ENVIRONMENTAL ASSESSMENT

Managing Damage to Resources and Threats to Human Health and Safety Caused by Waterfowl in the Commonwealth of Virginia

Prepared by:

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

In cooperation with:

United States Department of the Interior
United States Fish and Wildlife Service
Migratory Bird Program
Region 5

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ACRONYMS

AFBWPS	Atlantic Flyway Breeding Waterfowl Plot Survey
AFMWS	Atlantic Flyway Mid-winter Waterfowl Survey
AMDUCA	Animal Medicinal Drug Use Clarification Act of 1994
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
CBC	Christmas Bird Count
CDC	U.S. Department of Health and Human Services, Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSA	Cooperative Service Agreement
DEA	U.S. Department of Justice, Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	U.S. Department of Transportation, Federal Aviation Administration
FDA	U.S. Department of Health and Human Services, Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MANEM	Mid-Atlantic / New England / Maritimes Region Waterbird Working Group
MOU	Memorandum of Understanding
MSMSS	Mid-Summer Mute Swan Survey
NAGPRA	Native American Graves Protection and Repatriation Act
NASS	U.S. Department of Agriculture, National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NWRC	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center
PPE	Personal Protective Equipment
USAF	U.S. Department of the Air Force
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Department of the Interior, U.S. Fish and Wildlife Service
ROD	Record of Decision
SOPs	Standard Operating Procedures
VAC	Virginia Administrative Code
VBBAP	Virginia Breeding Bird Atlas Project
VDACS	Virginia Department of Agriculture and Consumer Services
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
WBPHS	Waterfowl Breeding Population and Habitat Survey
WS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services
WS-Virginia	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program in Virginia

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Across the United States, habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with the needs of animals which increases the potential for conflicting human/animal interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS' involvement in waterfowl damage management in Virginia. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the federal agency authorized to protect American resources from damage associated with wildlife (the Act of March 2, 1931 (7 U.S.C. 8351-8352) as amended, and the Act of December 22, 1987 (7 U.S.C. 8353)). Human/animal conflict issues are complicated by the wide range of public responses to animals and animal damage. What may be unacceptable damage to one person may be a normal cost of living with nature to someone else. The relationship in American culture of values and damage can be summarized in this way:

> *Animals have either positive or negative values, depending on varying human perspectives and circumstances (Decker and Goff 1987). Animals are generally regarded as providing economic, recreational and aesthetic benefits, and the mere knowledge that animals exist is a positive benefit to many people. However, the activities of some animals may result in economic losses to agriculture and damage to property. Sensitivity to varying perspectives and values is required to manage the balance between human and animal needs. In addressing conflicts, managers must consider not only the needs of those directly affected by damage but a range of environmental, sociocultural and economic considerations as well.*

WS' activities are conducted to prevent or reduce animal damage to agricultural, industrial, and natural resources, and to property, livestock, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, tribes, private organizations, and individuals. The WS program uses an integrated approach (WS Directive 2.105)[1] in which a combination of methods may be used or recommended to reduce damage. Program activities are not based on punishing offending animals but are conducted to reduce damage and risks to human and livestock health and safety, and are used as part of the WS Decision Model (Slate et al. 1992).

WS is a cooperatively funded, service-oriented program that receives requests for assistance with damage caused by animals from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and animal management agencies to reduce damage effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies.

WS chose to prepare this EA in cooperation with the U.S. Fish and Wildlife Service (USFWS) to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of direct, indirect, and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed damage management program. Pursuant to the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations, WS is preparing this EA[2] to document the analyses associated with proposed federal actions and to inform decision-makers and the

[1] WS Program Directives are available at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_WS_Program_Directives

[2] The CEQ defines an EA as documentation that "...(1) briefly provides sufficient evidence and analysis for determining whether to prepare an [Environmental Impact Statement]; (2) aids an agency's compliance with NEPA when no environmental impact statement is necessary; and (3) facilitates preparation of an Environmental Impact Statement when one is necessary" (Council on Environmental Quality 2007).

public of reasonable alternatives capable of avoiding or minimizing significant effects. This EA will also serve as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into the actions of the agency.

1.2 NEED FOR ACTION

WS continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, property, and reduce or prevent threats to human health and safety associated with species of waterfowl, including mute swan (*Cygnus olor*), tundra swan (*Cygnus columbianus*), Canada goose (*Branta canadensis*), brant (*Branta bernicla*), snow goose (*Chen caerulescens*), black-bellied whistling-duck (*Dendrocygna autumnalis*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), gadwall (*Anas strepera*), northern pintail (*Anas acuta*), American wigeon (*Anas americana*), northern shoveler (*Anas clypeata*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), Muscovy duck (*Cairina moschata*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), ring-necked duck (*Aythya collaris*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), common eider (*Somateria mollissima*), harlequin duck (*Histrionicus histrionicus*), long-tailed duck (*Clangula hyemalis*), surf scoter (*Melanitta perspicillata*), black scoter (*Melanitta americana*), white-winged scoter (*Melanitta fusca*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), hooded merganser (*Lophodytes cucullatus*), common merganser (*Mergus merganser*), red-breasted merganser (*Mergus serrator*), ruddy duck (*Oxyura jamaicensis*), free-ranging domestic and feral waterfowl, and American coot (*Fulica americana*)[3]. This EA will assist in determining if the proposed management of waterfowl damage could have a significant impact on the human environment based on previous activities conducted and based on the anticipation of receiving additional requests for assistance. Because the goal of WS is to conduct a coordinated program in accordance with plans and objectives developed to reduce damage, and because this goal and these objectives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within Virginia as part of a coordinated program.

Changes in the need for action and the affected environment have prompted WS to initiate this new analysis to address damage or threats associated with waterfowl in the Commonwealth. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action.

Some species of animals have adapted to and have thrived in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and animals. Those conflicts often lead people to request assistance with reducing damage or threats. Animals can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard animals as providing economic, recreational, and aesthetic benefits. Knowing that animals exist in the natural environment provides a positive benefit to some people. However, activities associated with these animals may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values is required to balance the needs of people and animals. When addressing damage or threats of damage caused by animals, damage management professionals must consider not only the needs of those people directly affected by damage but a range of environmental, sociocultural, and economic considerations as well.

