

January 31, 2005

Mr. David Sutherland
Chesapeake Bay Field Office
U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, MD 21401

SUBJECT: BIOLOGICAL ASSESSMENT FOR THE EARLY SITE PERMIT (ESP) OF THE
NORTH ANNA ESP SITE AND A REQUEST FOR INFORMAL CONSULTATION

Dear Mr. Sutherland:

The U.S. Nuclear Regulatory Commission (NRC) has prepared the enclosed biological assessment (BA) to evaluate whether the proposed action of the North Anna ESP would have adverse effects on listed species. The North Anna ESP site is located within the North Anna Power Station (NAPS) site adjacent to Lake Anna near Mineral, Virginia. The proposed Federal action is the issuance, under provisions of Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52), of an ESP for the North Anna ESP site for postulated additional nuclear power facilities, and to conduct site preparation and limited construction activities. The site preparation and limited construction activities allowed by 10 CFR 52.25 include clearing, grading, and constructing non-safety-related facilities. The proposed action does not include approval to construct and operate new units; therefore, the BA does not analyze environmental impacts that could result from construction and operation of two new nuclear units at the North Anna ESP site. Impacts associated with actual facility construction and operation will be assessed during the NRC staff's review of an application for a combined license or construction permit, should the applicant choose to go forward with the project.

The existing transmission system at the NAPS is sufficient to transmit all power generated by existing and proposed nuclear units at NAPS. The NRC's recent analysis of the existing transmission system at NAPS (NRC 2002) concluded that continued operation would not impact threatened or endangered species. Because no changes to transmission lines or rights-of-way are anticipated, this BA does not consider them for further analysis.

By letter dated December 21, 2003, (NRC 2003b), the NRC requested the Federally listed threatened or endangered species that may be in the vicinity of NAPS and its associated transmission lines. In a letter dated October 25, 2004, (FWS 2004a) the U.S. Fish and Wildlife Service (FWS) provided the Federally listed threatened or endangered species. The FWS identified the following: one endangered species, dwarf wedgemussel (*Alasmodonta heterodon*); and four threatened species, bald eagle (*Haliaeetus leucocephalus*), small whorled pogonia (*Isotria medeoloides*), sensitive joint-vetch (*Aeschynomene virginica*), and swamp pink (*Helonias bullata*). For documentation purposes, the NRC has addressed the potential impact of the North Anna ESP site on these five species in the enclosed BA.

The NRC has determined that the proposed action would not affect the dwarf wedgemussel because there is no suitable habitat for the dwarf wedgemussel on the North Anna ESP site.

Because bald eagles have been observed in the vicinity of the project site, the NRC determined that the proposed action may affect, but is not likely to adversely affect, the bald eagle. The NRC concluded that the proposed action would not affect the small whorled pogonia, sensitive joint-vetch, and swamp pink because no known habitats exist for these protected plant species on the North Anna ESP site. Finally, no designated critical habitat exists for any of the five listed species.

We are placing this BA in our project files and are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the applicant, on research performed by NRC staff, and information from FWS (i.e., current listings of species provided by the FWS, Gloucester, Virginia Field Office).

If you have any questions regarding this BA or the staff's request, please contact Mr. Jack Cushing, Environmental Project Manager, at 301-415-1424, or by e-mail at jxc9@nrc.gov.

Sincerely,
/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-008

Enclosure: As stated

cc w/encl.: See next page

Because bald eagles have been observed in the vicinity of the project site, the NRC determined that the proposed action may affect, but is not likely to adversely affect, the bald eagle. The NRC concluded that the proposed action would not affect the small whorled pogonia, sensitive joint-vetch, and swamp pink because no known habitats exist for these protected plant species on the North Anna ESP site. Finally, no designated critical habitat exists for any of the five listed species.

We are placing this BA in our project files and are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the applicant, on research performed by NRC staff, and information from FWS (i.e., current listings of species provided by the FWS, Gloucester, Virginia Field Office).

If you have any questions regarding this BA or the staff's request, please contact Mr. Jack Cushing, Environmental Project Manager, at 301-415-1424, or by e-mail at jxc9@nrc.gov.

Sincerely,

/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-008
Enclosure: As stated
cc w/encl.: See next page

DISTRIBUTION:

RLEP/Environmental R/F	M. Parkhurst, PNNL	M. Jenkins, Y. Edmonds
B. Zalzman	OPA	B. Sheron (RidsNrrAdpt)
B. Keeling	PMNS	F. Cameron
R. Hannah	RidsOgcMailCenter	ACRS/ACNW
T. Smith	W. Borchardt (RidsNrrOD)	
D. Matthews/F. Gillespie (RidsNrrDrip)		P.T. Kuo (RidsNrrDripRlep)
A. Williamson	OCA	M. Masnik
M. Scott	K. Clark, RII	RIDSRgn1MailCenter
B. Poole	A. Kugler	M. King, RII
S. Burnell	T. Combs, OCA	T. Madden
R. Weisman	RLEP R/F	

Adams accession no.: **ML050320461**
E:\Filenet\ML050320461.wpd

OFFICE	GS:RLEP	LA:RLEP	PM:RLEP	SC:RLEP	OGC	PD:RLEP
NAME	HNash	MJenkins	JCushing	AKugler	BPoole	PTKuo
DATE	1/7/05	1/24/05	1/24/05	1/31/05	1/21/05	1/31/05

OFFICIAL RECORD COPY

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

cc:

Mr. Joseph D. Hegner
Lead Engineer - Licensing
Dominion Generation
Early Site Permitting Project
5000 Dominion Boulevard
Glen Allen, VA 23060

Mr. C. Lee Lintecum
County Administrator
Louisa County
P.O. Box 160
Louisa, VA 23093

Lillian M. Cuoco, Esq.
Senior Nuclear Counsel
Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Building 475, 5th Floor
Rope Ferry Road
Rt. 156
Waterford, CT 06385

David R. Lewis, Esq.
Shaw Pittman
2300 N Street, N.W.
Washington, D.C. 20037

Dr. W. T. Lough
Virginia State Corporation Commission
Division of Energy Regulation
P.O. Box 1197
Richmond, VA 23209

Mr. Chris L. Funderburk, Director
Nuclear Licensing & Operations Support
Virginia Electric Power Company
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, VA 23060-6711

Office of the Attorney General
Commonwealth of Virginia
900 East Main Street
Richmond, VA 23219

Senior Resident Inspector
North Anna Power Station
U.S. Nuclear Regulatory Commission
1024 Haley Drive
Mineral, VA 23117

Mr. David A. Heacock
Site Vice President
Virginia Electric and Power Company
North Anna Power Station
P.O. Box 402
Mineral, VA 23117-0402

Mr. Robert B. Strobe, M.D., M.P.H.
State Health Commissioner
Office of the Commissioner
Virginia Department of Health
P.O. Box 2448
Richmond, VA 23218

Mr. Marvin L. Smith
Project Manager
North Anna Early Site Permit Project
Dominion Energy, Inc.
5000 Dominion Blvd.
Glen Allen, VA 23060

Mr. Eugene S. Grecheck
Vice President - Nuclear Support Services
Dominion Energy, Inc.
5000 Dominion Blvd.
Glen Allen, VA 23060

Mr. David Lochbaum
Union of Concern Scientists
1707 H Street, NW
Suite 600
Washington, DC 20006-3919

Mr. Paul Gunter
Director of the Reactor Watchdog Project
Nuclear Information & Resource Service
1424 16th Street, NW, Suite 404
Washington, DC 20036

