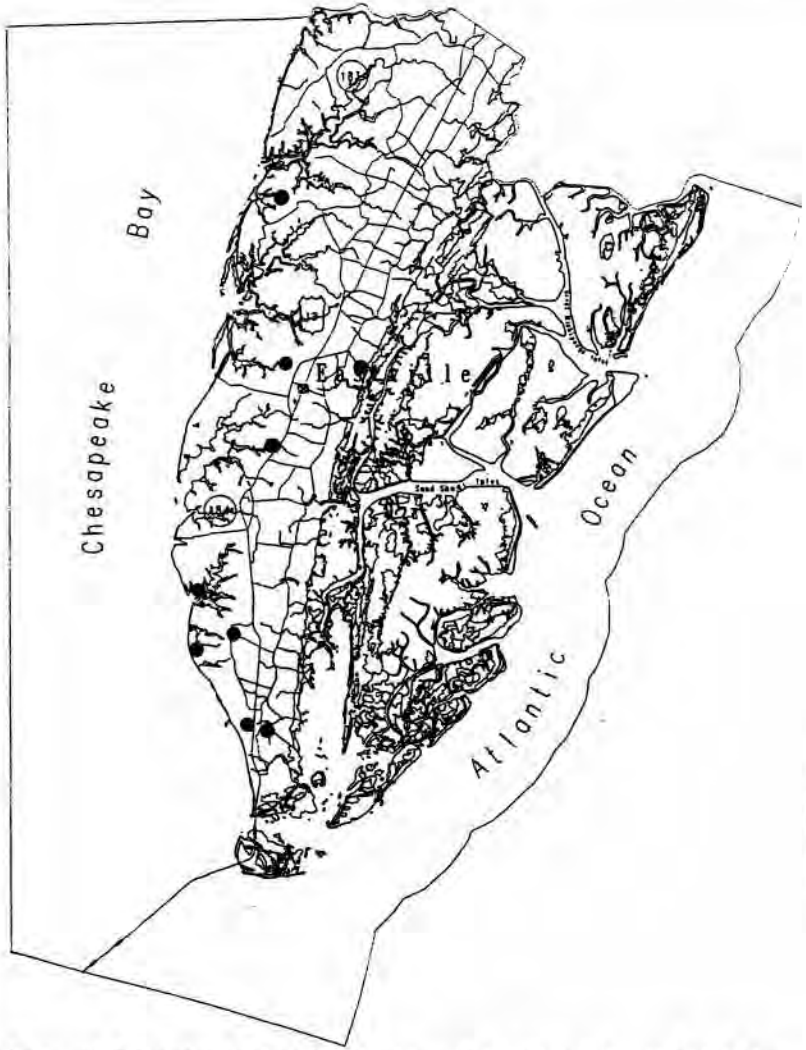


NORTHAMPTON COUNTY
VIRGINIA

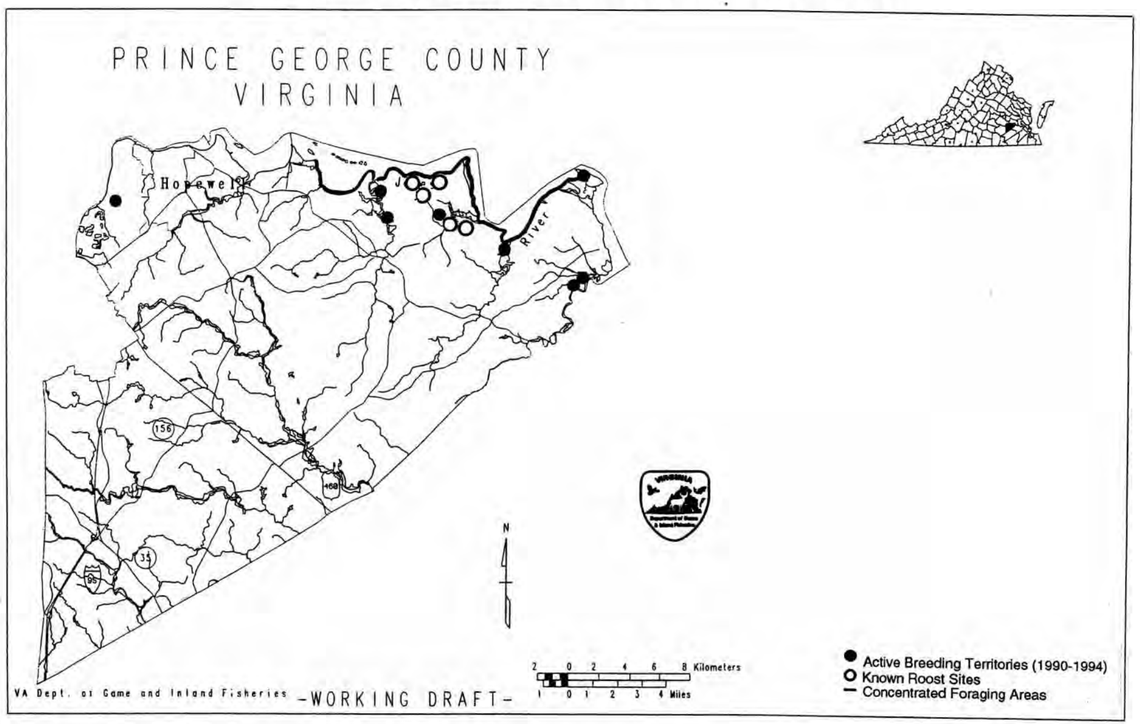
N

5 0 5 10 15 20 Kilometers
2.5 0 2.5 5 7.5 10 Miles

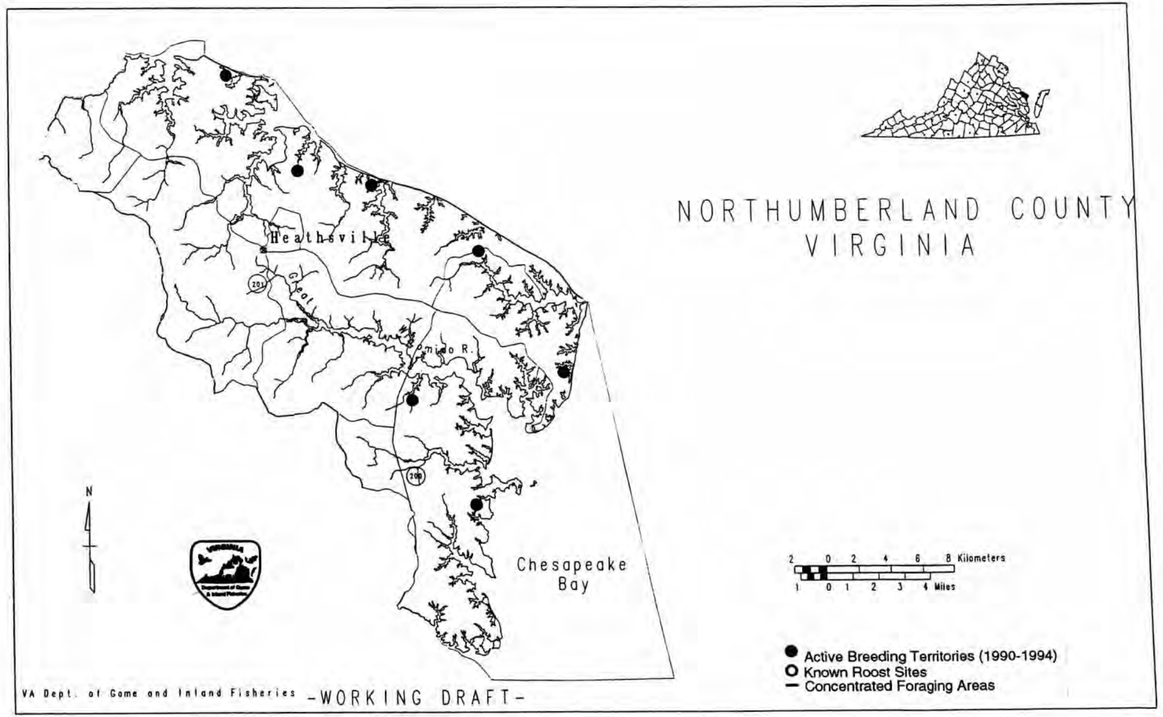
- Active Breeding Territories (1990-1994)
- Known Roost Sites
- Concentrated Foraging Areas