[3] WS acknowledges that American coot are not universally considered to be species of waterfowl. However, for the purposes of this document, the term waterfowl shall be inclusive of all those species listed above including American coots.

Both sociological and biological carrying capacities must be applied to resolve damage problems. The animal acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for animals or the maximum number of a given species that can coexist compatibly with local human populations. The biological carrying capacity is the ability of the land or habitat to support healthy populations of animals without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). Those phenomena are especially important because they define the sensitivity of a person or community to a species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the animal acceptance capacity. The available habitat may have a biological carrying capacity to support higher populations; however, in many cases the animal acceptance capacity is lower or has been reached. Once the animal acceptance capacity is reached or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species have no intent to do harm. They utilize habitats (e.g., reproduce, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people often seek assistance.

The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (e.g., economic, social, aesthetics). Therefore, how damage is defined can often be unique to an individual person, and damage occurring to one individual may not be considered damage by another individual. However, the term "damage" is consistently used to describe situations where an individual person has determined the losses associated with animals is actual damage requiring assistance (i.e., has reached an individual threshold). The term "damage" is most often defined as economic losses to resources or threats to human safety. However, damage could also include a loss in aesthetic value and other situations where the actions of animals are no longer tolerable to an individual person.

Managing damage caused by animals is often based on balancing animal populations and human perceptions in a struggle to preserve rare species, regulate species populations, oversee consumptive uses of animals, and conserve the environment that provides habitat. Animals are regarded as has having aesthetic, ecological, economic, educational, nutritional, scientific and socio-cultural values (Chardonnet et al. 2002), and there is enjoyment in knowing species exist and contribute to natural ecosystems (Decker et al. 2001). However, when the presence of an adaptable and opportunistic species is combined with human expansion, land management conflicts often develop.

Waterfowl add an aesthetic component to the environment, provide essential ecological functions, sometimes provide opportunities for hunting, and provide people with a connection with nature. Many people, even those experiencing damage, consider the waterfowl addressed in this EA to be a charismatic and valuable component of their environment. However, tolerance differs among individuals.

The need for action to manage damage and threats associated with waterfowl arises from requests for assistance[4] received by WS to reduce and prevent damage. Requests for assistance with managing waterfowl damage or threats of waterfowl damage from federal fiscal year (FY) 2012 through FY 2016

[4] WS only conducts damage management after receiving a request for assistance. Before initiating damage activities, a Memorandum of Understanding, cooperative service agreement, or other comparable document must be signed between WS and the cooperating entity which lists all the methods the property owner or manager will allow to be used on property they own and/or manage.

were primarily related to Canada geese (1,660 requests), mallards (322 requests), mute swans (39 requests), Muscovy ducks (31 requests) and free-ranging domestic and feral waterfowl (83 requests).

Two forms of assistance have been provided by WS to those people requesting assistance with resolving damage or the threat of damage. Technical assistance is the provision of information, recommendations, and demonstrations on available and appropriate methods that could be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 2 of this EA. Direct operational assistance is the direct application of methods by WS. Direct operational assistance can only commence after technical assistance has been provided (see WS Directive 2.101, WS Directive 2.201) and those persons requesting assistance have been informed of their options (see WS Directive 3.101). WS' direct operational assistance activities will be discussed further in Chapter 2 of this EA. The numbers of requests for assistance are representative of the damage and threats that could be caused by waterfowl. Many of the requests for assistance involved multiple resources and multiple species.

Table 1.1 – Species of waterfowl addressed in the EA and agricultural (A), natural (N), property (P), and human health and safety (H) resources affected by these species.

Species	Resource			
	A	N	P	H
Mute swan	X	X	X	X
Tundra swan			X	X
Canada goose	X	X	X	X
Brant			X	X
Snow goose	X	X	X	X
Black-bellied whistling-duck			X	X
Wood duck			X	X
Mallard	X	X	X	X
American black duck			X	X
Gadwall			X	X
Northern pintail	X		X	X
American wigeon	X		X	X
Northern shoveler			X	X
Blue-winged teal	X		X	X
Green-winged teal			X	X
Muscovy duck			X	X
Canvasback			X	X
Redhead	X		X	X
Ring-necked duck			X	X
Greater scaup	X		X	X
Lesser scaup	X		X	X
Common eider			X	X
Harlequin duck			X	X
Long-tailed duck			X	X
Surf scoter	X		X	X
Black scoter			X	X
White-winged scoter	X		X	X
Common goldeneye			X	X
Bufflehead	X		X	X
Hooded merganser	X		X	X
Common merganser	X		X	X
Red-breasted merganser	X		X	X
Ruddy duck			X	X
Free-ranging domestic and feral	X	X	X	X
American coot	X		X	X

Table 1.1 lists species of waterfowl addressed in this EA and the resource types that these species can cause damage to in Virginia. Many of the species of waterfowl addressed in this EA can cause damage to or pose threats to more than one resource. Specific information regarding waterfowl damage to agricultural resources, natural resources, property, and to reduce or prevent threats to human health and safety are discussed in the following subsections.

Need for Waterfowl Damage Management to Reduce or Prevent Threats to Human Health and Safety

Requests received by WS for assistance in reducing or preventing threats to human health and safety from waterfowl falls into three categories.

Threat of Disease Transmission

Zoonotic diseases are animal diseases which are transmissible to people. Disease transmission can occur from direct interactions between people and waterfowl, ingestion (or inhalation) of contaminated material, or from interactions with pets and livestock that have direct contact with waterfowl. Livestock can encounter and interact with waterfowl, which can increase the possibility of transmission to people. Increased exposure to waterfowl's feces in areas where both birds and humans congregate (e.g., parks, recreational areas etc.) can also increase the possibility of transmission to people. Also of concern, is the ability of birds to fly and transport disease causing organisms from one location to another. Disease transmission from waterfowl to humans is uncommon. However, the infrequency of such transmissions does not diminish the concerns of those individuals requesting assistance because disease transmissions are documented and possible. Diseases which can be transmitted from waterfowl to humans may be bacterial, spirochetal, rickettsial, viral, fungal, or parasites.