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 2 -

cc:

Mr. Ron Simard
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Russell Bell
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Thomas P. Miller
U.S. Department of Energy
Headquarters - Germantown
19901 Germantown Road
Germantown, MD 20874-1290

Mr. James Riccio
Greenpeace
702 H Street, NW, Suite 300
Washington, DC 20001

Ms. Patricia Campbell
Winston & Strawn
1400 L Street, NW
Washington, DC 20005

Mr. James F. Mallay, Director
Regulatory Affairs
FRAMATOME, ANP
3315 Old Forest Road
Lynchburg, VA 24501

Mr. Ernie H. Kennedy
Vice President New Plants
Nuclear Plant Projects
Westinghouse Electric Company
2000 Day Hill Road
Windsor, CT 06095-0500

Dr. Regis A. Matzie
Senior Vice President and
Chief Technology Officer
Westinghouse Electric Company
2000 Day Hill Road
Windsor, CT 06095-0500

Mr. Gary Wright, Manager
Division of Nuclear Safety
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Mr. Vince Langman
Licensing Manager
Atomic Energy of Canada Limited
2251 Speakman Drive
Mississauga, Ontario
Canada L5K 1B2

Mr. Ed Wallace, General Manager
Projects
PBMR Pty LTD
P. O. Box 9396
Centurion 0046
Republic of South Africa

Mr. David Ritter
Research Associate on Nuclear Energy
Public Citizens Critical Mass Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

Mr. Tom Clements
6703 Guide Avenue
Takoma Park, MD 20912

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 3 -

cc:

Mr. Paul Leventhal
Nuclear Control Institute
1000 Connecticut Avenue, NW
Suite 410
Washington, DC 20036

Mr. Jack W. Roe
SCIENTECH, INC.
910 Clopper Road
Gaithersburg, MD 20878

Dr. Gail H. Marcus
U.S. Department of Energy
Room 5A-143
1000 Independence Ave., SW
Washington, DC 20585

Mr. Charles Brinkman
Westinghouse Electric Co.
Washington Operations
12300 Twinbrook Pkwy., Suite 330
Rockville, MD 20852

Mr. Marvin Fertel
Senior Vice President
and Chief Nuclear Officer
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Dr. Glenn R. George
PA Consulting Group
130 Potter Street
Haddonfield, NJ 08033

Mr. Arthur R. Woods
Enercon Services, Inc.
500 TownPark Lane
Kennesaw, GA 30144

Ms. Vanessa E. Quinn, Chief
Radiological Emergency Preparedness
Branch
Department of Homeland Security/FEMA
500 C Street, SW
Washington, DC 20472

Mr. David A. Christian
Senior Vice President, Nuclear Operations,
and Chief Nuclear Officer
Dominion Nuclear North Anna, LLC
5000 Dominion Blvd.
Glen Allen, VA 23060

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 4 -

cc:

Dr. Ethel Eaton, Manager
Office of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Mr. David W. Sutherland
Chesapeake Bay Field Office
U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, MD 21401

Ms. Karen Mayne, Supervisor
Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061

Mr. Michael Murphy
Virginia Dept. of Environmental Quality
P.O. Box 10009
Richmond, VA 23240-0009

Ms. Ellie Irons
Virginia Dept. of Environmental Quality
629 E. Main Street
Room 631
Richmond, VA 23219

Mr. Tom Faha
Virginia Dept. of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193

Mr. C. Lee Lintecum
County Administrator
P.O. Box 160
Louisa, VA 23093

Mr. Edwin Keller, Mayor
Town of Mineral
P.O. Box 316
102 East First Street
Mineral, VA 23117

Mr. Bill Borduin
Lake Anna Civic Association
637 Bear Castle Drive
Bumpass, VA 23024

Mr. C. Edward Kube, Jr.
Orange County Administrator
P.O. Box 111
Orange, VA 22960

Mr. R. Duff Green
Orange County Emergency Manager
P.O. Box 111
Orange, VA 22960

Spotsylvania County Administrator
P.O. Box 99
Spotsylvania, VA 22553-0099

Mr. Richard Goss
Planning Director
County of Spotsylvania
P.O. Box 876
Spotsylvania, VA 22553

Mr. Troy B. Tignor, CZA
Zoning Administrator
County of Spotsylvania
P.O. Box 220
Spotsylvania, VA 22553

Mr. R. Christian Eudailey, Director
Department of Fire, Rescue, and
Emergency Services
County of Spotsylvania
P.O. Box 818
Spotsylvania, VA 22553

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 5 -

cc:

Carrie E. Girstantas, M.E.
Department of Systems Engineering
University of Virginia
1111 Sherwood Avenue
Charlottesville, VA 22903

Carrie E. Girstantas
415 W. Green Springs Road
Gordonsville, VA 22942

Brendan Hoffman
Public Citizen
215 Pennsylvania Avenue SE
Washington, DC 20003

Louis Zeller
BREDL
P.O. Box 88
Glendale Springs, NC 28629

Amzic Sullivan
9443 Dyke Road
Dyke, VA 22935

Terry M. Jones
P.O. Box 95
Louisa, VA 23093

Dan Holmes
Piedmont Environmental Council
P.O. Box 266
Orange, VA 22960

Ernest Reed
Living Education Center for Ecology and
the Arts
P.O. Box 2612
Charlottesville, VA 22902

Alexis Zeigler
912 Woodfolk Drive
Charlottesville, VA 22902

Abhaya Thiele
406 Key West Drive
Charlottesville, VA 22902

Bill Murphey
449 Lakeway Road
Mineral, VA 23117

John A. Hoyt
320 Bear Castle Drive
Bumpass, VA 23024

Marione Cobb
138 Twin Oaks Road
Louisa, VA 23093

Olivia Ryan
Valere Real Estate
9942 Kentucky Springs Road
Mineral, VA 23117

Brianne Boylan
138 Twin Oaks Road
Louisa, VA 23093

Sam Forrest
1800 Rock Quarry Road
Louisa, VA 23093

Brian Buckley
Catholic Worker
16560 Louisa Road
Trevilians, VA 23170

Donal Day
Piedmont Alliance for Safe Energy
151 Buckingham Circle
Charlottesville, VA 22903

Jon Kessler
1125 Little High Street
Charlottesville, VA 22902

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 6 -

cc:

Irene Luck
The Central Virginian
P.O. Box 464
Louisa, VA 23093

Bill Maher
203 Hazelton Court
Mullica Hill, NJ 08062

Joe Hegner
5000 Dominion Blvd.
Glen Allen, VA 23060

Renee Edwards
755 Bohannon Road
Bumpass, VA 23024

Casey Herndon
Living Education Center for Ecology and
the Arts
2422 Jefferson Park Avenue
Charlottesville, VA 22903

Tony Banks
Dominion
5000 Dominion Blvd.
Glen Allen, VA 23060

Bob Arment
408 Lakeway Road
Mineral, VA 23117

Robert H. Meier
26 Lizzie Lane
Bumpass, VA 23024

Tom Wilcox
VA Dept. of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230

Jean Moss Holland
254 Moss Lane
Bumpass, VA 23024

Rusty Dennen
The FreeLance-Star
616 Amelia Street
Fredericksburg, VA 22401

Maggie McIlvaine
P.O. Box 364
Keswick, VA 22947

Lawrence Katz
218 Tara Woods Drive
Bumpass, VA 23024

Howard West
138 Rhett Butler Drive
Bumpass, VA 23024

Jim Peck
139 Rhett Butler Drive
Bumpass, VA 23024

Marilyn Root
Lake Anna Observer
191 Lakewood Landing Drive
Bumpass, VA 23024

Richard Zuercker
Dominion
5000 Dominion Blvd.
Glen Allen, VA 23060

Gary Voelker
Lake Anna Civic Association
11708 Jonas Adolph Lane
Bumpass, VA 23024