VA Dept. of Game and Inland Fisheries -WORKING DRAFT-

BALD EAGLE ACTIVITY AREAS



BALD EAGLE ACTIVITY AREAS



BALD EAGLE ACTIVITY AREAS

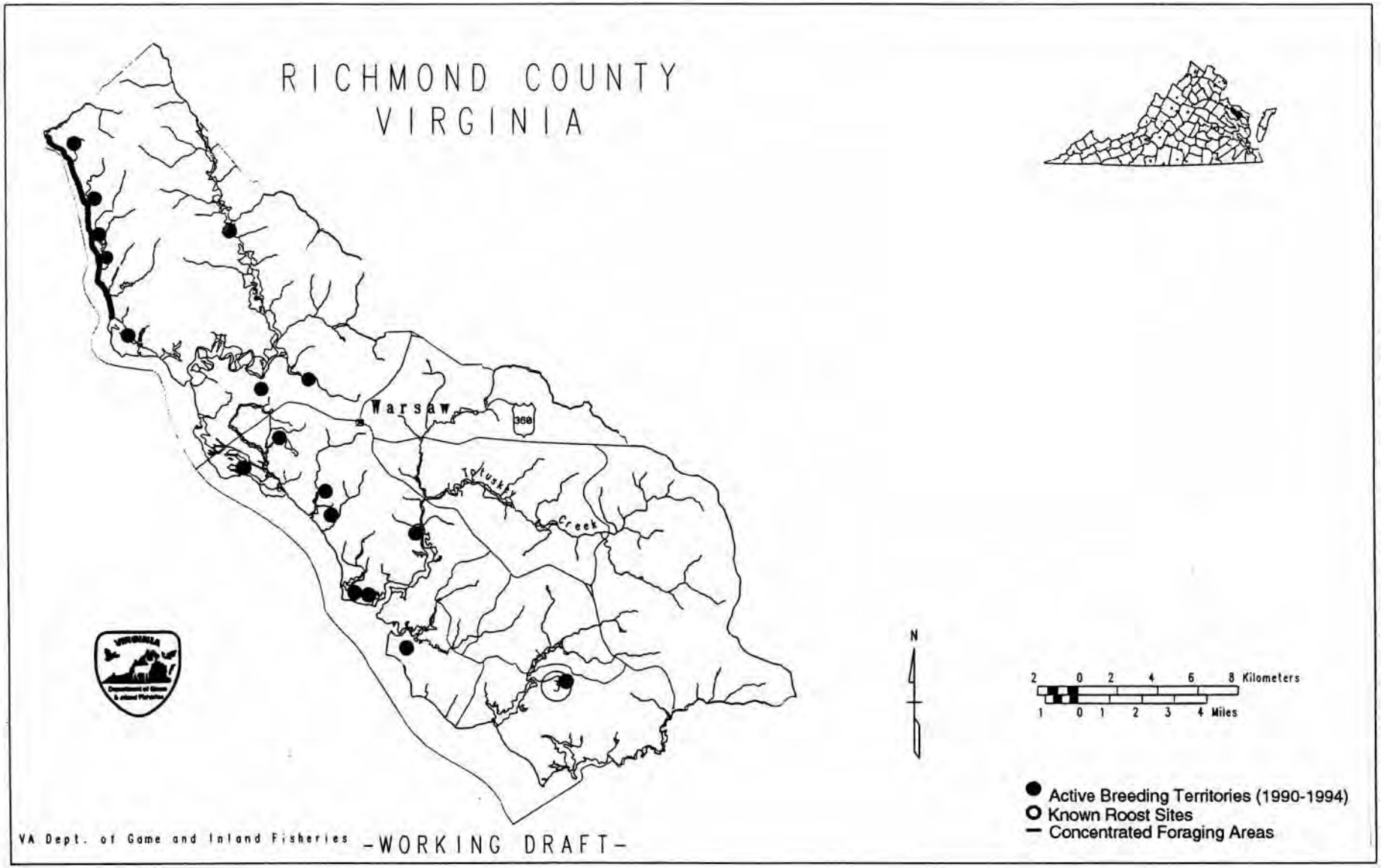
PRINCE WILLIAM COUNTY
VIRGINIA

2.5 0 2.5 5 7.5 10 Kilometers
1.5 0 1.5 3 4.5 6 Miles

- Active Breeding Territories (1990-1994)
- Known Roost Sites
- Concentrated Foraging Areas

VA Dept. of Game and Inland Fisheries -WORKING DRAFT-

BALD EAGLE ACTIVITY AREAS



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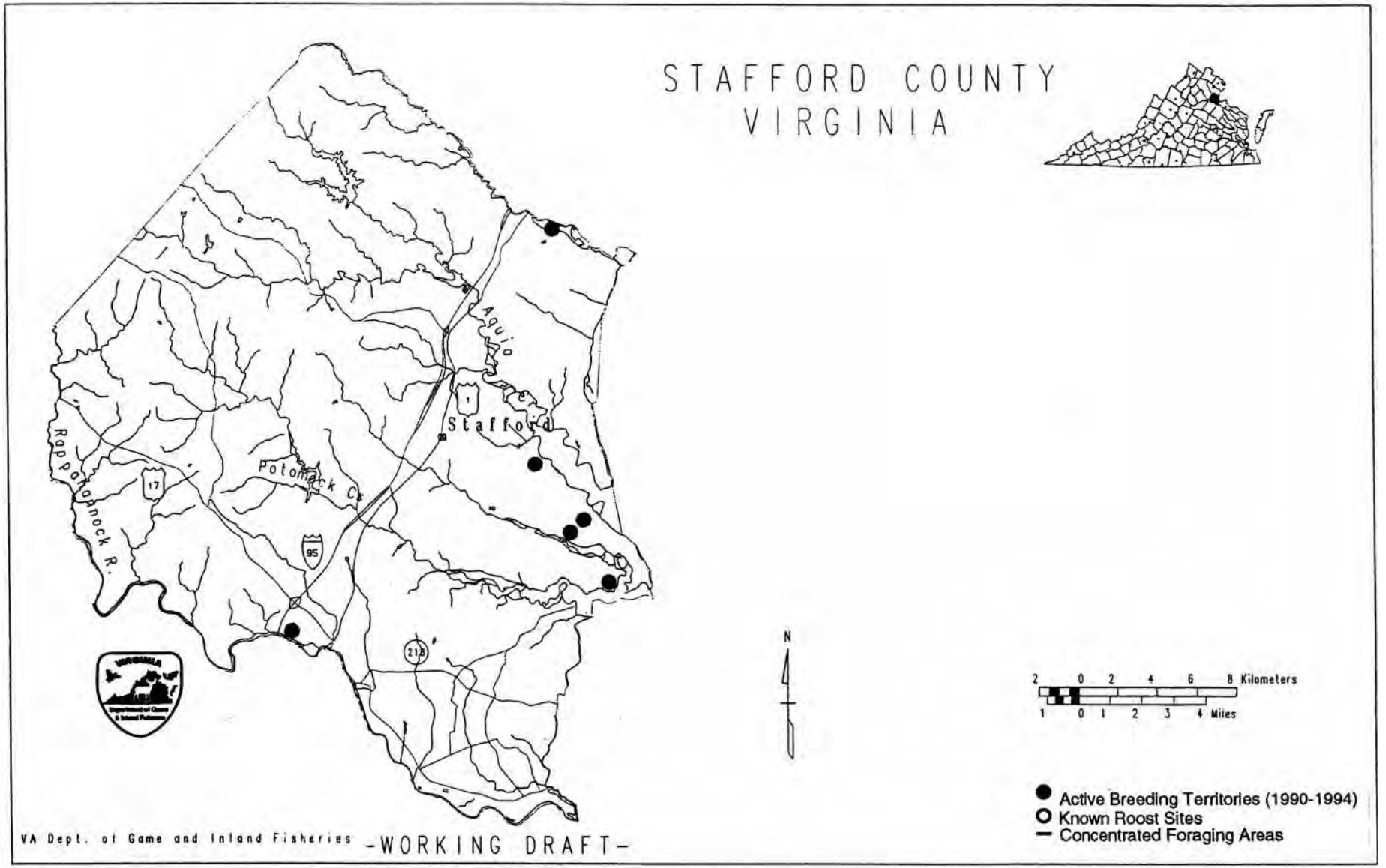

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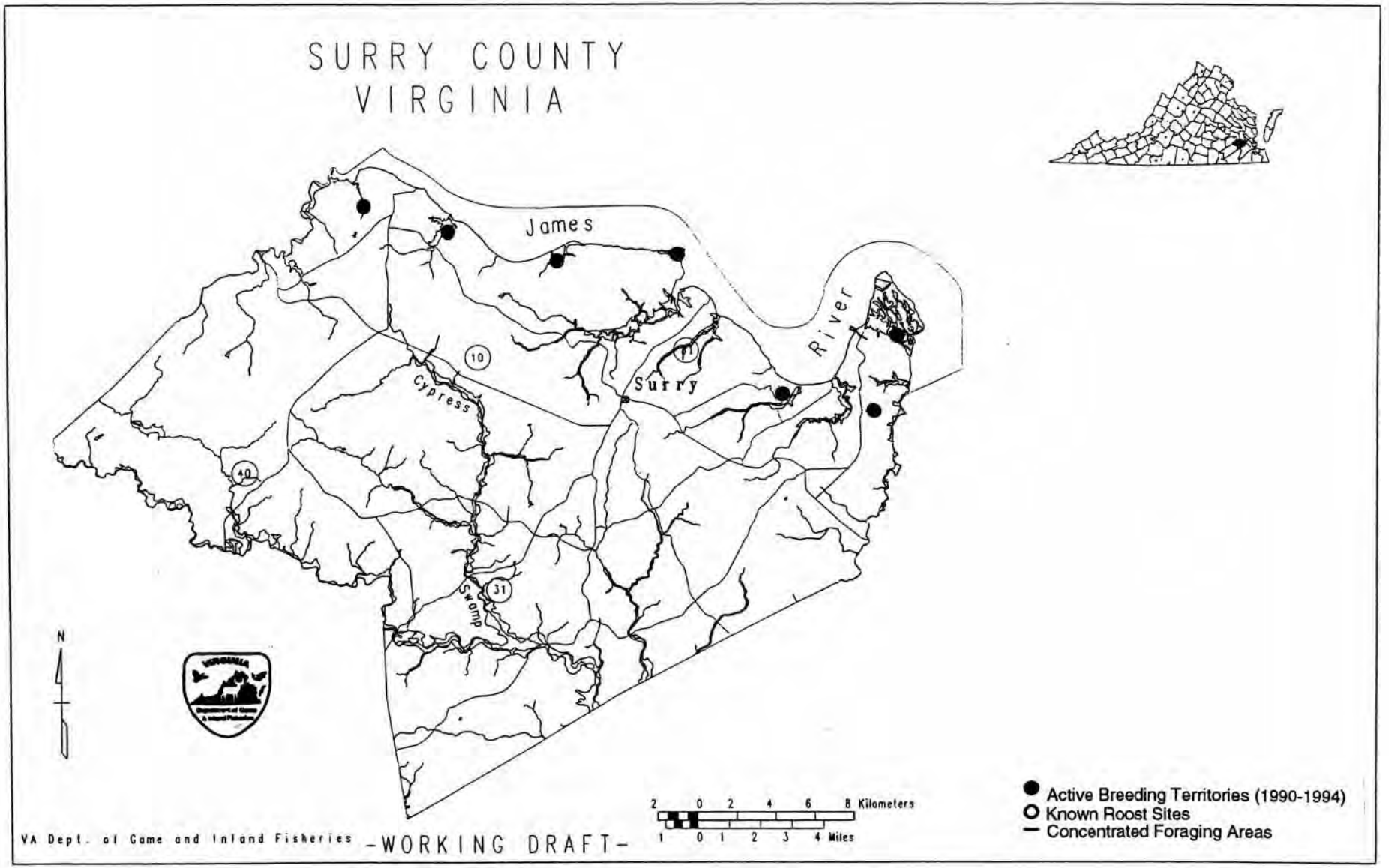