WS continues to receive requests for assistance from persons concerned about the potential risk of transmission of diseases to humans from waterfowl. Under the proposed action, WS could provide both technical assistance and direct control to these persons. WS could also conduct or assist with the monitoring or surveillance of diseases in waterfowl addressed in this EA. Most disease sampling would occur ancillary to other wildlife damage management activities (i.e., disease sampling occurs after birds have been captured or lethally removed for other purposes). WS may also sample birds captured or lethally removed by private or other government entities or dying from other causes. For example, WS may sample mallards killed by hunters for zoonotic or other diseases.

This section includes brief descriptions of examples of zoonotic diseases for which WS could provide surveillance or management assistance. Additional examples of zoonotic diseases, their animal host and how humans become exposed are displayed in Table 1.2. Hosts are organisms that harbor or carry other organisms either externally or internally (e.g., parasites). This discussion is intended to briefly address the more commonly known zoonotic diseases associated with those species addressed in this EA. It is not intended to be an exhaustive discussion of all potential zoonotic diseases. The transmission of many zoonotic diseases from wildlife to humans is neither well documented nor well understood. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonella poisoning may have contracted salmonella bacterium from direct contact with an infected bird, but may have also contracted the bacterium from eating undercooked meat or from other sources. Consequently, this list is not all-inclusive and new diseases may be identified in the future or may be introduced from other geographic areas.

Table 1.2 – Diseases that pose potential human health and safety risks through transmission to humans (modified from Tsiodras et al. 2008).

Disease (causative agent)	How humans contract from birds[1]	Hosts[2]
Psittacosis or Ornithosis *(Chlamydia psittaci)*	Exposure to infected feces or nasal discharge[3]	Ducks
E. coli (*Escherichia coli*)	Swimming in contaminated water[4], indirect contact with contaminated materials[5]	Ducks
Salmonella (*enterica typhimurium*)	Consumption of or contact with contaminated materials or dead birds[6,7]	Waterfowl
Mycobacterium (*M. avium, M. ulcerans)*	Exposure to birds, contaminated water	Ducks
Lyme Disease (*Borrelia burgdorferi spp.*)	Bite of an infected tick	Waterfowl
West Nile Virus	Bite of an infected mosquito	Waterfowl[8]
Influenza A virus (e.g., H5N1)	Exposure to birds[9]	Ducks, geese, swans
Enterococcus Infections (e.g., meningitis)	Contaminated water, exposure to birds	Ducks, waterfowl
Staphylococcus	Contaminated water	Ducks
Enterobacteriaceae, *Yersinia* species	Various	Ducks, Waterfowl
Campylobacter (*Campylobacter spp.*)	Contaminated water[10]	Ducks
Helicobacter (various species)	Contaminated water, feces	Geese
Other gram negative bacilli (Pseudomonas, Aeromonas, etc.)	Various[11]	Geese
Cholera (*Vibrio cholerae*)	Contaminated water[12]	Coot[13], ducks[13]
Tick-borne Encephalitis virus	Bite of an infected tick	Mallards
Newcastle Disease Virus	Infected birds, contaminated materials	Waterfowl
Eastern and western equine encephalitis	Bite of an infected mosquito	Waterfowl
Coccidia (Eimeria)	Ingestion	Waterfowl
Cryptosportidium	Ingestion, often of contaminated water	Ducks, geese, swans
Helminths parasites (e.g., swimmer's itch)	Swimming	Waterfowl
Sarcocystis	Contaminated water	Ducks, geese, swans

[1]See Tsiodras et al. for additional citations
[2]Host species listed here only include those animals addressed in this EA.
[3]Smith et al. 2005
[4]Samadpour et al. 2002
[5]Ejidokun et al. 2005
[6]Kapperud et al. 1998
[7]Thornley et al. 2003
[8]Meece et al. 2006
[9]Gill et al. 2006
[10]Savill et al. 2003
[11]Feare et al. 1999
[12] CDC 2016a
[13]Ogg et al. 1989

Psittacosisis is a bacterial infection caused by *Chlamydia psittaci*. The bacteria can be found in the feces and nasal discharge of infected birds (Smith et al. 2005). Once these substances have dried, humans can become infected by inhaling the dried materials as dust particles or by direct contact with an infected bird (Conover and Vail 2015). Although rare, infection can be serious, resulting in hospitalization or even death (Conover and Vail 2015). People most at risk include persons that handle wild or domestic birds (e.g., biologists, wildlife rehabilitators, farm workers, workers at processing plants). The most recent

psittacosis case in Virginia was reported in 2003 (VDH 2014). Fewer than 10 confirmed cases are reported in the U.S. each year but many cases may not be correctly diagnosed or reported (CDC 2016*b*).

Escherichia coli, commonly known as E. coli, is a bacteria associated with the fecal material of warm-blooded animals including waterfowl. Human infection can occur through consumption of food or water contaminated with the bacteria, or through direct or indirect contact with fecal material (Ejidokun et al. 2006, Conover and Vail 2015). In 1999, an outbreak of E. coli in Washington State which sickened 37 children, eight of who had to be hospitalized, was traced to lake water (that the children had swam in) and duck feces at the swimming beach (Samadpour et al. 2002, Bruce et al. 2003, Conover and Vail 2015). In Virginia, Canada geese have been found (via genetic fingerprinting) to be responsible for the fecal contamination of ponds on Fisherman Island (Simmons et al. 1995). E. coli contamination is of particular concern when surface water is used as a municipal water supply. Alderisio and DeLuca (1999) found that Canada geese were responsible for increased fecal bacteria levels at a reservoir where upwards of 80% of New York City's drinking water resides (Klett et al. 1998). Waterfowl such as Canada geese also have the ability to transfer E. coli that is resistant to antibiotics and other antimicrobials from place to place (e.g., from liquid waste facilities to fields where fresh fruits and vegetables are grown) Cole et al. (2005).