Pat and Ed Mitchell
9626 Fredericks Hall Road
Mineral, VA 23117

North Anna Early Site Permit
Dominion Nuclear North Anna, LLC

- 7 -

cc:

Steven Boretos
5116 Ridge Road
Spotsylvania, VA 23117

Karen Patterson
Tetra Tech NUS
900 Trail Ridge Road
Aiken, SC 29803

Mike Duffey
Dominion
16119 Goshen Road
Montpelier, VA 23192

Kristina Cruise
newsdesk@nbc29.com

Aviv Goldsmith
6147 Hickory Ridge Road
Spotsylvania, VA 22553

ENCLOSURE
BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT

**North Anna
Early Site Permit Application**

Louisa County, Virginia

Docket Number 52-008

January 2005

1.0 Introduction

On September 25, 2003¹, the U.S. Nuclear Regulatory Commission (NRC) received an application from Dominion Nuclear North Anna, LLC (Dominion) for an early site permit (ESP) for an ESP site (the North Anna ESP site) located within the existing North Anna Power Station (NAPS) site near the town of Mineral, in Louisa County, Virginia (Figure 1). Under the NRC regulations in Title 10 of the Code of Federal Regulations (CFR) Part 52 and in accordance with the applicable provisions of 10 CFR Part 51, which are the NRC regulations implementing the National Environmental Policy Act of 1969 (NEPA), the NRC is required to prepare an environmental impact statement (EIS) as part of its review of an ESP application. The NRC staff published in the Federal Register a Notice of Intent (68 FR 65961) to conduct scoping, prepare an EIS, and publish a draft EIS for public comment. The comment period for the draft EIS ends on March 1, 2005. The draft EIS is available on the NRC website at www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1811/index.html. The final EIS will be issued after considering public comments on the draft. A separate safety evaluation report will also be prepared in accordance with 10 CFR Part 52.

The North Anna ESP site proposed by Dominion is located in Louisa County in central Virginia, near the town of Mineral. It is completely within the confines of the current NAPS site, which is located on a peninsula on the southern shore of Lake Anna, approximately eight kilometers (km) (five miles [mi]) upstream of the North Anna Dam. Lake Anna is approximately 27 km (17 mi) long, with 435 km (272 mi) of shoreline. The lake was created in 1971 by the construction of a dam on the main stem of the North Anna River. Virginia Electric and Power Company (Virginia Power), a subsidiary of Dominion Resources, Inc., owns the land above and below the lake surface and around the lake up to the expected high-water mark.

As part of the environmental review process, the NRC staff sent letters to staff at the United States Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries (NRC 2003a,b) requesting lists of threatened and endangered species that potentially could be affected by the construction and operation of new power plants at NAPS. Specifically, the staff requested a list of species and information on protected, proposed, and candidate species, and critical habitat that may be in the vicinity of North Anna.

In a letter dated January 6, 2004 (NOAA 2004), NOAA Fisheries stated that "no federally listed or proposed threatened or endangered species under the jurisdiction of NOAA Fisheries are known to exist in the vicinity of the North Anna Power Station." The FWS replied by letter dated October 25, 2004 (FWS 2004a) with attached tables that identify two animal and three plant species listed by the Endangered Species Act (ESA) that occur or may occur in the counties adjacent to the NAPS. These species are the dwarf wedgemussel (*Alasmodonta heterodon*), bald eagle (*Haliaeetus leucocephalus*), small whorled pogonia (*Isotria medeoloides*), sensitive joint-vetch (*Aeschynomene virginica*), and swamp pink (*Helonias bullata*).

¹ The September 25, 2003, Environmental Report (ER) for this application was revised by letters dated October 2, 2003 (Revision 1), July 15, 2004 (Revision 2), and September 7, 2004 (Revision 3). Any reference in this Biological Assessment (BA) to the ER refers to Revision 3 (Dominion 2004), unless otherwise stated.