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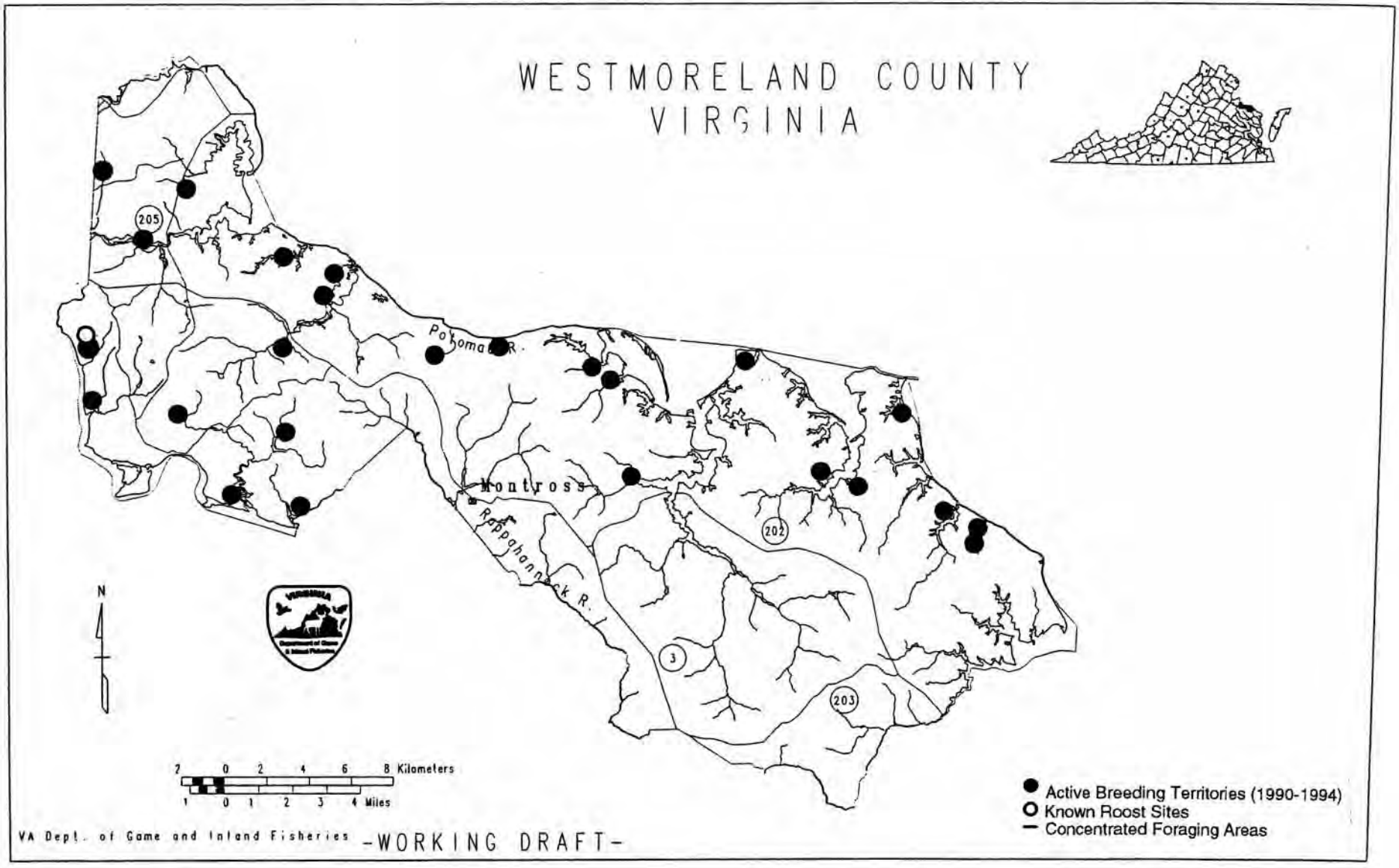

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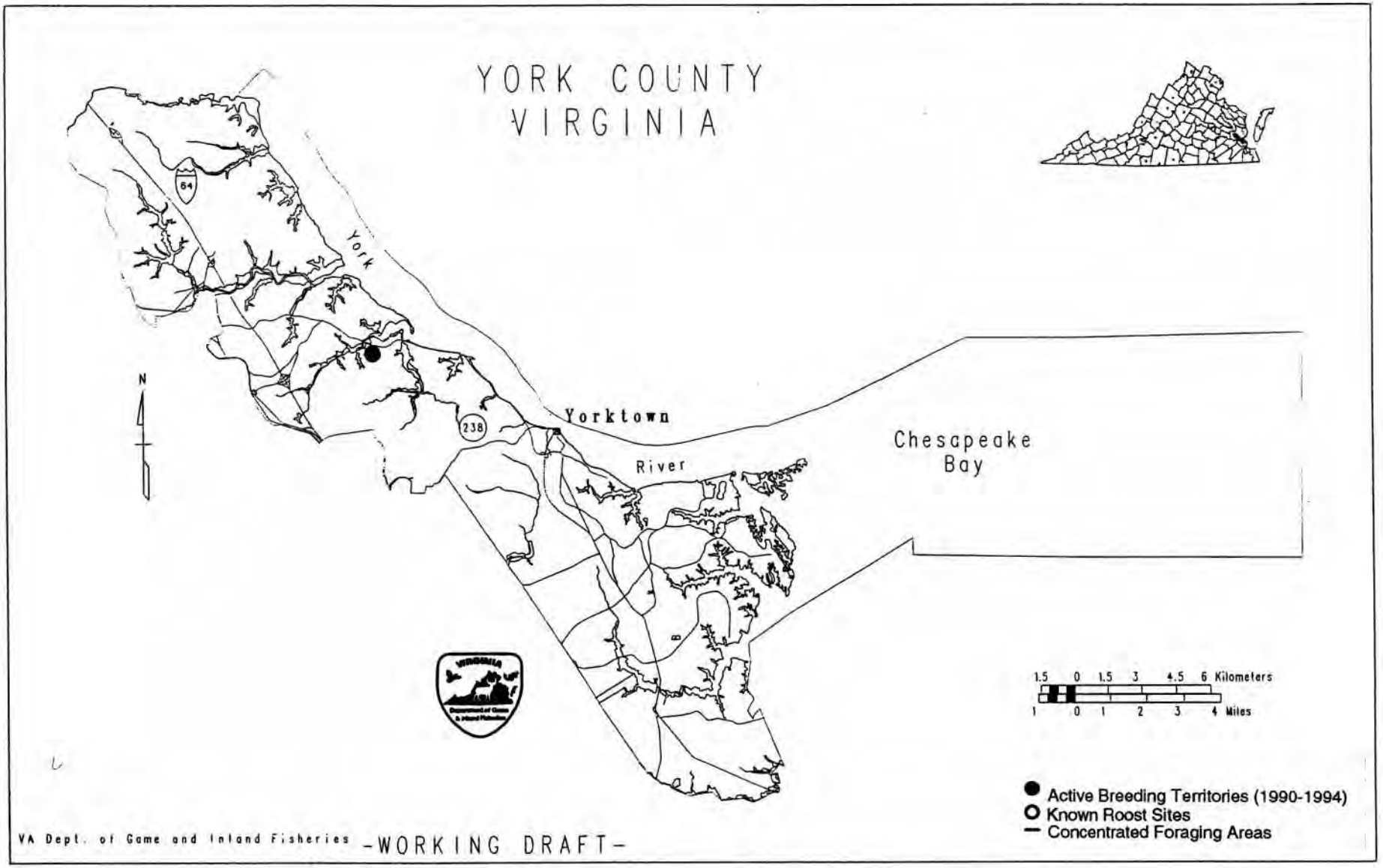

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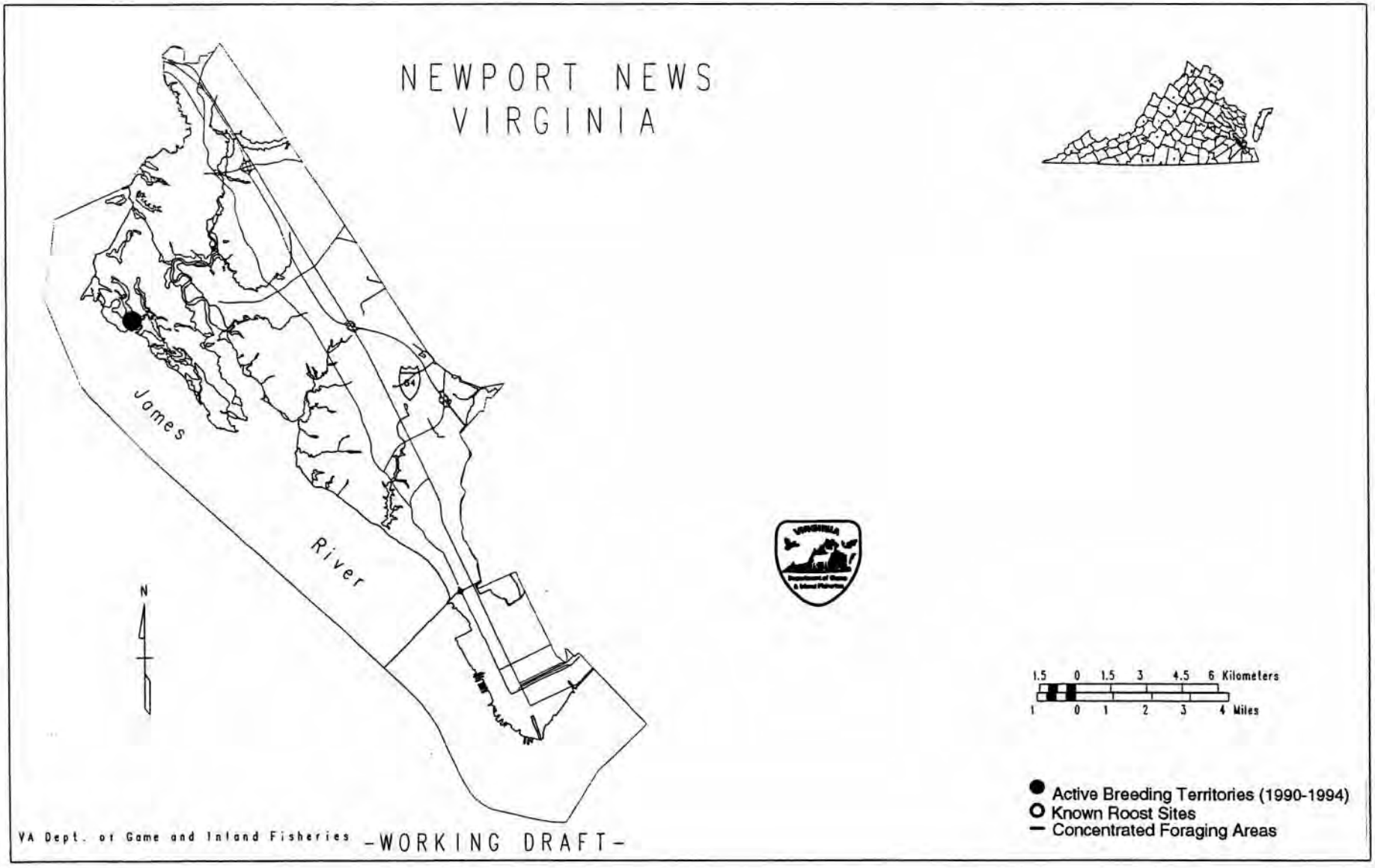