West Nile Virus is the most common mosquito-borne virus in Virginia (VDH 2014). In most cases, humans become infected when they are bitten by an infectious mosquito that has previously fed on an infected bird (Conover and Vail 2015). Most infections cause mild symptoms but severe cases can cause encephalitis (i.e., inflammation of the brain) or meningitis (i.e., inflammation of the lining of the brain and spinal cord) which may lead to permanent neurological problems or death (VDH 2014). Seven cases of West Nile Virus were reported in the Commonwealth in 2014 with one case proving fatal (VDH 2014).

Influenza or flu is caused by several species of virus. Type A influenza viruses infect birds and some strains have developed the ability to infect humans (Conover and Vail 2015). An example of a Type A influenza virus is H5N1 or avian influenza. Humans acquire the virus directly from birds including ducks and geese (Gill et al. 2006, Saad et al. 2007, Conover and Vail 2015). Although H5N1 has been reported among wild birds in the U.S., there have been no human cases reported in the U.S. (CDC 2015). Worldwide, there have been a total of 856 human cases and 452 human deaths from H5N1 (WHO 2017). The virus has not developed the ability to easily spread from person to person but because it may obtain that ability, H5N1 has been called "a pandemic in waiting" (Conover and Vail 2015).

Campylobacteriosis is a disease caused by bacteria in the genus *Campylobacter*. Most people acquire the disease from ingesting contaminated food or water although people can acquire the disease from contact with the fecal material of infected animals (VDH 2014, Conover and Vail 2015). Wild birds, including Canada geese and mallards can spread the bacteria in their feces (Keller et al. 2011, Fallacara et al. 2001, Ruthledge et al. 2013). French et al. (2009) found that feces of wild birds in playgrounds could contribute to the occurrence of Campylobacteriosis in preschool children. Symptoms range from mild (diarrhea, abdominal pain, fever, nausea) to severe (arthritis, convulsions, Guillain-Barré syndrome) and children are most likely to become infected (VDH 2014). In 2014, 744 cases of Campylobacteriosis were reported in the Commonwealth (VDH 2014).

Cryptosporidium is an intestinal parasite that infects a wide range of vertebrate hosts, including birds. Humans become infected by drinking contaminated water (e.g., while swimming or from municipal water supplies) or from contact with the fecal material of infected animals (VDH 2014). In humans, these parasites can cause persistent diarrhea with nausea, cramping and abdominal pain and can produce life threatening infections in people with suppressed or compromised immune systems (Graczyk et al. 2008, VDH 2014). Cryptosporidium is present in the feces of wild ducks and geese (Graczyk et al. 1998, Kuhn et al. 2002, Kassa et al. 2004). Unfortunately, the cysts of these parasites (which are still infectious after passing through the intestinal tract of waterfowl) can survive many standard drinking water treatment

programs (Graczyk et al. 1997, Graczyk et al. 2008). In 2014, 152 cases of cryptosporidium were reported in Virginia (VDH 2014). Grounds maintenance workers, gardeners and others who are employed at golf courses, parks and other areas frequented by Canada geese are likely more at risk of becoming infected with cryptosporidium (Kassa et al. 2001).

This section includes only some examples of zoonotic diseases for which WS could provide surveillance or management assistance. It is not intended to be an exhaustive discussion of all potential zoonotic diseases for which WS could provide assistance.

Threat of Aircraft and Vehicles Striking Waterfowl

Collisions between aircraft or vehicles and birds are a concern throughout the world because of the hazards they pose to human health and safety. Injury or death can occur when vehicles strike birds or when drivers or pilots try to avoid a collision with birds.

From 1990 to 2015, civil aircraft strikes with those species addressed in this EA and unknown species of waterfowl were reported 5,110 times in the U.S. (Dolbeer et al. 2016). A total of 2,025 (39.6%) of these were reported to have caused damage to the aircraft (Dolbeer et al. 2016). However, the number of strikes actually occurring is likely to be much greater, since an estimated 80% of civil aviation wildlife strikes with wildlife go unreported (Cleary et al. 2000). These incidents can pose serious threats to human safety. For example, across the entire U.S. for the 25 year reporting period of injury-causing strikes, Canada geese were involved in 16 strikes that caused 27 injuries and two deaths, while mallards were involved in five strikes that injured six people. Both lesser scaup and American coot were involved in four strikes that injured four people (Dolbeer et al. 2016). The threat that Canada geese pose to aircraft safety was dramatically demonstrated in January 2009 when US Airways Flight 1549 made an emergency landing in the Hudson River after ingesting multiple Canada geese into both engines shortly after takeoff from New York's LaGuardia Airport (Dolbeer et al. 2016, Wright 2010). Though the aircraft was destroyed after sinking in the river, all 150 passengers and five crew members survived (Wright 2010). In 1995, a Boeing 707 taking off from Elmendorf Air Force Base in Alaska ingested Canada geese into the two left engines and crashed, killing all 24 crew members (York et al. 2000).

In Virginia, since 1990, 193 strikes with civil aircraft have occurred involving those species addressed in this EA. One hundred and six of these strikes involved Canada geese, 30 involved mallards, four involved wood ducks, and two involved lesser scaup. American black duck, American coot, blue-winged teal, and snow goose were each involved in a single strike. The other 47 strikes involved ducks, geese or swans that were not identified to species (FAA 2017). Fortunately, only one strike (with a goose) has resulted in the injury of one person (the pilot) and no strikes have caused a human fatality (FAA 2017). The infrequency of strikes does not lessen the need to prevent threats to human safety.

Additionally, some species addressed in this EA pose minimal strike hazards at airports but their presence on airport property can attract other species which pose higher risks of aircraft strikes. For example, duck nests or ducklings on airport property are a food source for many species and could attract predators such as raptors. Raptors often pose a high risk to aircraft due to their relative size and their soaring and hovering behavior. Therefore, reducing the number of ducks nesting at airports can reduce risks of strikes with raptors by reducing the availability of a food source.