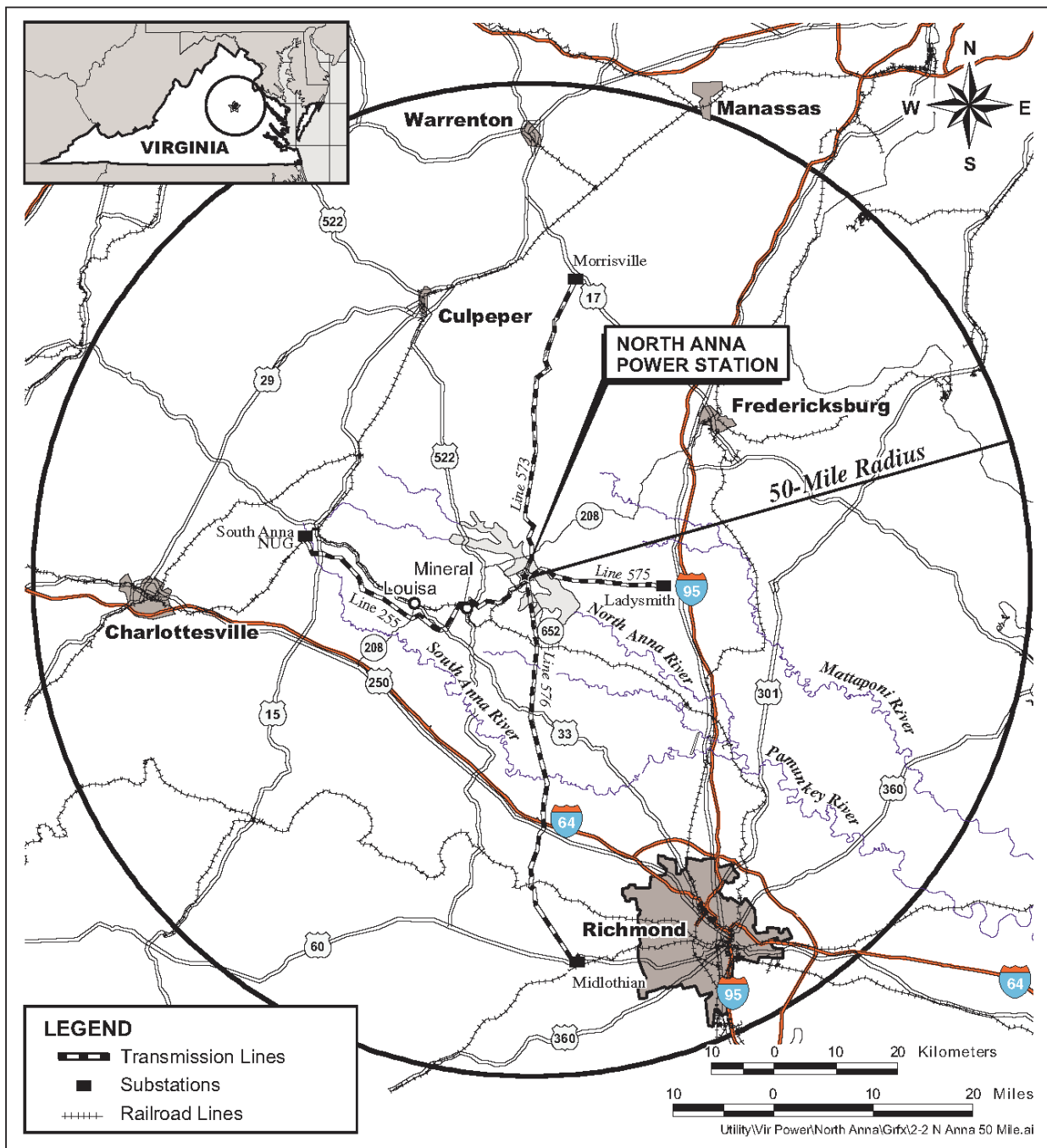


Figure 1. Location of North Anna ESP Site, 80-km (50-mi) Region

2.0 Project Description

The proposed Federal action is the issuance, under the provisions of 10 CFR Part 52, of an ESP for the North Anna ESP site for additional nuclear power facilities, and to conduct site preparation and limited construction activities identified in the application. The proposed action does not include approval to construct and operate new units but rather allows limited construction associated with site preparation activities. The complete construction and operation of new units are not presently proposed; therefore, this BA does not analyze the environmental impacts that could result from the actual construction and operation of two new nuclear units at the North Anna ESP site. Site preparation impacts are analyzed to determine whether activities proposed under the site redress plan might impact threatened and endangered species that occur in the vicinity of the NAPS.

No specific plant design has been selected by Dominion for the ESP site; instead, a set of bounding plant parameters has been specified to envelope future site development. This plant parameter envelope is based on the addition of power generation from two distinct units, to be designated as North Anna Units 3 and 4. Cooling water for Unit 3, the first of the proposed new units, would be provided by Lake Anna. Unit 4 would use dry cooling towers.

In this BA, the proposed ESP site is evaluated only for those activities related to the site preparation activities and the limited construction activities allowed by 10 CFR 52.25. The site redress plan provides for redress of impacts associated with site preparation and limited construction activities, if the applicant ultimately decides not to pursue construction of one or more nuclear units after the permitted activities have occurred. The activities permitted under 10 CFR 52.25 would allow for these site preparation and limited construction activities such as clearing and grading, and the construction of non-safety related facilities, which could include intake and discharge structures, cooling towers, turbine buildings, and non-safety related support facilities.

Dominion evaluated the existing transmission system that connects the NAPS site with the regional transmission grid, and determined that the existing transmission lines are sufficient to transmit all of the power generated by the existing and the postulated new nuclear units at the NAPS site. Therefore, no changes to the existing transmission system are proposed. The NRC examined the potential impacts of continued operation of the NAPS transmission lines in connection with the license renewal for NAPS Units 1 and 2 (NRC 2002) and determined that there would be no effect to threatened or endangered species. Because no changes to the lines or rights-of-way are anticipated, the transmission lines are not considered in this BA.

3.0 Potential Environmental Impacts

Site preparation activities may result in the removal of approximately 32 hectares (ha) (80 acres [ac]) of forested habitats, as well as grading of areas previously disturbed during construction of the existing NAPS units. In addition to direct habitat loss, there would likely be a temporary increase in ambient noise levels typical of land development and construction activities. Construction of intake and discharge structures would impact small portions of the Lake Anna shoreline.

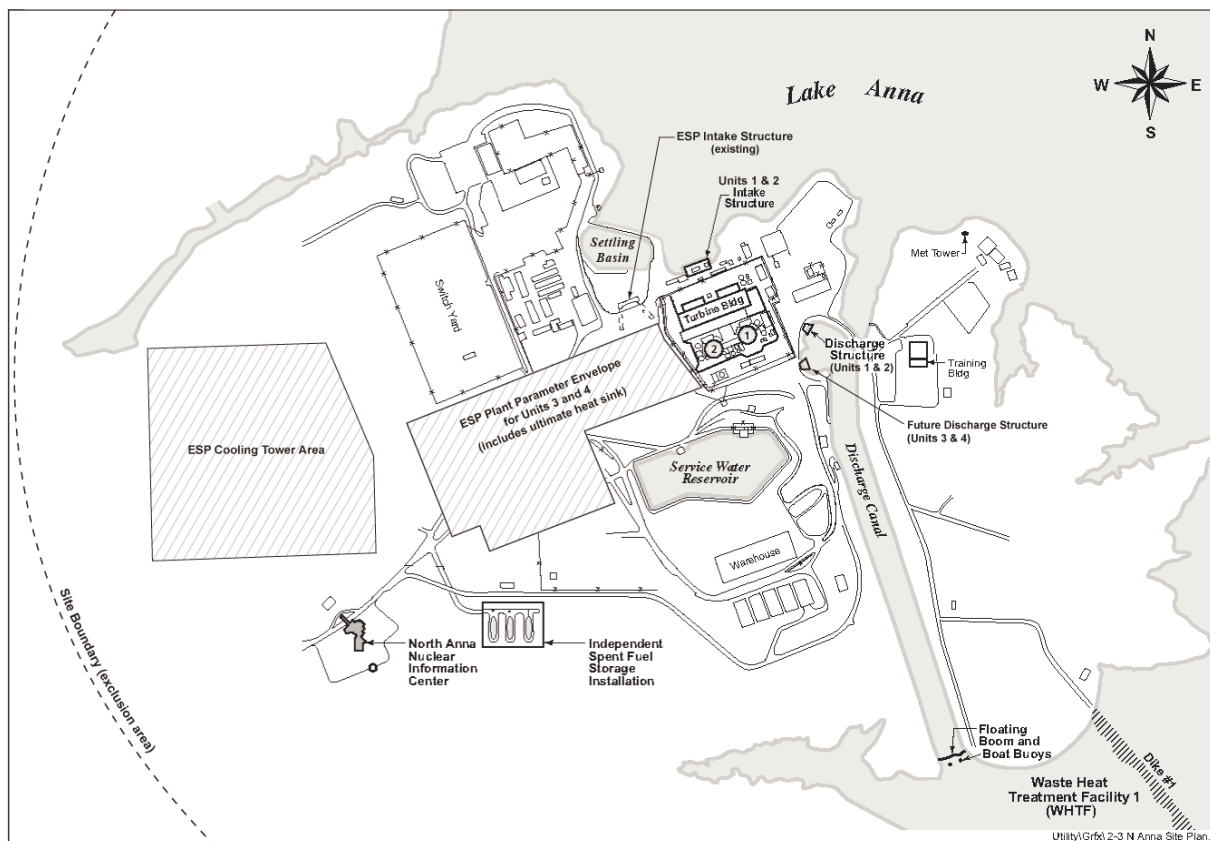


Figure 2. North Anna ESP Site Boundaries within the Existing NAPS Site

Much of the proposed North Anna ESP site construction area consists of dirt roads, cleared areas, parking lots, buildings, and early succession habitats (Figure 2). The western portion of the current and proposed laydown area, located northeast of the current switchyard, can be classified as "old-field" habitat. None of the current or proposed laydown area is forested. The area proposed for temporary offices, located east of the switchyard, is an existing office complex; thus, undisturbed habitats would not be impacted. The proposed cooling tower site consists primarily of forested habitat.

4.0 Description of the Project Area

4.1 Terrestrial Biological Communities of the North Anna Site

The ESP site is located within the Piedmont Physiographic Province as described by Omernik (1987). Although forests in the Piedmont Province are nominally characterized by oak-hickory-pine forest (Woods et al. 1999), this portion of north-central Virginia has been settled since the colonial era and, therefore, no longer contains virgin forests. Vegetative cover surrounding the ESP site is an irregular patchwork of row crops, pastures, pine plantations, abandoned (old) fields, and second-growth forests of hardwoods and mixed pine-hardwoods (Dominion 2004).