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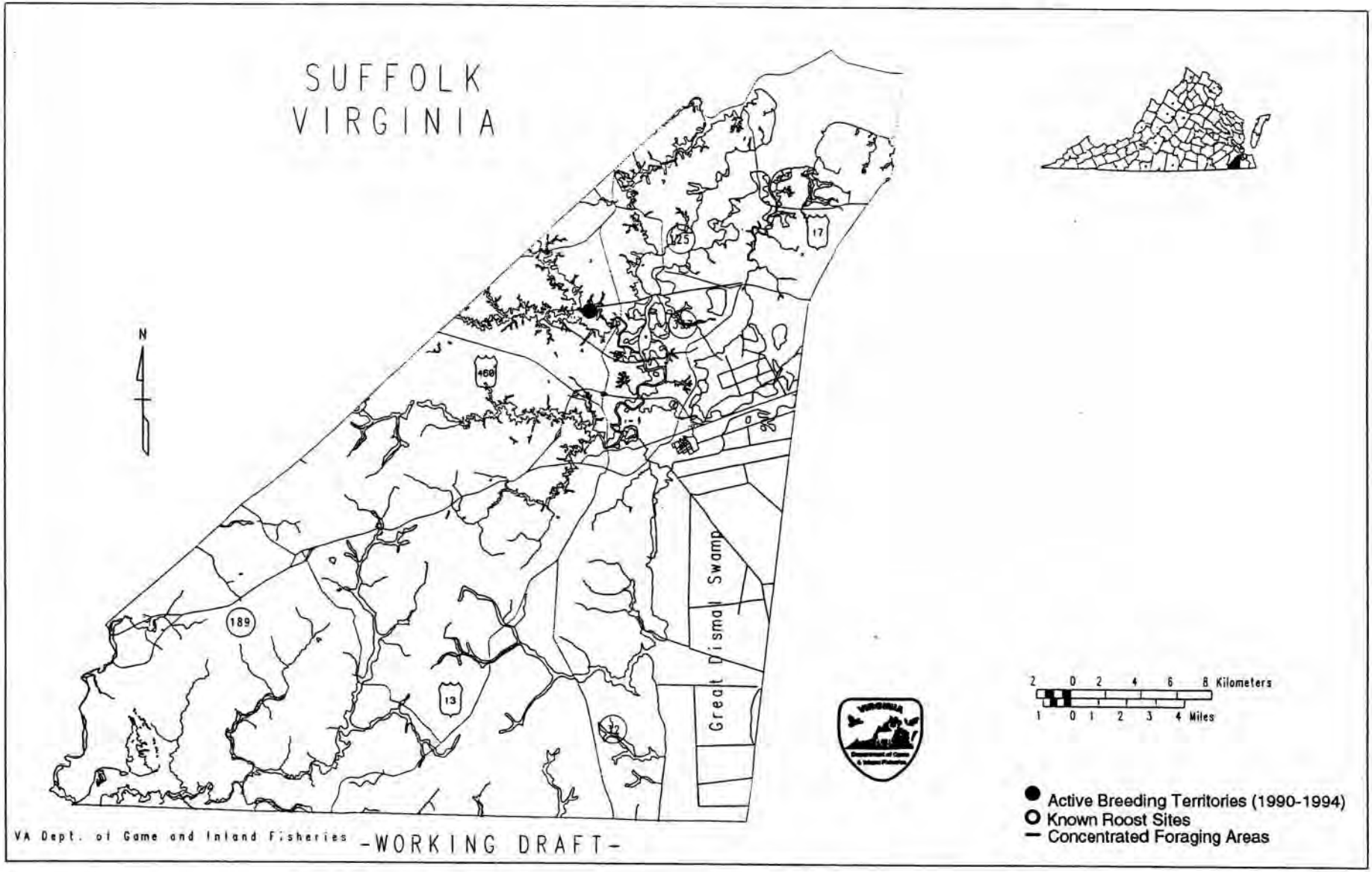
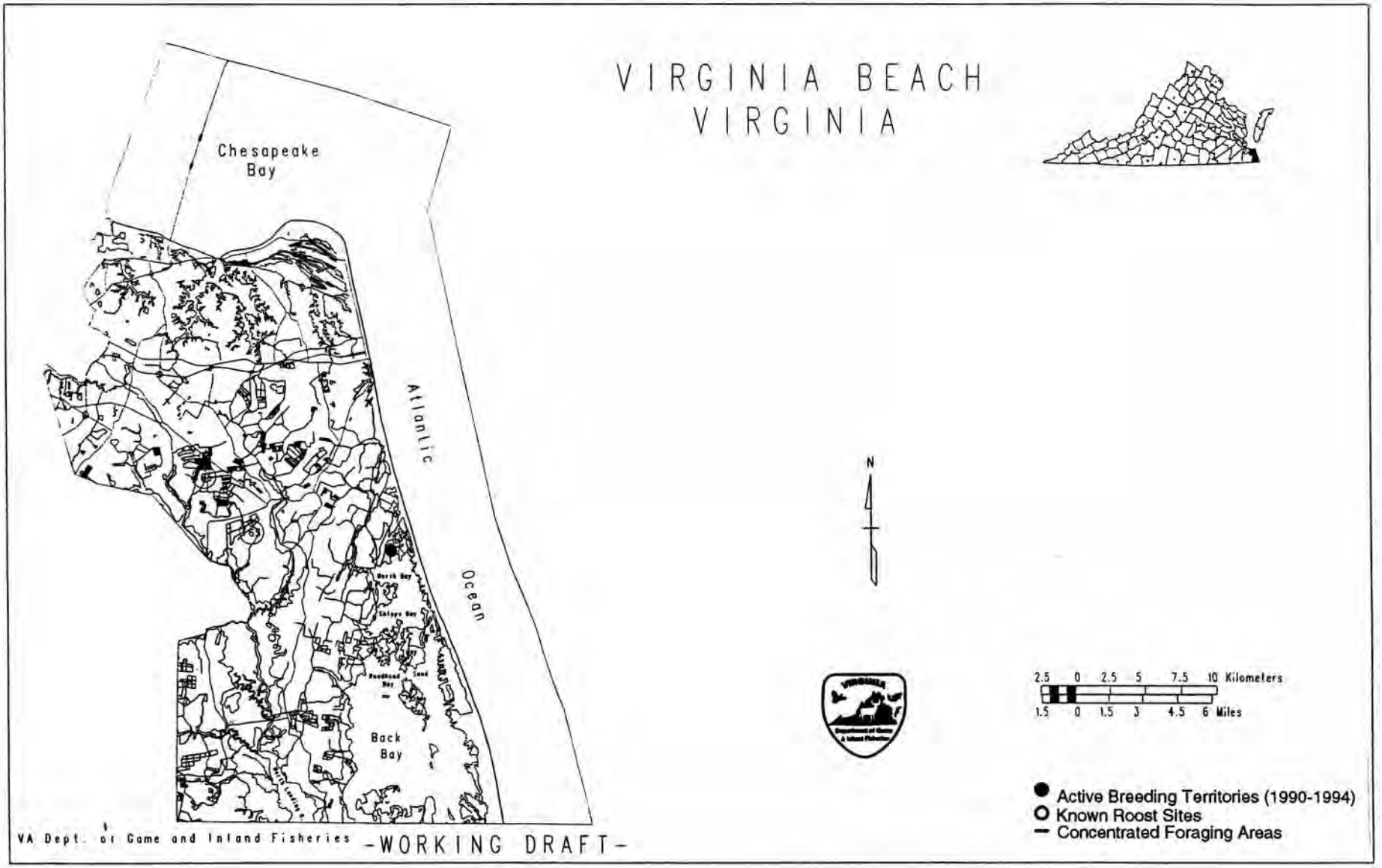


BALD EAGLE ACTIVITY AREAS



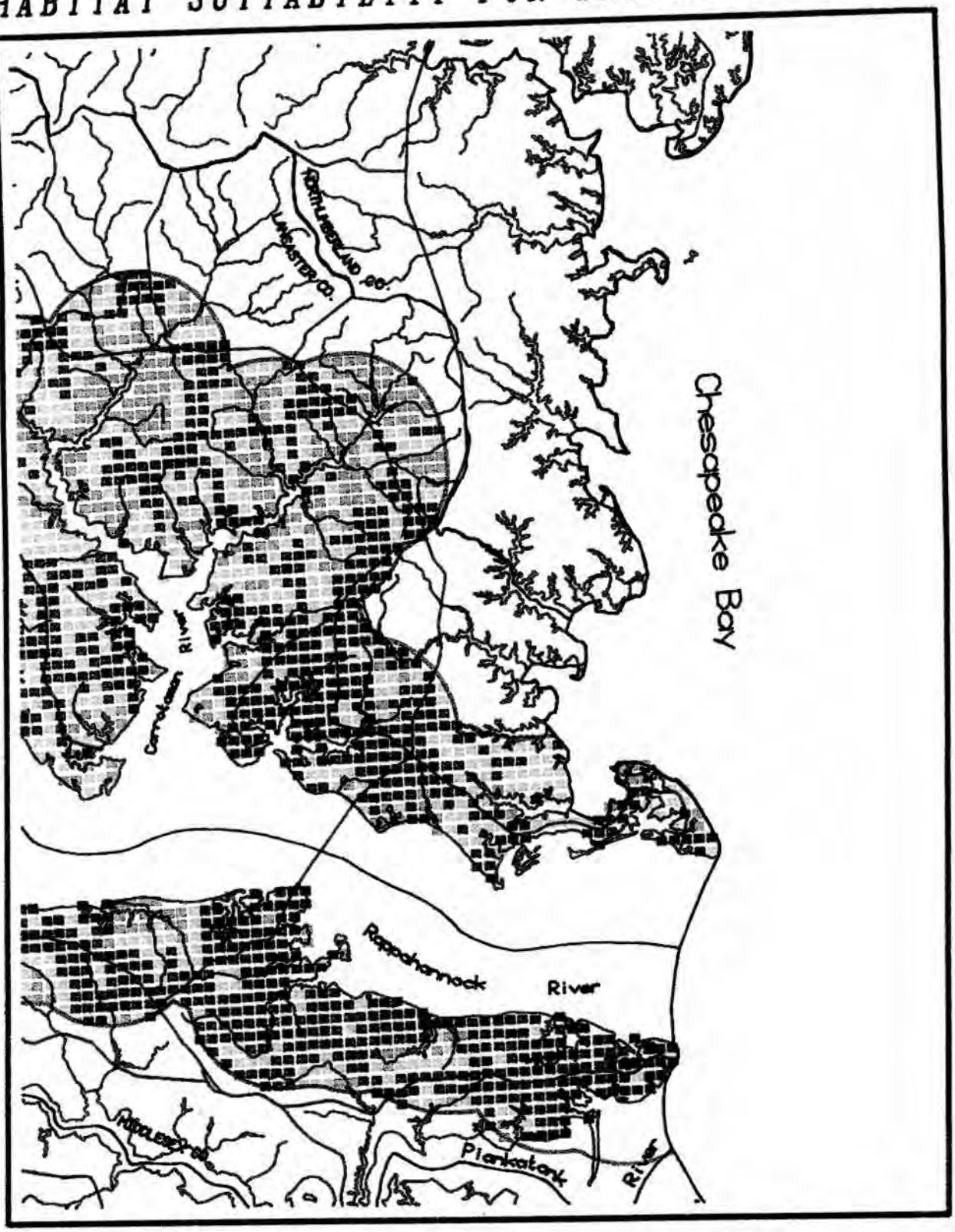
APPENDIX II:

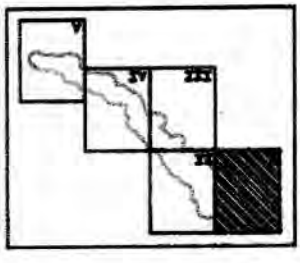
Habitat suitability map or maps (maps produced from 1992 data)

RAPPAHANNOCK RIVER

HABITAT SUITABILITY FOR BREEDING EAGLES

I





1 0 1 2 3 4 Miles

N

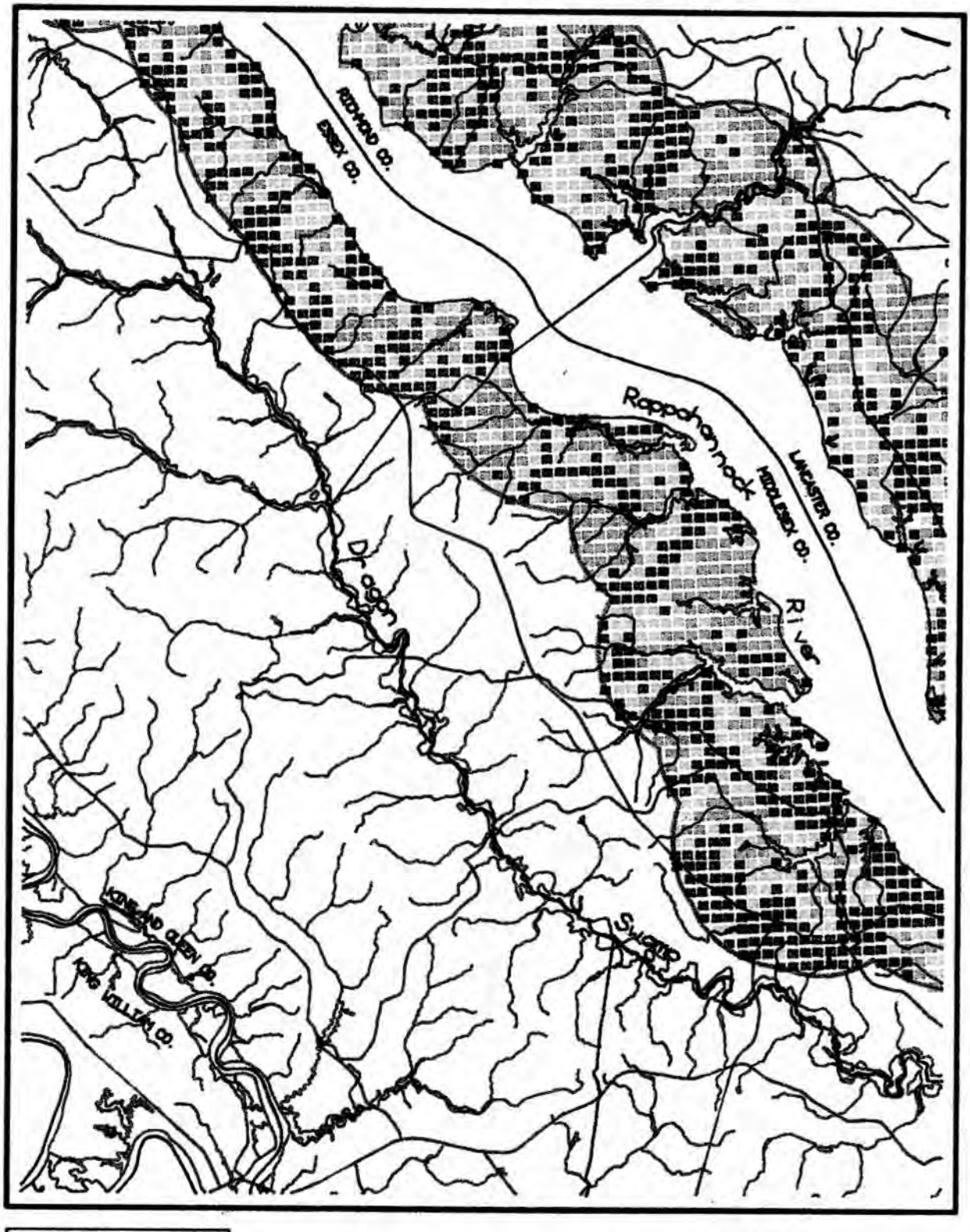
LEGEND

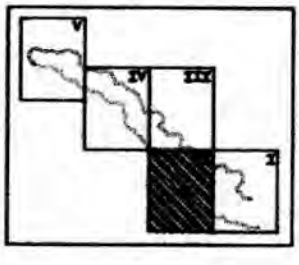
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

RAPPAHANNOCK RIVER

II

HABITAT SUITABILITY FOR BREEDING EAGLES





1 0 1 2 3 4 Miles

N

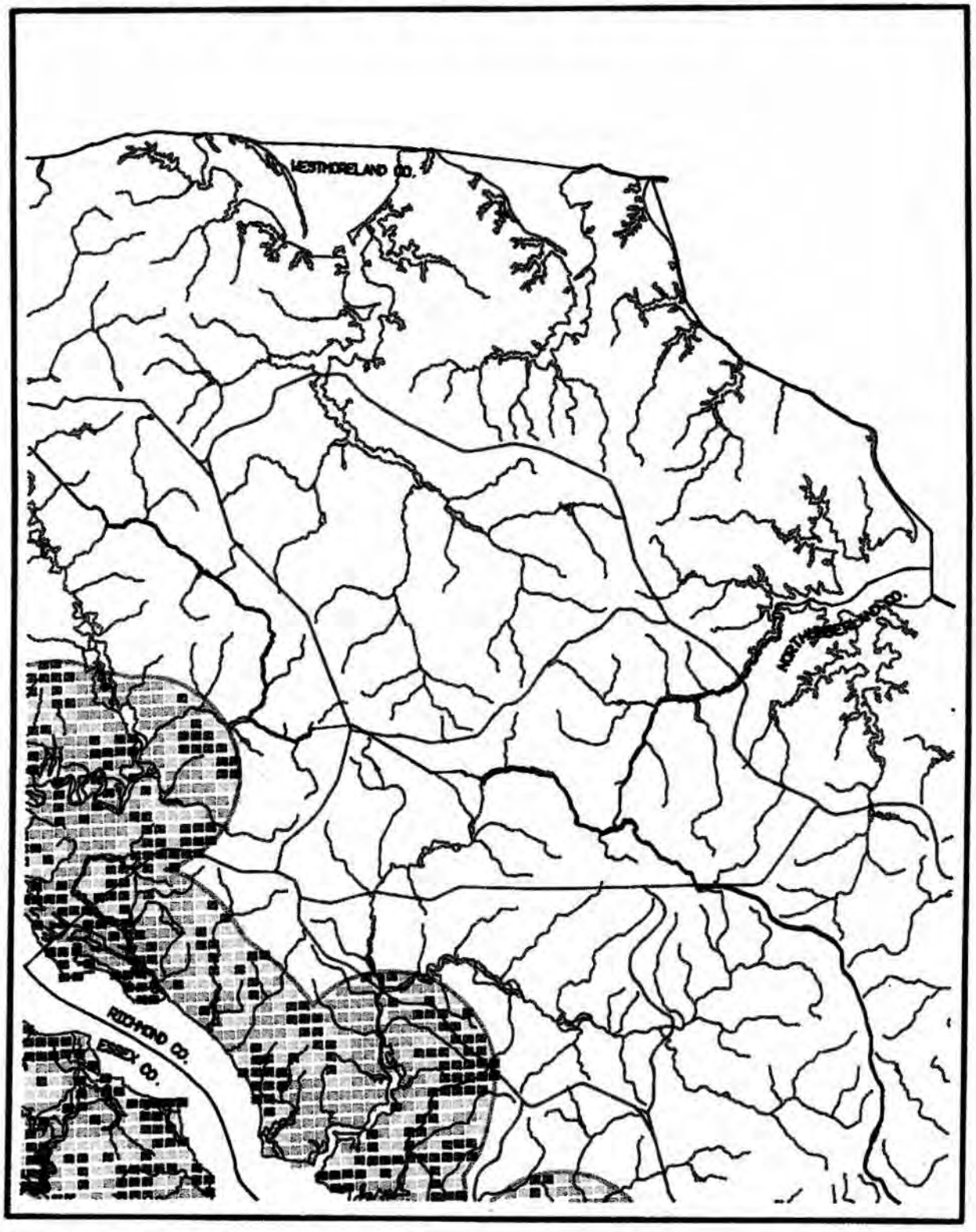
LEGEND

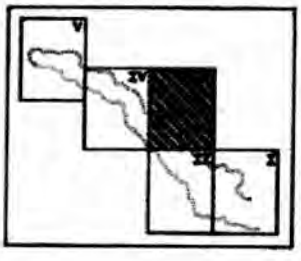
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