Similar to strikes between waterfowl and aircraft, strikes between vehicles and waterfowl are often unreported (Sargeant 1981, Loss et al. 2014). The CDC estimated that 26,647 people are injured per year in collisions with animals (mostly deer), and an additional 10,000 people are injured annually when drivers take evasive action to avoid a collision (CDC 2004). The possibility exists for any collision or any evasive action taken by a driver to avoid a collision to result in human injury or death. Dangerous

situations involving vehicles and waterfowl occur on an annual basis in spring when birds attempt to lead flightless young (i.e., ducklings, goslings) across roadways (Sawkar 2015). However, collisions between flying waterfowl and vehicles also occurs (CBS News 2014).

Additional Human Safety Concerns

Humans are increasingly living in close proximity to wildlife. This closeness coupled with a lack of harassing and threatening behavior by people toward wildlife has led to a decline in the fear wildlife have toward people. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension occurs that can lead to threatening behavior toward people. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Though waterfowl rarely attack humans, attacks do occur, especially when birds are building nests, incubating eggs or rearing chicks. Canada geese aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Preusser et al. 2008). This is of particular concern because Canada geese often nest in high densities in areas used by humans for recreational purposes (VerCauteren and Marks 2004). Mute swans are similarly aggressive, and are known to attack people and capsize watercraft (VDGIF 2012). If people or their pets approach waterfowl, their nests, or young, injuries could occur if birds react aggressively (Conover 2002). In 2012, aggressive behavior by a mute swan contributed to the death of a man kayaking in Illinois (Delgado and Ruzich 2012).

Additionally, waterfowl can threaten human health and safety when the buildup of feces on docks, walkways, and other foot traffic areas causes slipping hazards. The threat of personal injury resulting from falls as people loose footing has been cause for the closure of these areas (French and Parkhurst 2009). To avoid those conditions, regular cleanup is often required to alleviate threats of slipping on fecal matter, which can be economically burdensome.

Need for Waterfowl Damage Management to Resolve Damage to Agricultural Resources

Requests received by WS for assistance in reducing or prevent damage or threats of damage from those species of birds addressed in this EA to agriculture falls into three categories: crops, livestock and other resources. Farming is an important industry in Virginia with approximately 8.3 million acres devoted to agricultural production in Virginia in 2012 (NASS 2014). In the same year, agricultural products sold in the Commonwealth had a market value estimated at $3.7 billion (NASS 2014).

Damage and Threats to Agricultural Crops

In 2012, crops sold in the Commonwealth had a market value estimated at $1.3 billion (NASS 2014). Sales of grains, oilseeds, dry beans and peas in 2012 totaled $633 million, while sales of sod and plants raised for the nursery industry totaled $251 million and the sale of hay and other crops totaled $139 million (NASS 2014). Other important crops include vegetables, melons, potatoes and sweet potatoes, cotton, fruits, and berries (NASS 2014). Many of these crops are vulnerable to waterfowl damage.

Reports of wildlife damage to agricultural crops have increased over time (Conover and Decker 1991). In its most recent survey of agricultural losses to wildlife, conducted in 2002, the National Agricultural Statistics Service (NASS), reported that nationwide, field crop losses to wildlife totaled $619 million and losses of vegetables, fruits and nuts totaled $146 million (NASS 2002). Wildlife damage, including damage to crops associated with waterfowl, is not evenly distributed among agricultural producers (Fox et al. 2016). Individual farmers in areas with the highest densities of waterfowl experience a disproportionate amount of damage (Merkens et al. 2012, Fox et al. 2016).

Waterfowl damage to agricultural crops occurs when birds directly consume plant parts, when birds trample plants, compact or disturb soil, or when they contaminate crops or fields with fecal material (Wood et al. 2012, Fox et al. 2016). Waterfowl damage to agricultural resources can also occur when birds directly compete with livestock for forage. Different species of waterfowl tend to select for different species of plants at different life stages (Fox et al. 2016). Larger species of waterfowl have a greater impact than smaller species because they have increased energy requirements (and thus remove more vegetation per unit of time) and because they disturb larger areas (Wood et al. 2012). Larger species are also more likely to cause damage by trampling crops. The greatest damage to crops often occurs where high-densities of large bodied species congregate during the non-breeding period (Wood et al. 2012, Merkens et al. 2012). Although crop damage varies considerably, and variations in yield caused by factors besides waterfowl damage make it difficult to provide precise estimates of yield loss, losses have been documented as high as 100% (Merkens et al. 2012, Wood et al. 2012). In general, less damage occurs during the winter than in the spring (Fox et al. 2016).

Canada geese feed and cause damage to a variety of crops (Atlantic Flyway Council 1999). In Virginia, WS has documented reports of Canada goose damage to asparagus, barley, broccoli, corn, cotton, grapes, green beans, milo, oats, pasture, rye, sod, soybeans, strawberries, and wheat. Authors have noted Canada geese dependence and use of agricultural crops including alfalfa, barley, corn, oats, soybeans, and wheat (Hunt 1984, Craven and Hunt 1984, Borman et al. 2002). In South Dakota, farmers reporting damage to crops (e.g., corn, small grains, soybeans) associated with Canada geese lost an average of 1.8 acres to geese (Schaible et al. 2005).

Unlike Canada geese, snow geese are grubbers – disturbing the soil to excavate and then consume underground plant parts such as roots and tubers (Fox et al. 2016). This disturbance may lead changes to soil structure which may have negative effects on plant growth. Snow goose damage to agricultural crops is variable year to year. For example, in Delaware, 7,040 acres were damaged at a cost of $235,000 in 1999 and 10,300 acres were damaged at a cost of $394,000 the next year (Castelli et al. 2009). This damage was primarily to wheat, barley and rye crops (Castelli et al. 2009). In Virginia, snow goose damage occurs primarily to winter wheat (Castelli et al. 2009). However, snow geese will also feed on buck wheat, clover, corn, rye, sorghum, and soybeans (Castelli et al. 2009) as well as on pasture grasses (Hill and Frederick 1997).