Approximately 30 percent of the North Anna site consists of power generation and maintenance facilities, parking lots, roads, cleared areas, and mowed grass. Hardwood forests and planted pines exist on approximately 70 percent of the site that has not been cleared for the construction or operation of the existing units. These wooded areas are remnants of forests that were used for timber production prior to acquisition by Virginia Power and are dominated by a variety of oaks (*Quercus* spp.), yellow poplar (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*) trees. Scattered loblolly pines (*Pinus taeda*), Virginia pines (*P. virginiana*), and short-leaf pines (*P. echinata*) exist in some wooded areas (Dominion 2004).

The Piedmont region of Virginia is characterized as an irregular plain with low, rounded ridges and shallow ravines (Woods et al. 1999). There are no steep ridges on the ESP site. The rolling terrain at the site extends down slope to the waters of Lake Anna, resulting in essentially no marsh habitat along the shoreline at the site. Hydrophytic vegetation, such as cattail (*Typha* spp.) and rushes (*Juncus* spp.), are typically absent or extend only to approximately 0.3 meters (m) to 1 m (one to three feet [ft]) beyond the shoreline (Dominion 2004). Two intermittent streams flowing north into an unnamed arm of Lake Anna, just northwest of the power-block area, bisect the area where cooling towers are proposed to be located. A narrow band of wetlands is associated with each of these streams. A small (<.5 ha [one ac]) isolated wetland is located within the ESP site.

Wildlife species found in the forested portions of the North Anna site are those typically found in upland Piedmont forests of north-central Virginia. Frequently observed mammals, such as the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), and gray fox (*Urocyon cinereoagenteus*), exist at the site, as do smaller mammals such as moles (Talpidae), shrews (Soricidae), and a variety of mice (Muridae) and voles (*Microtus* spp.). Woodchucks (*Marmota monax*) live in the grassy areas near forest edges at the site, and beavers (*Castor canadensis*) occur in Lake Anna and its tributaries. Various birds and herpifauna (e.g., snakes, turtles, lizards, and toads) live in the uplands and along the edge of Lake Anna (Dominion 2004).

Virginia Power has cooperated with the National Audubon Society in conducting periodic "Christmas Bird Counts" during December or January. Common bird species recorded in upland areas on and near the North Anna site during these surveys include the American crow (*Corvus brachyrhynchos*), blue jay (*Cyanocitta cristata*), Carolina chickadee (*Parus carolinensis*), mourning dove (*Zenaidura macroura*), black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), European starling (*Sturnus vulgaris*), song sparrow (*Melospiza melodia*), white-throated sparrow (*Zonotrichia albicollis*), dark-eyed junco (*Junco hyemalis*), northern cardinal (*Cardinalis cardinalis*), house finch (*Carpodacus mexicanus*), tufted titmouse (*Baeolophus bicolor*), red-bellied woodpecker (*Melanerpes carolinus*), downy woodpecker (*Picoides pubescens*), and northern flicker (*Colaptes auratus*) (Audubon Society 2004). Species known to nest within forested areas at the North Anna site, along forested edges, and in open areas (for example, northern cardinal, Carolina chickadee, blue jay) are those that commonly nest in upland Virginia habitats. Virginia Power has placed bluebird nest boxes in suitable habitats at the North Anna site and has constructed roofed structures for swallows in some locations. Eastern bluebirds (*Sialia sialis*) annually use the nest boxes, and barn swallows (*Hirundo rustica*) nest beneath the roofed structures (Dominion 2004).

Several species of residential and migratory wading birds and waterfowl use Lake Anna. Numerous gulls, ducks, and geese were noted during Christmas Bird Counts (Audubon Society 2004), as were great blue herons (*Ardea herodias*). Virginia Power biologists have documented breeding at Lake Anna by mallards (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), and Canada geese (*Branta canadensis*) (VEPCo 1986). Virginia Power, in association with the Louisa County Chapter of Ducks Unlimited, has placed wood duck nest boxes on Lake Anna, and wood ducks have used several of these nest boxes (VEPCo 1986). Belted kingfishers (*Ceryle alcyon*), great blue herons, and green-backed herons (*Butorides virescens*) are present at Lake Anna throughout the year, and belted kingfishers and green-backed heron presumably nest on or near the Lake Anna shoreline. There are no known great blue herons rookeries at Lake Anna (Dominion 2004). Waterfowl are typically most abundant at Lake Anna during the winter. Lake Anna provides important habitat for migratory waterfowl on the Atlantic flyway, especially during extremely cold winters when the elevated water temperature from station operation maintains a large ice-free body of water. The most common ducks observed during winter are mallard, American black duck (*Anas rubripes*), bufflehead (*Bucephala albeola*), and greater scaup (*Aythya marila*). The Canada goose, American coot (*Fulica americana*), ringed-billed gull (*Larus delawarensis*), and herring gull (*L. argentatus*) are also abundant on Lake Anna during the winter (Audubon Society 2004; VEPCo 1986).

4.2 Aquatic Biological Communities of the North Anna Site

The aquatic resources in the vicinity of the North Anna ESP site, the Waste Heat Treatment Facility (WHTF), and the North Anna River, are associated with Lake Anna (VEPCo 2001). Lake Anna was created to serve as the cooling water source for NAPS. The lake was formed during 1971 by erecting a dam on the main stem of the North Anna River, just upstream of the confluence of the North Anna River and Northeast Creek.

Lake Anna is typical of many shallow reservoirs found in the southern and mid-Atlantic states. Since impoundment, Lake Anna has gone through the typical ecological succession of reservoirs. The initial biotic community was highly productive because initial nutrient levels were high. Productivity subsequently decreased and ultimately stabilized (Paterson and Fernando 1970; Voshell and Simmons 1978). Aquatic communities in Lake Anna experienced gradual post-impoundment changes from riverine to lake communities. Some of these communities had stabilized in Lake Anna by 1975 (VEPCo 1986), and all have been relatively stable since 1985 (VEPCo 1986; VEPCo 2002).

Lake Anna contains numerous phytoplankton, zooplankton, and benthic macroinvertebrate communities. Seventy-seven genera of phytoplankton have been identified, and diatoms, green algae, blue-green algae (Cyanobacteria), and cryptomonads are the dominant forms. The zooplankton are dominated by small-bodied forms (rotifers and copepods). This has been attributed to selective predation upon larger-bodied zooplankton by landlocked schooling clupeids such as various shad species (Brooks and Dodson 1965). A total of 124 benthic taxa have been identified from Lake Anna (VEPCo 1986). Three bivalve species were collected in the North Anna basin prior to impoundment: *Elliptio complanatus*, *E. productus*, and *Sphaerium striatum* (AEC 1973).

In more recent years, the introduced Asiatic clam (*Corbicula* spp.) has dominated collections from both Lake Anna and the lower North Anna River. The Asiatic clam has spread rapidly throughout the United States since its first discovery in 1938 (VEPCo 1986). Its populations

expand rapidly when they invade a new habitat, and densities stabilize as the species reach carrying capacity of the habitat. Asiatic clams are present throughout Lake Anna with the greatest population densities found at mid-lake (VEPCo 1989). After its initial invasion of Lake Anna, densities increased sharply from 1979 to 1981. Populations remained relatively stable between 1984 and 1988 (VEPCo 1989). Virginia Power received approval from VDEQ to discontinue Asiatic clam sampling in 1989. The zebra mussel (*Dreissena polymorpha*) has not been observed in Lake Anna.