RAPPAHANNOCK RIVER

III

HABITAT SUITABILITY FOR BREEDING EAGLES





1 0 1 2 3 4 Miles

N

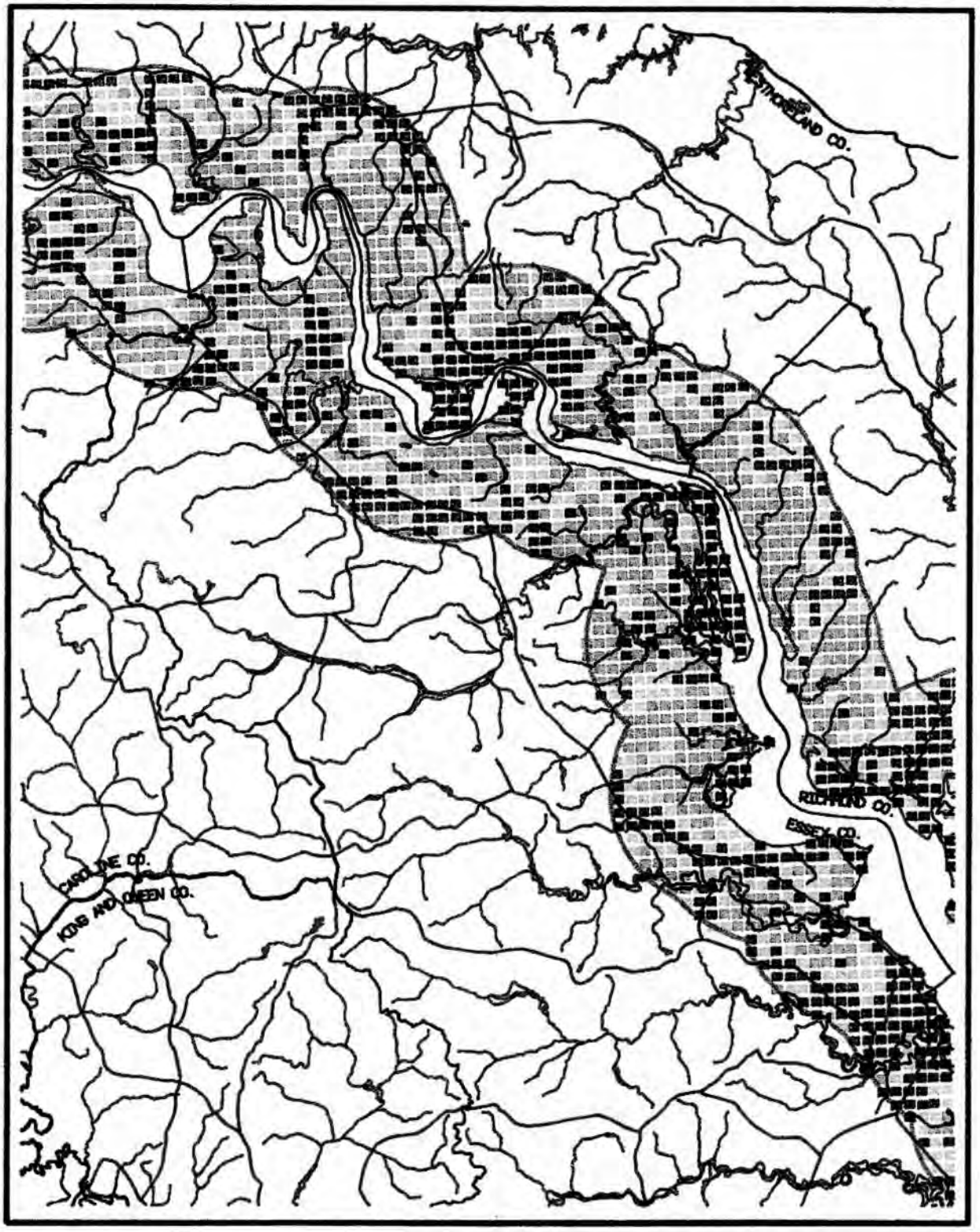
LEGEND

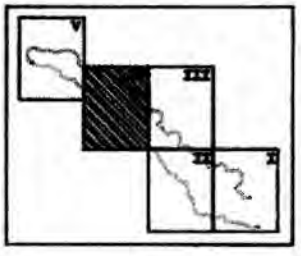
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

RAPPAHANNOCK RIVER

IV

HABITAT SUITABILITY FOR BREEDING EAGLES





1 0 1 2 3 4 Miles

N

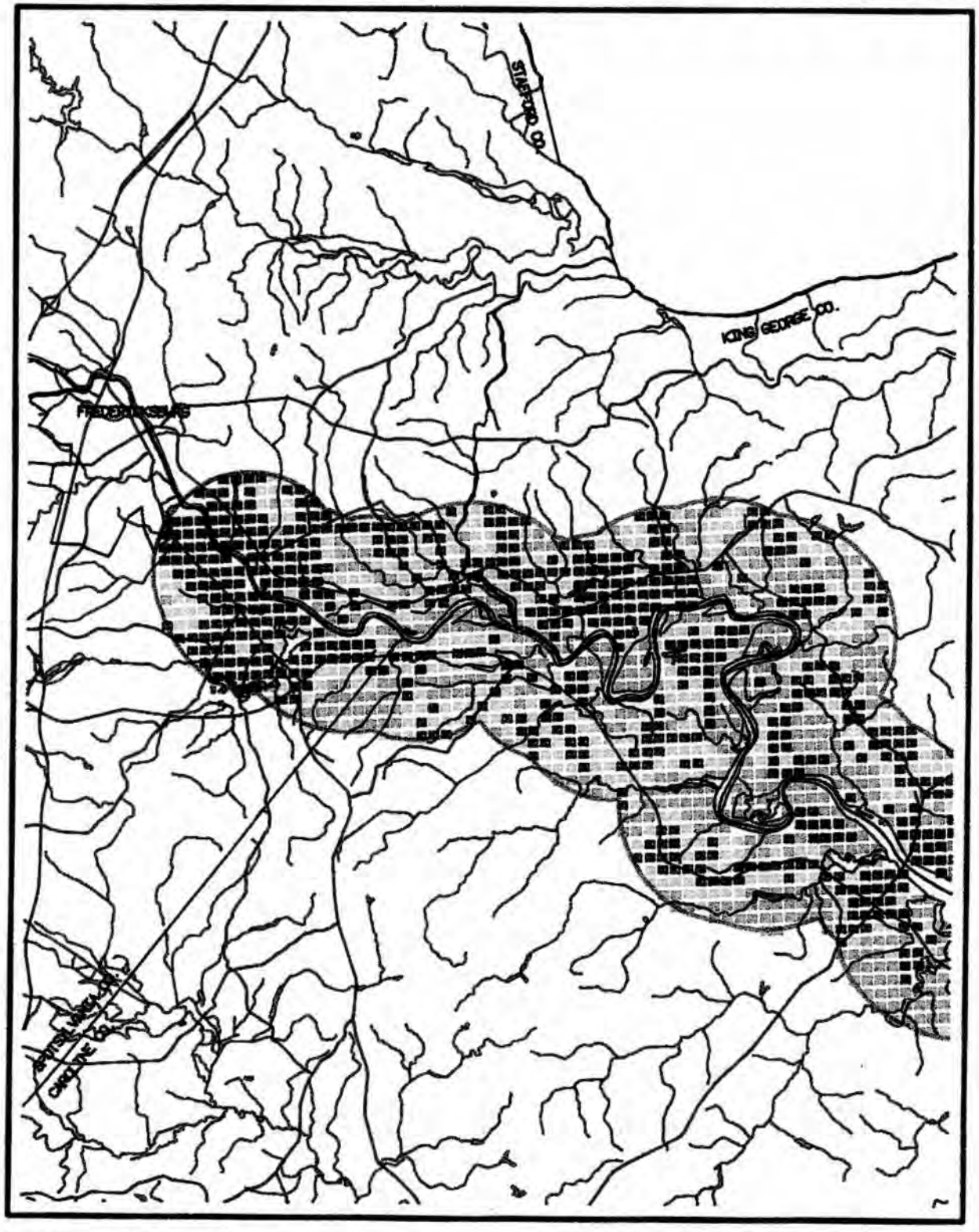
LEGEND

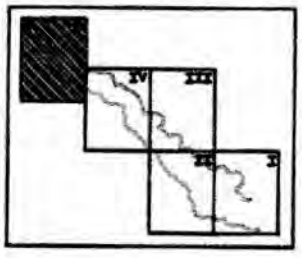
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

RAPPAHANNOCK RIVER

V

HABITAT SUITABILITY FOR BREEDING EAGLES





1 0 1 2 3 4 Miles

N

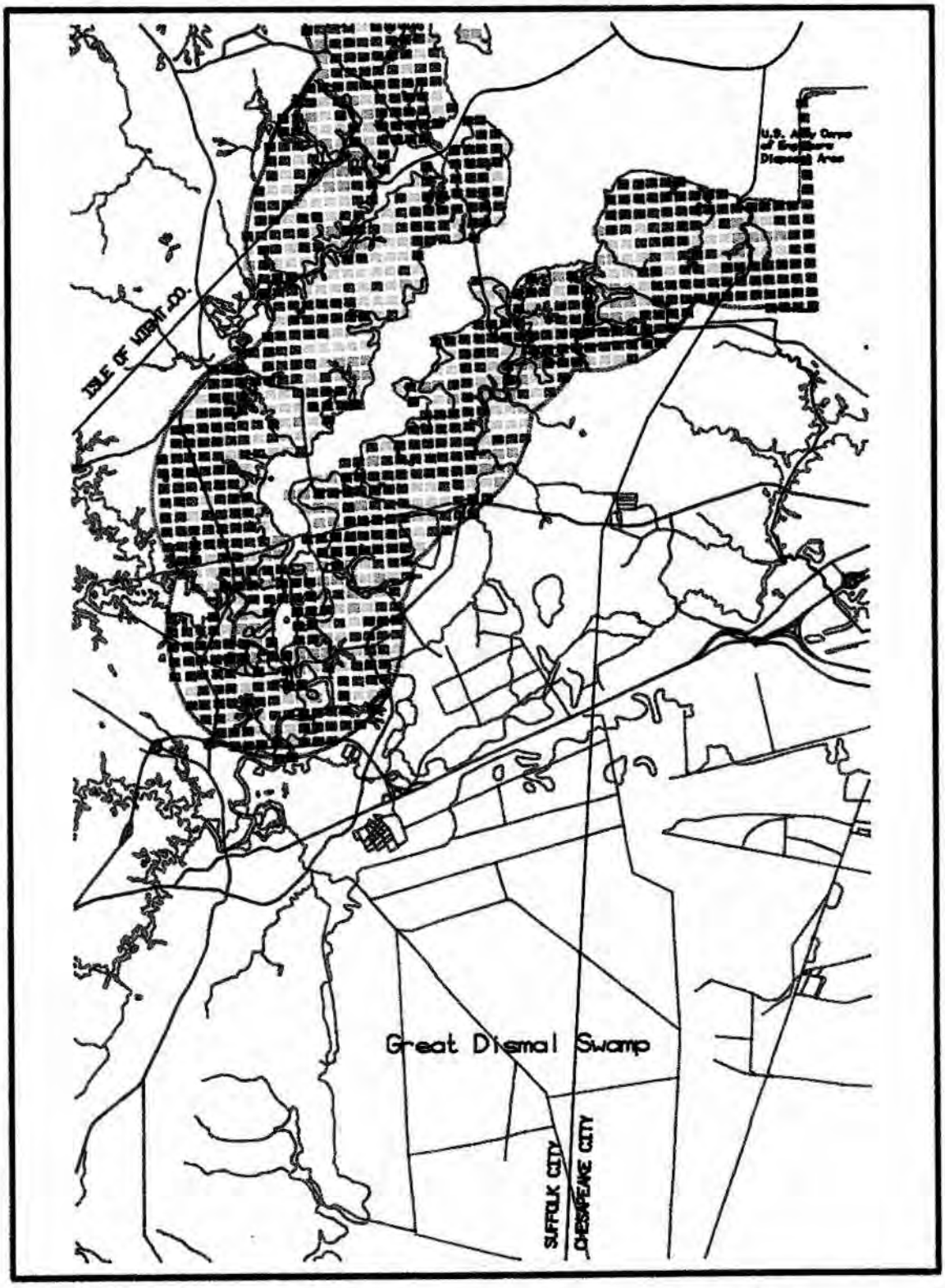
LEGEND

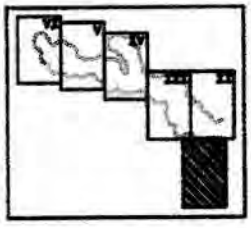
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