Ducks and coots can also cause damage to crops (Cleary 1994). Merkens et al. (2012) examined the impact of several species of waterfowl including American wigeon, mallards and northern pintails on agricultural crops. The authors found that larger fields with higher proportions of orchard grass were more likely to experience damage (Merkens et al. 2012).

Damage and Threats to Livestock

Predation

While large species of waterfowl are almost exclusively herbivorous, smaller species exhibit a wide range of diets which include small fish, mussels and clams (Wood et al. 2012). Waterfowl predation damage to livestock resources occurs from the economic losses associated with birds consuming fish and other commercially raised aquatic organisms. Damage can also result from the death of fish and other aquatic organisms from injury associated with bird predation. The sale of aquatic organisms grown by the aquaculture industry (fish, crustaceans and mollusks) in Virginia totaled $43.2 million in 2012 (NASS 2014). The principal aquaculture products propagated at facilities in Virginia are catfish, trout, baitfish, crustaceans, mollusks (primarily clams and oysters), and other food fish (NASS 2014, Hudson and Murray 2015).

Species of diving ducks (e.g., redhead, greater scaup, surf scoter, white-winged scoter, bufflehead and mergansers) are generally associated with more predation damage than species of dabbling ducks (e.g., mallard, northern pintail, blue-winged teal) (Gorenzel et al. 1994). However, dabbling ducks such as mallards can still cause substantial damage. Mallards have been identified by aquaculture facilities as posing a threat of economic loss from foraging behavior (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey conducted in 1984 of fisheries primarily in the eastern United States, managers at 49 of 175 facilities reported mallards as feeding on fish at those facilities, which represented an increase in the number of facilities reporting mallards as feeding on fish when compared to prior surveys (Parkhurst et al. 1987). Parkhurst et al. (1992) found mallards foraging on trout fingerlings at facilities in Pennsylvania. Mallards selected trout ranging in size from 8.9 centimeters to 12.2 centimeters in length. Once trout fingerlings reached a mean length of approximately 14 centimeters in raceways, mallards present at facilities switched to other food sources (Parkhurst et al. 1992). Of those predatory birds observed by Parkhurst et al. (1992), mallards consumed the most fish at the facilities (with a mean of 148,599 fish captured) and had the highest mean economic loss per year per site based on mallards being present at those facilities for a longer period of time per year compared to other species. American coot have also been identified as causing predation damage at aquaculture facilities (Gorenzel et al. 1994). Research examining waterfowls' impact to aquaculture is ongoing. For example, a multiyear study is currently examining the impacts of lesser scaup on commercially raised baitfish in Arkansas (Clements et al. 2016).

Disease

Although the source of disease outbreaks can be difficult to identify, a risk of disease transmission exists wherever wild or free ranging birds and livestock interact or use the same resources such as water or food. Of the animal diseases that occur in the U.S., 72% (42) are presumed to require wildlife to transmit, maintain or complete the life cycle of the pathogen (Miller et al. 2013). Of these, six are so common in wildlife and their ability to infect domestic animals is so common that it impedes their eradication (Miller et al. 2013). The role wildlife plays in livestock diseases is expected to increase (Siembieda et al. 2011). Diseases which can be transmitted from wild or free ranging birds to livestock may be bacterial, spirochetal, rickettsial, viral, fungal, prions or parasites. Examples of diseases, the livestock they affect and the animal host are displayed in Table 1.3. Livestock diseases cause loss through morbidity, mortality, decreased production, decreased feed efficiency, lower reproductive success, and the costs associated with veterinary diagnostics and treatment.

Wild waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson 2006). Wild waterfowl can carry both low pathogenic strains (Stallknecht 2003, Pedersen et al. 2010) and high pathogenic strains of avian influenza (Brown et al. 2006, Keawcharoen et al. 2008). While infected wild birds usually don't get sick, domestic poultry are highly susceptible to avian influenza, and can become sick or die (Nettles et al. 1985, Gauthier-Clerc et al. 2007, Pedersen et al. 2010, CDC 2017). Avian influenza viruses may be transferred from wild to domestic birds when birds make direct contact or make contact with surfaces or resources (water, food) that have been contaminated by the virus (CDC 2017). WS has been collecting samples from wild birds since 2006, with a focus on highly pathogenic avian influenza. Low pathogenic strains have been identified in wild waterfowl during these sampling efforts in Virginia (K. Schumacher, USDA APHIS WS National Wildlife Disease Program, personal communication, 2018). The potential impacts from an outbreak of high pathogenic avian influenza (strains of the disease which are severe and cause high levels of mortality) in domestic poultry would be devastating, and possibly crippling to the multi-billion dollar industry through losses in trade, consumer confidence, and eradication efforts (Pedersen et al. 2010). In 2002, the commercial poultry industry in Virginia experienced losses of $130 million due to an outbreak of avian influenza, with USDA spending an additional $17 million on response efforts and paying $154 million in indemnity to affected producers (G. Comyn, USDA, APHIS, Veterinary Services, personal communication, 2009). In 2015, 7.4 million turkeys and 43 million chickens either died of or were euthanized to contain an

outbreak of high pathogenic avian influenza in 21 states (USDA 2016). To date, this is the most expensive animal health incident ever recorded in U.S. history with a cost of $3.3 billion (USDA 2016).

Newcastle disease is a contagious viral disease caused by avian paramyxovirus 1 (APMV-1) (Davidson 2006, Iowa State University 2016). While some birds, including waterfowl, can carry the virus and not become sick, domestic poultry, particularly chickens are highly susceptible (Alexander and Senne 2008, Iowa State University 2016). APMV-1 may be transferred from wild to domestic birds through inhalation or ingestion of resources contaminated by the virus (Iowa State University 2016). Severity of the infection depends on the species of bird and the strain of the virus but may result in anything from a mild respiratory infection to sudden death with no preceding clinical signs (Iowa State University 2016). Mortality rates can be as high as 100% among infected chickens (Iowa State University 2016), so the economic impact is enormous (Alexander and Senne 2008).