Small numbers of unionid mussels (*Elliptio* spp.) and fingernail clams (Sphaeriidae) have also been collected. Acid drainage and sediment from the Contrary Creek mine site historically depressed freshwater mussel populations downstream from the Contrary Creek-North Anna River confluence; the first major mussel beds prior to the impoundment of Lake Anna did not occur until 100 m (328 ft) downstream of the confluence of the North and South Anna Rivers (Reed and Simmons 1972). There are indications that mussel populations (*Elliptio* spp.) are recovering in the lower North Anna River (VEPCo 1986).

Thirty-nine species of fish (representing 12 families) have been identified in Lake Anna (VEPCo 1986). Species include those historically found in the North Anna River, those that had been in local farm ponds inundated by the new reservoir, and species introduced by the Virginia Department of Game and Inland Fisheries (VDGIF).

Recreational species include largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), striped bass (*Morone saxatilis*), walleye (*Stizostedion vitreum*), bluegill (*Lepomis macrochirus*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), white perch (*M. americana*), pumpkinseed (*L. gibbosus*), redear sunfish (*L. microlophus*), redbreast sunfish (*L. auritus*), channel catfish (*Ictalurus punctatus*), and white catfish (*Ameiurus catus*). Forage species include threadfin shad (*Dorosoma petenense*) and gizzard shad (*D. cepedianum*). Striped bass and walleye are stocked annually by VDGIF. In 1994, sterile triploid herbivorous grass carp (*Ctenopharyngodon idella*) was stocked by Virginia Power to control the growth of the nuisance submerged aquatic plant hydrilla (*Hydrilla verticillata*) with the approval of the VDGIF.

Before the North Anna River was impounded, the fish community of the river downstream of the Contrary Creek inflow was dominated by pollution-tolerant species. In the years following impoundment (and reclamation of the Contrary Creek mine site), there was a steady increase in measures of abundance and diversity of fish. During 1984 to 1985, 38 species from ten families were found in the North Anna River, compared to 25 species from eight families in the control stream, the South Anna River (VEPCo 1986). When species from the North Anna Reservoir were subtracted from the North Anna River totals, the two fish communities (North and South Anna River communities) showed striking similarities, indicating that the operation of the existing units had little or no effect on fish populations downstream from the dam.

The WHTF is the body of water into which waste heat from the existing units is discharged via the discharge canal. It is physically separated from the rest of Lake Anna by a series of dikes. The same aquatic communities occur in the WHTF that occur in the main reservoir. Fish can swim from the main reservoir into the WHTF and back. However, fish are not stocked in the WHTF, and angler access to this fishery is restricted to the land owners along this part of the shoreline.

There is no commercial fishing in Lake Anna or the North Anna River. There are no runs of anadromous fish in the North Anna River. The North Anna River is a tributary of the Pamunkey River, which has an annual run of American shad, but these shad do not move into the North Anna River (Jenkins and Burkhead 1994; Bilkovic et al. 2002). The Pamunkey Fish Hatchery in King William County, Virginia, is approximately 121 km (75 mi) downstream of the North Anna Dam. Shad reared at this facility are normally stocked in the Pamunkey River and the James River as fry. Young American eels (*Anguilla rostrata*) are found in the North Anna River, but are not sought by commercial fishermen. The American eel is a catadromous species, meaning that these fish begin their lives in the open ocean and migrate into coastal rivers where they spend much of their lives in fresh water (Rohde et al. 1994). Upon reaching sexual maturity, at age five to seven years, the eels migrate back to the ocean where they spawn and die. Eels in the North Anna River are juveniles, also known as "yellow eels."

The lower North Anna River downstream from the North Anna Dam is small, approximately 23 to 46 m (75 to 150 ft) wide, but supports a diverse assemblage of stream fishes. It is a popular fishing spot. Unless stream flow is unusually high, powerboats are impractical. Most anglers fish from shore or from canoes and kayaks. Recreational fishermen generally seek largemouth and smallmouth bass or redbreast sunfish. Bluegill and redear sunfish are present as well, but receive less attention from anglers.

5.0 List of Federally Threatened and Endangered Species

This section describes the threatened and endangered animal and plant species that potentially exist at or near the proposed ESP site. The FWS provided a list of species in the counties of interest (FWS 2004a) and also maintains current lists of threatened or endangered species on its website (FWS 2004b). The Virginia Department of Game and Inland Fisheries (VDGIF) (VDGIF 2004) and Virginia Department of Conservation and Recreation (VDCR 2004) also maintain lists of State-protected species on their websites. Species potentially occurring near the proposed North Anna ESP site that are listed as threatened or endangered by the FWS are listed in Table 1.

Table 1. Federally Threatened or Endangered Species Known or Potentially Occurring Near the Proposed North Anna ESP Site .

Scientific Name	Species	Counties	Status*
Invertebrates			
<i>Alasmidonta heterodon</i>	dwarf wedgemussel	Louisa, Orange, Hanover	FE
Birds			
<i>Haliaeetus leucocephalus</i>	bald eagle	Louisa, Orange, Caroline, Spotsylvania, Hanover	FT
Vascular Plants			
<i>Isotria medeoloides</i>	small whorled pogonia	Spotsylvania, Hanover, Caroline	FT
<i>Aeschynomene virginica</i>	sensitive joint-vetch	Hanover, Caroline	FT
<i>Helonias bullata</i>	swamp pink	Spotsylvania, Hanover, Caroline	FT
Status*: FE = Federally endangered, FT = Federally threatened			
Sources: FWS 2004a, 2004b, VDCR 2004, VDGIF 2004			

6.0 Description of Species and Habitats

In this section, each of the species listed in Table 1 is described, including its habitat requirements, status, and distribution in relation to the proposed project.

Dwarf Wedgemussel

The dwarf wedgemussel (*Alismidonta heterodon*) occurs sporadically in Atlantic coast rivers from Canada to North Carolina (FWS 1993). It is a small freshwater mussel (< 55 millimeters [2.17 inches]) long and roughly trapezoidal in shape. The outside of the shell is brown or yellowish-brown, with greenish rays visible in young or pale-colored specimens. The interior of the shell is bluish or silvery white and is iridescent in the posterior part of the shell. The hinge teeth are small but distinct. This species is unique in that it has two lateral teeth in the right valve and one in the left; other species have two lateral teeth in the left valve and one in the right (Environment Canada 2004).

The mussel is found in small streams to medium-sized rivers with slow to moderate current and fine sediment, sand, or gravel substrates. It appears to have poor tolerance for suspended silt. Stream-side vegetation seems to be required. The mussel releases a parasitic larvae, but the host fish species for the larvae is not known. The maximum life span of the mussel is believed to be 12-18 years. The mussel is vulnerable to pesticide and metal contamination, and to low oxygen levels. Impoundment of rivers has been a major negative factor on continued persistence of this species throughout its range, possibly due to dams blocking movements of host fish species (Environment Canada 2004).

The dwarf wedgemussel is known to occur in the South Anna River in Louisa County, VA (FWS 1993), but it has not been reported in the North Anna River or its tributaries. There are no rivers

or streams on the proposed North Anna ESP site that are suitable habitat for the dwarf wedgemussel.

Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) in Virginia are most common along the Chesapeake Bay, and along the lower reaches of several of the larger river systems such as the Potomac, Rappahannock, York, and James Rivers (VDGIF 2004, Watts and Byrd 2003). Most nest sites are found in the midst of large wooded areas adjacent to marshes or bodies of water, or in isolated trees located in marshes, on farmland, or in logged over areas where scattered seed trees remain (VDGIF 2004). Most eagle nests are less than 1.6 km (one mi) from feeding areas, although some can be as much as 3.2 km (two mi) from primary food sources. Wintering roost sites typically have the same characteristics as nest sites (VDGIF 2004). Bald eagle habitat usually occurs in undeveloped areas with little human activity. Bald eagles are primarily fish eaters but will prey upon mammals and birds when necessary, and they will eat carrion.

Bald eagles are occasionally observed along Lake Anna (six were observed during the 2003 Christmas Bird Count) (Audubon Society 2004). However, there are no known eagle nests near the proposed ESP site (NRC 2002). The VDGIF database indicates that one nest was located approximately eight km (five mi) downstream from Lake Anna Dam in 2000, but later surveys indicate this nest was not in use in 2003 (Watts and Byrd 2003). Dominion biologists indicated that there is a bald eagle nest near the north end of Lake Anna, approximately 16 km (10 mi) upstream of the existing units (Dominion 2004). Although the VDGIF information service does not include records of bald eagle nests on Lake Anna upstream from the NAPS, Watts and Byrd (2003) found that there was an occupied territory, but not an active nest, within the Mineral United States Geological Survey quadrangle in 2003. The Mineral quad is located west of the North Anna Power Station and includes the upper reaches of Lake Anna.

Small Whorled Pogonia

The small whorled pogonia (*Isotria medeoloides*) generally grows in open, dry, deciduous woods with acidic, sandy, loamy soil with low nutrient content. Suitable habitat for this species is limited on the NAPS site. It is not known to occur at the proposed North Anna ESP site (Dominion 2004; NRC 2002) and has not been reported in Louisa County. It has been reported to occur in the adjacent Spotsylvania and Caroline Counties, and potentially occurs in Hanover County (FWS 2004a, VDCR 2004).

Sensitive Joint-Vetch

The sensitive joint-vetch (*Aeschynomene virginica*) occurs in fresh to slightly-brackish tidal river systems in the intertidal area where the plants are flooded twice daily. Lake Anna and the North Anna River are not tidally influenced, and therefore, no habitat for the sensitive joint-vetch occurs at the proposed ESP site. The species is thought to potentially occur in Caroline and Hanover Counties (FWA 2004a) because suitable habitat is located within these counties, and the sensitive joint-vetch is known to occur in adjacent counties. However, any potential habitat would be located at least 48 km (30 mi) from the proposed North Anna ESP site.

Swamp Pink

The swamp pink (*Helonias bullata*), occurs in a variety of wetland habitats such as bogs, spring seeps, stream edges, and wet meadows. Sites are typically saturated year-round, but are rarely flooded. Soils are usually neutral to acidic. There is very little saturated ground or wetlands on the proposed North Anna ESP site; therefore, it is unlikely that there is suitable habitat within the affected area. The swamp pink is not known to occur at the North Anna site (Dominion 2004; NRC 2002) and has not been reported in Louisa County. It has been reported in Caroline County and is considered as potentially occurring in Hanover and Spotsylvania Counties (FWS 2004a).

7.0 Evaluation of Potential Impacts

Site preparation and limited construction activities would result in the removal of up to approximately 32 ha (80 ac) of forested habitat within the site. The ESP site does not contain any old growth timber, unique or sensitive plants, or unique or sensitive plant communities. Therefore, construction activities would not noticeably reduce the local or regional diversity of plants or plant communities. There are no areas designated by the FWS as critical habitat for endangered or threatened species at or near the site. No threatened or endangered plant species have been reported near the North Anna ESP site or in Louisa County, and no suitable habitat for threatened or endangered plant species is known to exist on the North Anna ESP site.

Movement of construction workers, materials, and equipment, and the operation of construction equipment (e.g., earth-moving equipment, portable generators, pile drivers, pneumatic equipment, and hand tools) would generate noise. Noise from human activities can affect wildlife by inducing physiological changes, nest or habitat abandonment, and behavioral modifications, or it may disrupt communications required for breeding or defense (Larkin 1996). However, it is not unusual for wildlife to adapt to noise from human activities (Larkin 1996). Although short-term noise levels from construction activities could be as high as approximately 110 decibels (e.g., impulse noise during pile-driving activities), these noise levels would not extend far beyond the boundaries of the ESP site. At a distance of 120 m (400 ft) from the construction site, noise levels from these activities would range from approximately 60 to 80 decibels. These noise levels are below the 80-to-85-decibel threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from construction activities would not be likely to disturb wildlife beyond 120 m (400 ft) from the construction site. Additionally, construction would occur adjacent to the existing operating Units 1 and 2, where wildlife has presumably become accustomed to typical, existing operating facility noise levels of approximately 50 to 60 decibels at the NAPS security fence (Dominion 2004).

There are no small streams to medium-sized rivers with slow-to-moderate current and fine sediment, sand, or gravel substrates on the ESP site. Two intermittent streams exist on the North Anna ESP site (Dominion 2004); however, they are not expected to support a population of dwarf wedgemussels. Besides being intermittent streams, they do not support fish populations that are essential to the life cycle of the dwarf wedgemussel. Proposed activities authorized under 10 CFR 52.25 would not adversely affect the North Anna River.

The 32 ha (80 ac) of forested habitat removed during construction presumably could be used by bald eagles for perching, roosting, or nesting. Eagles are occasionally observed in the vicinity of NAPS, but there is no indication that the proposed project site is regularly utilized by bald eagles. The nearest known bald eagle territory is believed to be approximately 16 km (ten mi) from site

preparation and construction activities at the proposed ESP site. The *Bald Eagle Protection Guidelines for Virginia* (USFWS and VGDIF 2000) recommends a buffer of 400 m (0.25 mi), in which construction activities should be limited. Although bald eagles may occasionally be observed near the plant, no nesting or roosting activity has ever been observed within an area that could be affected by construction or operational noise. No avian collisions with existing structures at the NAPS site have been noted (Dominion 2004); therefore, such collisions during the site preparation and construction phase would be unlikely.

8.0 Management Actions Related to the Species

To minimize construction-related impacts to wildlife, Dominion has stated that it would adhere to State permit conditions that may restrict the timing of certain construction activities (Dominion 2004). Dominion maintains a migratory bird protection program, including protection of nests and reporting bird (especially raptor) strikes and other events (Dominion 2001).

A few small wetland areas and two intermittent streams exist on the North Anna ESP site (Dominion 2004). Watercourses and wetlands would be avoided to the extent possible during any construction. Dominion has stated (Dominion 2004) that any work that has the potential to impact a wetland would be performed in accordance with applicable laws, regulations, permits, and authorizations. Wetland delineations and surveys would be conducted prior to commencement of construction activities. The Army Corps of Engineers has jurisdiction over wetlands under Section 404 of the Clean Water Act. If the areas are determined to be wetlands under the Clean Water Act, disturbance of the areas would either be avoided or other appropriate mitigation actions would be implemented as required by any applicable permits and regulations (Dominion 2004).

9.0 Conclusions

The proposed action is the issuance of an ESP for two additional nuclear power units at the North Anna ESP site. This BA has considered the potential impacts of site preparation and limited construction activities at the proposed site on species listed as threatened or endangered under the ESA, species proposed for such status, species considered candidates for listing under the ESA, or designated critical habitats for such listed species.