I

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

N

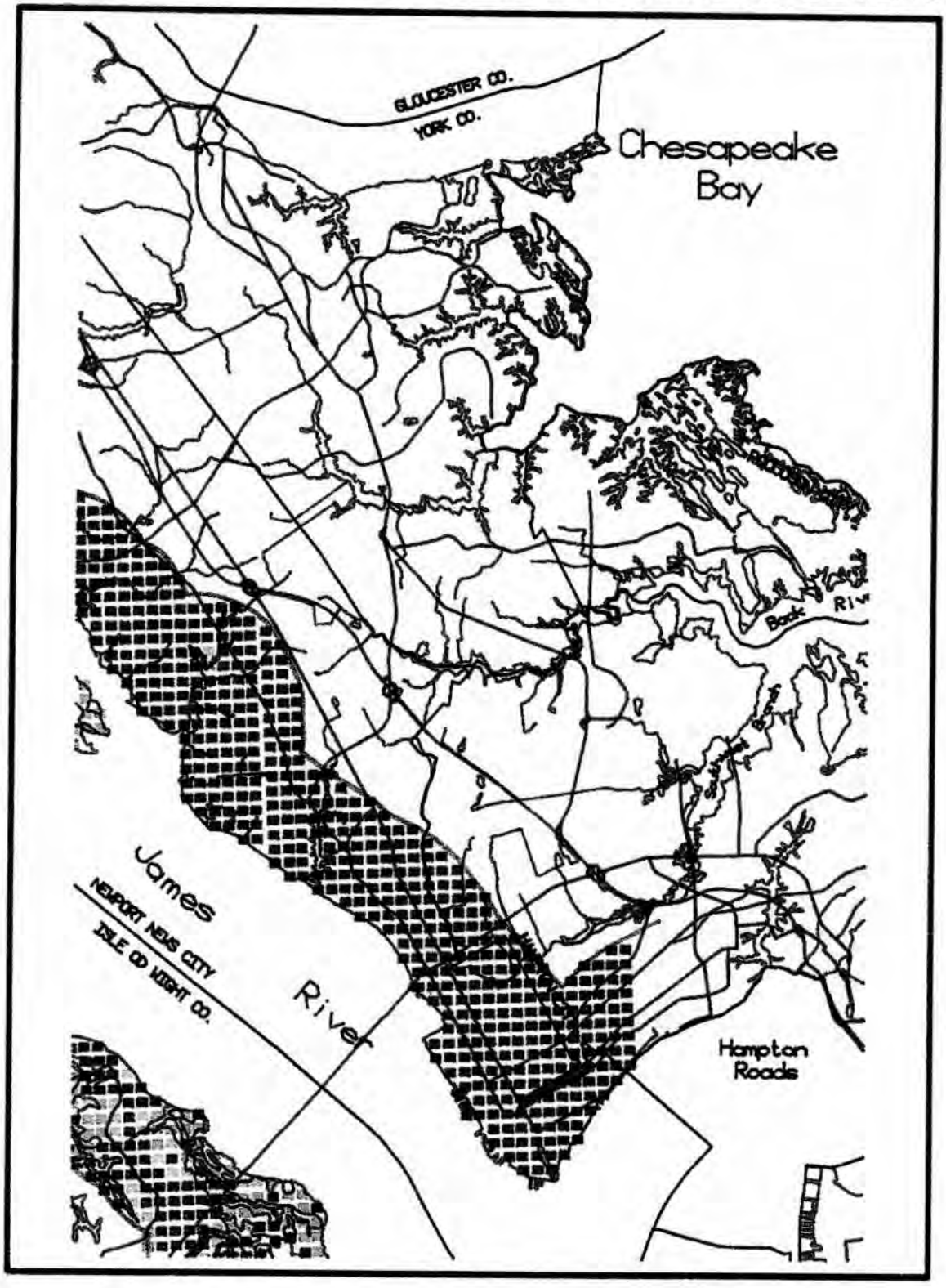
LEGEND

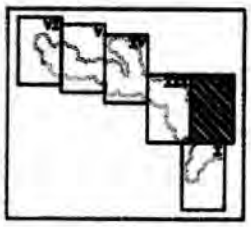
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

II

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

N

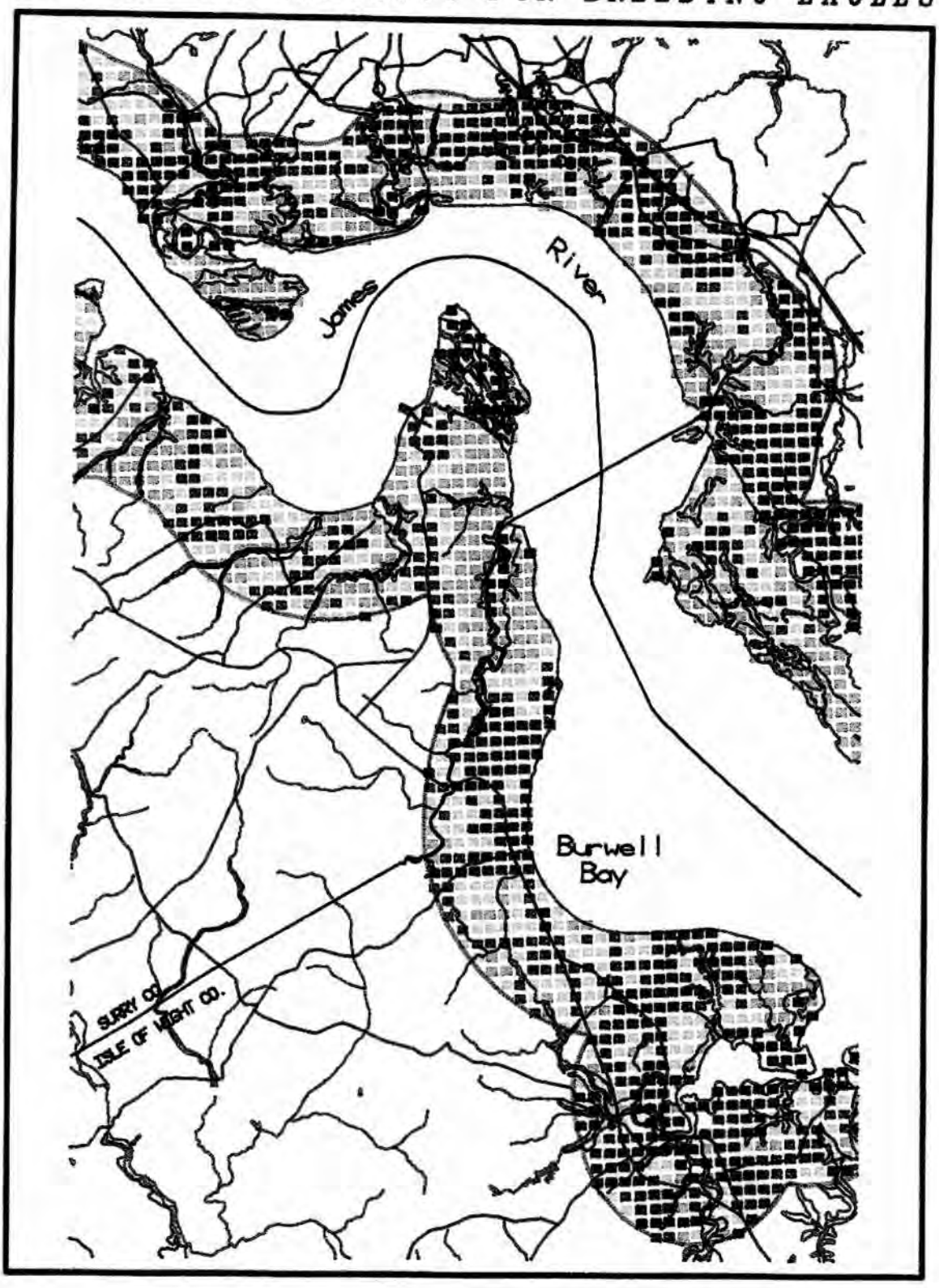
LEGEND

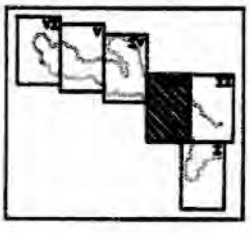
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