Waterfowl are carriers of a variety of other bacterial, viral and fungal diseases and parasites that can impact livestock, including swine, cattle and poultry (Fraser and Fraser 2010). Although difficult to document, wild birds at livestock facilities are strongly associated with the contamination of food and water sources (e.g., livestock ponds, harvested grasses etc.). For example, E. coli and salmonella may both be introduced to or transmitted between sites at livestock operations by wild birds (Pedersen and Clark 2007). Hill and Frederick (1997) found that greater snow geese used cattle feedlots and farm ponds on the Delmarva Peninsula. Salmonella causes fever, decreased milk production, dehydration and severe diarrhea in cattle, and if undetected and untreated, can result in death (McGuirk and Peek 2003).

Table 1.3: Wildlife diseases with waterfowl hosts that pose threats to livestock in the United States (modified from Miller et al. 2013)

Disease	Affected livestock	Hosts*
Avian chlamydiosis	Ducks, turkeys, chickens	ducks
Avian infectious bronchitis	Chickens	ducks, geese, other wild birds
Avian influenza	Chickens, turkeys, ducks, geese, game birds	waterfowl
Avian mycoplasmosis (*Mycroplasmosis gallisepticum, Mycroplasma anatis*)	Chickens, turkeys, game birds, ducks, geese	ducks[1]
Fowl cholera	Poultry	waterfowl
Infectious bursal disease	Chickens, turkeys, ducks, guinea fowl	waterfowl
Newcastle disease	Chickens, turkeys, game birds, ducks, geese, pigeons	Waterfowl[2]
Pullorum disease	Chickens, turkeys, pheasants, other poultry	Waterfowl
West nile virus	Equids[4], geese	Waterfowl[3]

*Host species listed here only include those animals addressed in this EA.
[1]See Sumithra et al. 2013, Samuel et al. 1996
[2]See Thomas et al. 2007
[3]Hofmeister et al. 2016
[4]Equids include horses, donkeys, and mules

Damage and Threats to Other Agricultural Resources

Canada geese can produce 175 g of feces a day (2–4% of their body mass) (Fox et al. 2016). Therefore, pastures where large numbers of birds congregate can quickly become covered. Farmers have reported that livestock are dissuaded from grazing in locations where the ground is saturated with Canada goose droppings, but evidence to support this claim is scant (Fox et al. 2016).

Need for Waterfowl Damage Management to Resolve Damage to Natural Resources

Waterfowl can negatively affect natural resources through habitat degradation, competition with other wildlife, and other factors. Habitat degradation occurs when large concentrations of birds in a localized area negatively affect characteristics of the surrounding habitat, which can then adversely affect other wildlife species. Competition occurs when species compete for available resources, such as food or habitat. Examples of these types of damage and threats which occur or could occur in Virginia include but are not limited to the following examples:

Damage and Threats to Habitat

On average, mute swans consume 35% (males) and 43% (females) of their body weight and uproot an additional 20 pounds of submerged aquatic vegetation on a daily basis (Fenwick 1983, Costanzo et al. 2015). In some instances, mute swans have eliminated individual plant species from a wetland and contributed to substantial reductions in the abundance of submerged aquatic vegetation (Tatu et al. 2005, 2007*a*; Costanzo et al. 2015). Mute swans spend more time foraging when they are in flocks than when they are in pairs or alone (Tatu et al. 2007*b*). Therefore, flocks of mute swans have an increased potential to cause habitat damage.

Canada geese can cause damage to habitat when they trample or consume vegetation which stabilizes shorelines, resulting in erosion and the movement of soil sediments into lakes, ponds, rivers and wetlands (USFWS 2005, Atlantic Flyway Council 2011). Damage to habitat can also occur when they consume vegetation planted for stream, wetland or other habitat restoration projects (Atlantic Flyway Council 2011, Cahoon 2007). Canada geese can prohibit plant development and change vegetation composition (Cahoon 2007). For example, Haramis and Kearns (2007) found that geese herbivory was an important factor in the decline of wild rice along the tidal Patuxent River in Maryland. Studies suggest that large concentrations of Canada geese can be a significant source of nitrogen and phosphorous in surface waters (Manny et al. 1994; and Kitchell et al. 1999). Kear (1963) estimated that Canada geese deposit up to 0.39 pounds of feces a day (dry weight). This has led to concerns about eutrophication, nutrient stimulation of phytoplankton populations, changes in phytoplankton species composition and the development of cyanobacteria (algal) blooms and the production of cyanotoxins as a result of extra nitrogen and phosphorous (Pettigrew et al. 1998, Manny et al. 1994, Kitchell et al. 1999, Harris et al. 1981, Zhou et al. 2004, Unckless and Marewicz 2007). These changes to water quality can cause stress or death to aquatic organisms.

Similar concerns have been raised about snow geese's impact of surface waters (Post et al. 1998, Olson et al. 2005). For example, Olson et al. (2005) found that even when snow geese were present for a short period of time, their feces caused substantial changes in the amount of nutrients in a Pennsylvania reservoir. The current population level of snow geese has led to the serious damage of its arctic breeding habitat, and in some areas its wintering habitat (Mowbray et al. 2000). Snow geese can have detrimental negative impacts on habitat through their foraging behavior. To consume the roots of plants, snow geese pull up or excavate down into the mat or fabric of roots that holds a marsh together (Mowbray et al. 2000). This accelerates erosion by tidal currents and wave action, which coupled with the removal of the roots, effectively kills the plants and areas of the marsh. For example, in Delaware's Bombay Hook

National Wildlife Refuge, snow geese's foraging behavior damages 988 acres of salt marsh annually (Castelli et al. 2009). In Virginia, islands in Chincoteague Bay along Assateague Island National Seashore as well as coastal marshes in the Chincoteague area and farther have also seen extensive damage. In one location, about 50 acres of marsh has been foraged so heavily that no vegetation grows there any longer (Castelli et al. 2009). Marshes provide many ecological services, including the recharge and discharge of ground water, stabilization of sediments, flood control and storm buffering, erosion control and habitat for many species of plants and animals including clapper rails (*Rallus longirostris*) and black ducks (Hill and Frederick 1997, Witmer et al. 2012).