There is no habitat for the dwarf wedgemussel on the North Anna ESP site, and the proposed site preparation activities would not have an effect on, or occur near, the North Anna River or any other potential habitat areas. Therefore, the staff concludes that the proposed action would have no effect on the dwarf wedgemussel.

Because bald eagles have been observed in the vicinity of the North Anna ESP site, but have never been observed to nest or roost in the vicinity, the staff has concluded that the proposed action may affect, but are not likely to adversely affect bald eagles.

It is very unlikely that three protected plant species, small-whorled pogonia, sensitive joint-vetch, and swamp pink, may occur at the NAPS site. These species have never been reported in Louisa county, and there is no known habitat for these species on the North Anna ESP site. Therefore, the staff concludes that the proposed action would have no effect on the small-whorled pogonia, sensitive joint-vetch, and swamp pink.

10.0 References

10 CFR Part 51. Code of the *Federal Regulations*, Title 10, *Energy*, Part 51, " Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, " Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

Audubon Society. 2004. "103rd Christmas Bird Count. Lake Anna Virginia, United States." <http://audubon.birdsource.org/CBCOutput/review.html?speciesByState=false&year=103&circle=S1022926>. Accessed 3/1/2004.

Bilkovic, D. M., C. H. Hershner, and J. E. Olney. 2002. "Macroscale Assessment of American Shad Spawning and Nursery Habitat in the Mattaponi and Pamunkey Rivers, Virginia. *North American Journal of Fisheries Management* 22:1176-1192; 2002."

Brooks, J.L. and S.I. Dodson. 1965. "Predation, Body Size, and Composition of Plankton." *Science*, 150:28-35.

Dominion Nuclear North Anna, LLC (Dominion) 2001. "Migratory Birds." *Water/Waste Environmental Protection Manual*. Chapter 13. Glen Allen, Virginia.

Dominion Nuclear North Anna, LLC (Dominion). 2004. *North Anna Early Site Permit Applications – Part 3 - Environmental Report*. Revision 3, Glen Allen, Virginia.

Endangered Species Act of 1973. 16 USC 1531, et seq.

Environment Canada. 2004.
http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=591#description. Accessed 11/4/2004.

Golden, J., R. P. Ouellette, S. Saari, and P. N. Cheremisinoff. 1980. Environmental Impact Data Book. Ann Arbor Science Publishers, Inc. Ann Arbor, Michigan.

Jenkins, R. E. and N. M. Burkhead. 1994. *Freshwater Fishes of Virginia*. American Fisheries Society, Bethesda, Maryland.

Larkin, R. P. 1996. Effects of Military Noise on Wildlife: A Literature Review. USACERL Technical Report 96/21. U.S. Army Construction Engineering Research Lab. Champaign, Illinois. http://nhsbig.inhs.uiuc.edu/bioacoustics/noise_and_wildlife.txt. Accessed 9/21/2004.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

National Oceanic and Atmospheric Administration (NOAA). 2004. Letter from Mary Colligan (NOAA) to Pao-Tsin Kuo, NRC. Date January 6, 2004.

Omernik, J. 1987. "Ecoregions of the conterminous United States. Map (Scale 1:7500000)." *Annals of the Association of American Geographers* 77(1):118-125.

Paterson, C.G. and C.H. Fernando. 1970. Benthic Fauna Colonization of a New Reservoir with Particular Reference to the Chironomidae. *J. Fish. Res. Bd., Canada* 27:213-232.

Reed, J.C. and G.M. Simmons. 1972. *An Ecological Investigation of the Lower North Anna and Upper Pamunkey River System*. Prepared for Virginia Electric and Power Company, Richmond, Virginia.

Rohde, F. C., R. G. Arndt, D. G. Lindquist, and J. F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. The University of North Carolina Press, Chapel Hill, North Carolina.

U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to the Continuation of Construction and the Operation of Units 1 and 2 and Construction of Units 3 and 4, North Anna Power Station*. Washington, D.C.

U.S. Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries (FWS and VDGI). 2000. Bald Eagle Protection Guidelines for Virginia.
<http://www.dgif.state.va.us/wildlife/publications/EagleGuidelines.pdf>. Accessed 3/23/2004.

U.S. Fish and Wildlife Service (FWS). 1993. Dwarf wedge mussel recovery plan. Hadley, Massachusetts.

U.S. Fish and Wildlife Service (FWS) 2004a. Letter From Karen Mayne, FWS to the NRC, dated October 25, 2004. "NRC's North Anna and Surry Power Stations", Project number 9064.

U.S. Fish and Wildlife Service (FWS). 2004b. "Threatened and Endangered Species System (TESS) Listings by State and Territory as of 03/01/2004. Virginia."
http://ecos.fws.gov/tess_public/TESSWebpageUsaLists?state=VA . Accessed 3/1/2004.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 7, Regarding North Anna Power Station, Units 1 and 2*, NUREG-1437, Office of Nuclear Reactor Regulation, Division of Regulatory Improvement Programs, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2003a. Letter from P.T. Kuo, U.S. Nuclear Regulatory Commission, to M. Colligan, NOAA Fisheries, Application for an Early Site Permit for the North Anna Power Station Site.

U.S. Nuclear Regulatory Commission (NRC). 2003b. Letter from P.T. Kuo, U.S. Nuclear Regulatory Commission, to J. Wolflin, U.S. Fish and Wildlife Service, Application for an Early Site Permit for the North Anna Power Station Site.

Virginia Department of Conservation & Recreation (VDCR). 2004. "Virginia's Natural Communities, Rare, Threatened and Endangered Animals and Plants."
www.dcr.state.va.us/dnh/nhrinfo.htm. Accessed 3/25/2004.

Virginia Department of Game and Inland Fisheries (VDGIF). 2004. "Geographic Search. Fish and Wildlife Information Service." Available at vafwis.org/perl/vafwis.pl/vafwis.login. (Note: This is a protected website that is accessible only through VDGIF authorization.)

Virginia Electric and Power Company (VEPCo). 1986. *Section 316(a) Demonstration for North Anna Power Station: Environmental Studies of Lake Anna and the Lower North Anna River*. Virginia Power Corporate Technical Assessment. Water Quality Department. Richmond, Virginia.

Virginia Electric and Power Company (VEPCo). 1989. *Environmental Study of Lake Anna and the Lower North Anna River*. Annual Report for 1988. Richmond, Virginia.

Virginia Electric Power Company (VEPCo). 2001. *Application for License Renewal for North Anna Power Station, Units 1 and 2, Appendix E, Environmental Report - Operating License Renewal Stage*. Richmond, Virginia.

Virginia Electric and Power Company (VEPCo). 2002. *Environmental Study of Lake Anna and the Lower North Anna River*. Annual Report for 2001 including Summary for 1998-2000, Richmond, Virginia.

Voshell, J.R., and G.M. Simmons, Jr. 1978. "The Odonota of a New Reservoir in the South-Eastern United States," *Odonatologica* 7(1):67-76.

Watts, B.D. and M. A. Byrd. 2003. Virginia bald eagle nest and productivity survey: Year 2003 report. Center for Conservation Biology Technical Report Series, CCBTR-03-03. College of William and Mary, Williamsburg, VA. 26 pp.

Woods, A.J., J.M. Omernik, and D.D. Brown. 1999. "Level III Ecoregions of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia." National Health and Environmental Effects Research Laboratory. US EPA. Corvallis, Oregon.
http://www.epa.gov/wed/pages/ecoregions/reg3_eco.htm. Accessed 3/1/2004.