III

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

N

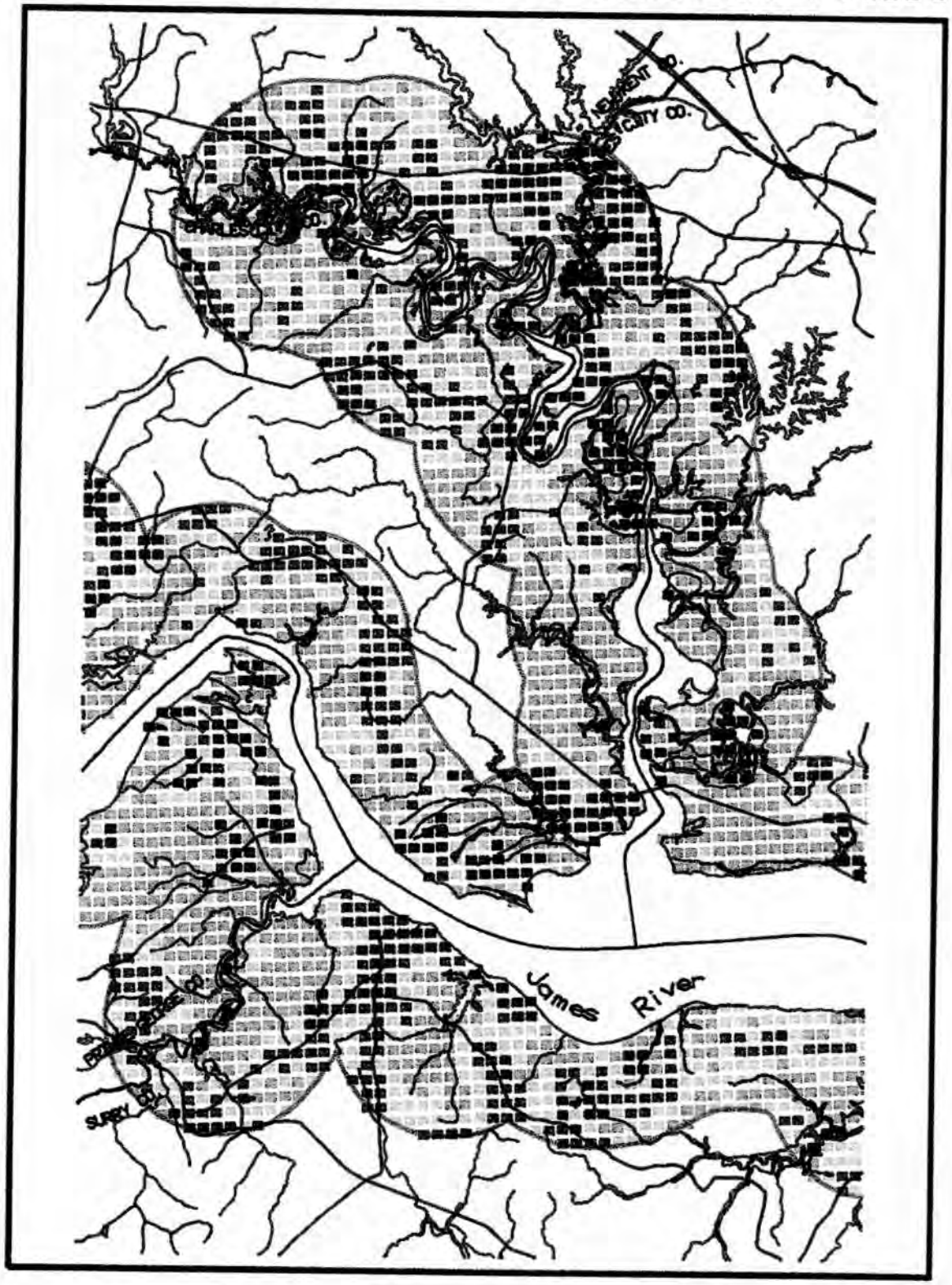
LEGEND

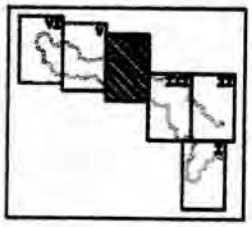
- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

IV

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

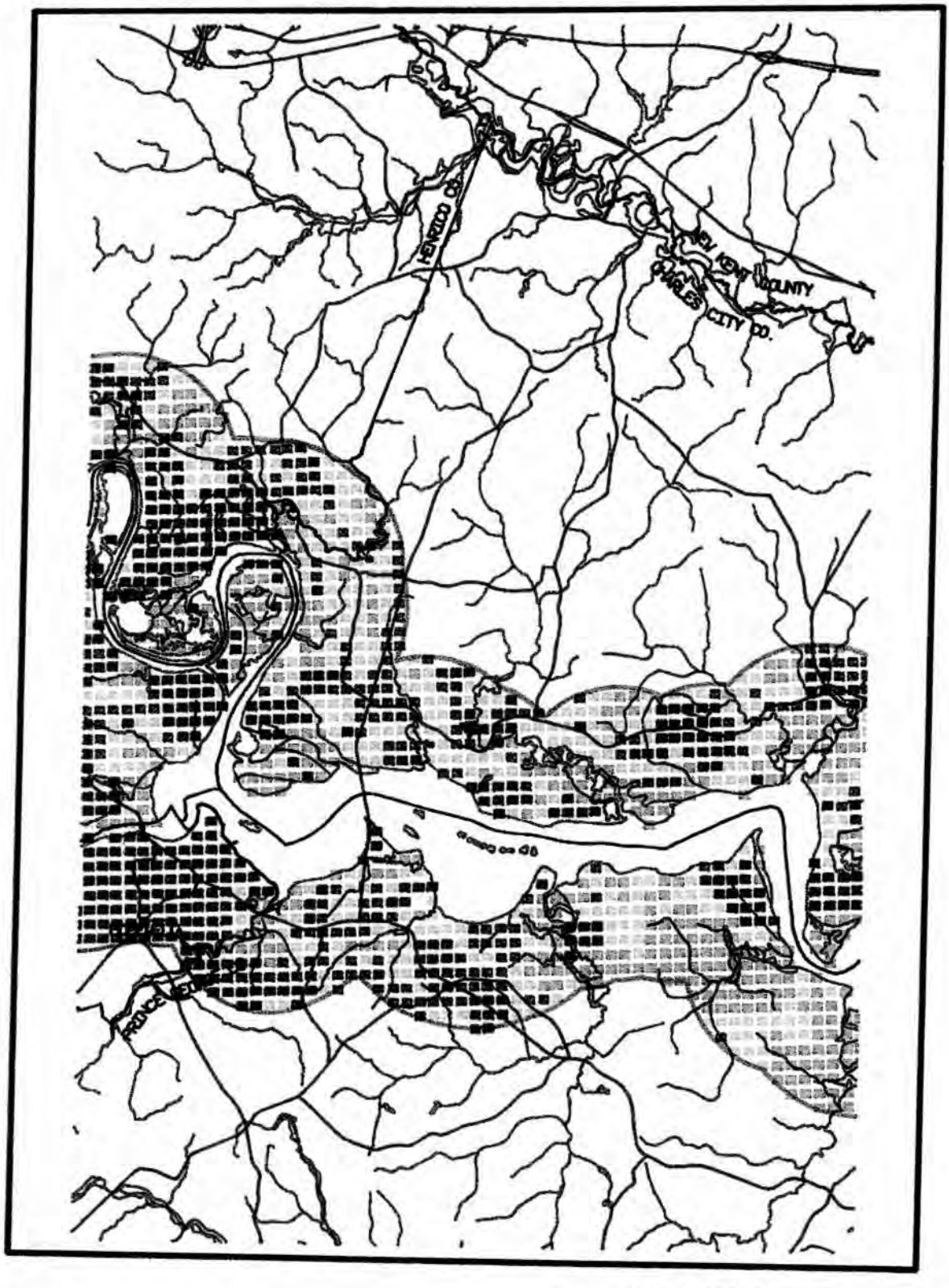
N

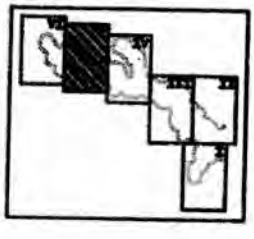
LEGEND

- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

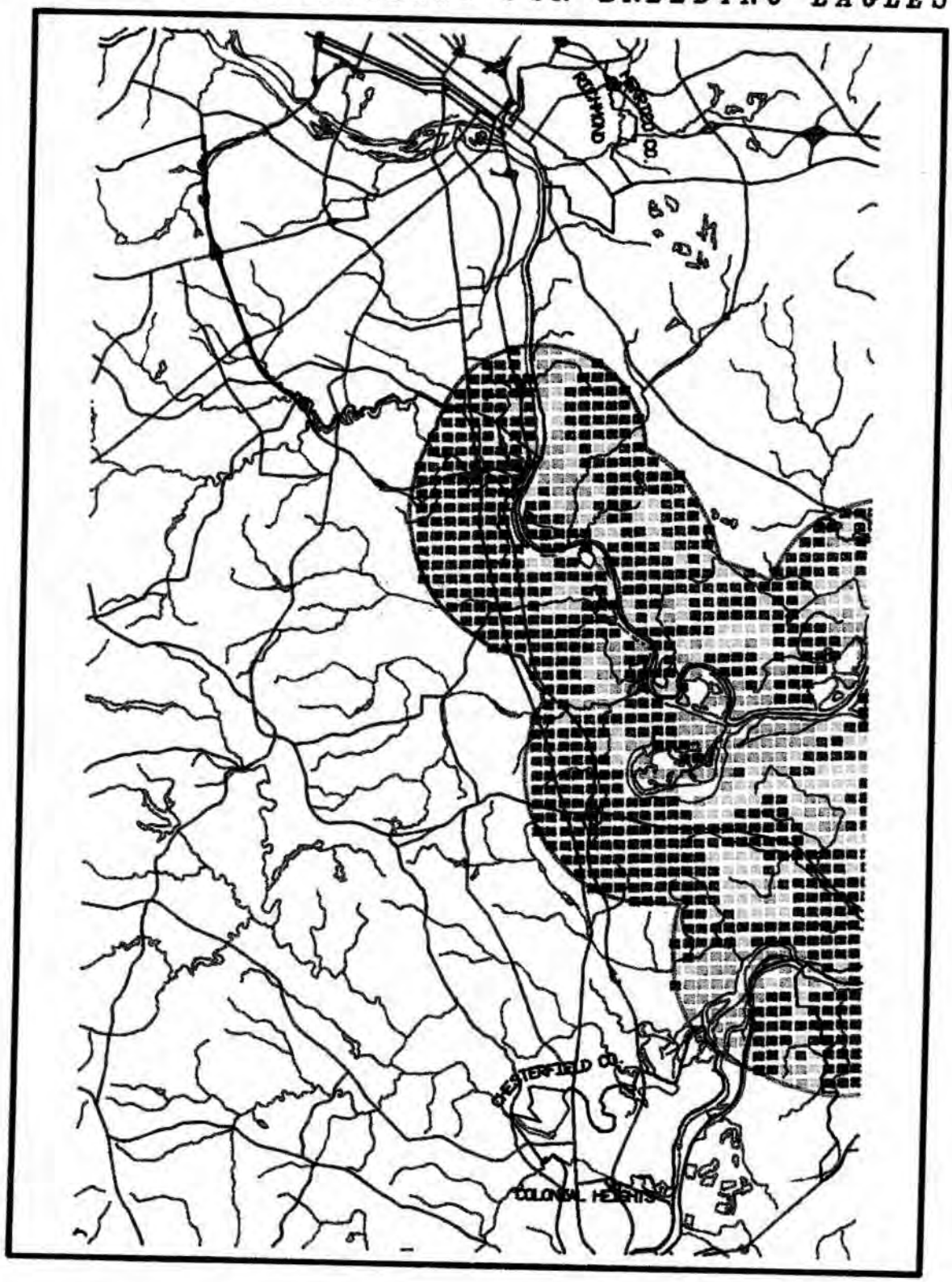
N

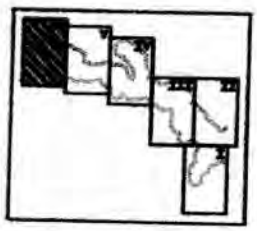
LEGEND

- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat

JAMES RIVER

HABITAT SUITABILITY FOR BREEDING EAGLES





0.8 0 0.8 1.5 2.3 3 Miles

N

LEGEND

- Unsuitable (Constr. 1)
- Unsuitable (Constr. 2)
- Questionable Habitat
- Usable Habitat
- Good Habitat