In general, geese have a greater impact on their foraging habitat than other waterfowl species (Krapu and Reinecke 1992). Therefore, although ducks, and coots may cause damage to habitat it is generally not at the same magnitude as that of larger bodied waterfowl.

Damage and Threats Caused by Competition

Mute swans negatively impact species of native wildlife by competing for resources (Costanzo 2015). Because they are larger than all other species of native waterfowl that reside in the Commonwealth, they have an advantage during aggressive interactions (Therres and Brinker 2004). For example, due to their strong territorial behavior, mute swans will attack and kill other birds and their young or drive them from foraging or shelter areas (Reese 1980, Kania and Smith 1986, Costanzo 2015). Mute swans will also attack small mammals (Ciaranca et al. 1997). As described above, due to the volume of submerged aquatic vegetation consumed, mute swans reduce the availability of food resources and habitat for other species, such as blue crabs (VDGIF 2012, Costanzo 2015). Declines in the numbers of black ducks, canvasback and redheads in the Chesapeake Bay appear to be related to the reduction in submerged aquatic vegetation (Haramis 1991*b*,*a*; Krementz 1991). Similarly, in Maryland, wintering tundra swans have declined by 40% since the 1990s which coincided with the period in which mute swans reached peak abundance (Costanzo 2015). Mute swans may also trample and cause shorebirds (e.g., black skimmers (*Rynchops niger*) and least terns (*Sterna antillarum*)) to abandon nesting areas (Therres and Brinker 2004).

Migrant Canada geese compete with resident (non-migrant) Canada geese for food and habitat resources (Abraham et al. 1999). Herbivory by Canada geese has led to a major decline in wild rice along the Patuxent River (Haramis and Kearns 2007). Wild rice seed is a critical fall food (Martin and Uhler 1939, Webster 1964, Perry 2007) and dense rice stems are important as cover (Melvin and Gibbs 1994) to a variety of birds.

Competition for food among waterfowl is more intense during winter (Krapu and Reinecke 1992). Snow geese migrate through and overwinter in large numbers in the Commonwealth (Mowbray et al. 2000). It is therefore logical to assume that competition for food between snow geese and other species occurs. Free-ranging domestic and feral waterfowl compete with wild waterfowl for a variety of resources. These birds will also breed and produce hybrid fertile offspring (Tubaro and Lijtmaer 2002, Ottenburghs et al. 2016). This becomes problematic when hybridization alters the gene pool of the wild population and/or reduces the overall population of pure bred wild waterfowl. In Florida, hybridization with domestic waterfowl is the biggest threat to the conservation of the native mottled duck (*Anas fulvigula*) (Florida Fish and Wildlife Conservation Commission 2017).

Damage and Threats Caused by Disease

Waterfowl can negatively affect other wildlife through the transmission of disease. For example, in situations where free-ranging domestic and feral waterfowl interact with wild waterfowl, the possibility of disease transfer exists. One such disease that occurs more commonly in domestic waterfowl than wild

waterfowl is listeria. In areas where domestic waterfowl have been released and become free-ranging and mingle with wild waterfowl, the transfer of disease is a concern. Examples of diseases which occur or could occur in Virginia and cause damage or threaten wildlife populations include but are not limited to some of the same diseases that threaten human and livestock health (see ***Damage and Threats to Livestock, Disease***).

Need for Waterfowl Damage Management to Resolve Damage to Property

Swans, geese, ducks, and coots have the ability to cause substantial damage to property. Examples of these types of damage and threats which occur or could occur include but are not limited to the following examples.

Damage Caused by Aircraft and Vehicles Striking Animals

Collisions between aircraft or vehicles and animals can result in significant damage. Birds of all sizes can be involved in collisions. Damage can occur when vehicles strike birds or when drivers or pilots try to avoid a collision with a bird or birds.

From 1990 to 2015, civil aircraft strikes with those species addressed in this EA and unknown species of waterfowl were reported 5,110 times in the U.S. (Dolbeer et al. 2016). A total of 2,025 (39.6%) of these were reported to have caused damage to the aircraft (Dolbeer et al. 2016). However, the number of strikes actually occurring is likely to be much greater, since an estimated 80% of civil animal strikes go unreported (Cleary et al. 2000). These incidents can result in significant costs related not only to damage to the aircraft but also negative effects on flight. For example, strikes or near collisions can result in precautionary or emergency landings, evasive maneuvers, jettisoned fuel, and delayed or cancelled flights (Dolbeer et al. 2016). From 1990 to 2015, strikes with those species addressed in the EA and unknown species of waterfowl caused $232 million dollars in total damages (Dolbeer et al. 2016). DeVault et al. (2016) found that waterbirds (cormorants, ducks and geese) and raptors were most likely to cause damage or substantial damage to aircraft when strikes occurred. Canada geese in the U.S. caused damage in 49.3% of strikes involving Canada geese and destroyed or damaged five aircraft beyond repair (Dolbeer et al. 2016).

In addition to civil aviation, the United States Air Force (USAF) reports that several species addressed in this EA are responsible for the costliest strikes (USAF 2017). From 1995 to 2014, Canada geese were involved in 56 strikes with United States Air Force aircraft at a cost of $80 million dollars, which is more than any other species (USAF 2017). Mallards were involved in 199 strikes at a cost of $10 million dollars, snow goose were involved in 44 strikes at a cost of $9 million dollars, lesser scaup were involved in 34 strikes at a cost of $3 million dollars, gadwall were involved in 53 strikes and northern pintail were involved in 76 strikes both at a cost of $1 million (USAF 2017). Additionally, American coot were involved at 151 strikes at a total cost of $811,000 (USAF 2017).

In Virginia since 1990, 194 strikes with civil aircraft have occurred involving those species addressed in the EA. In 12 of these strikes, substantial damage was reported; in 37 strikes minor damage was reported and in 87 no damage was reported (FAA 2017). However, for 30% (58) of the reported strikes, damage to the plane was either unknown or not reported (FAA 2017). Reported negative effects on flight include precautionary and emergency landings, altered flights, and aborted take offs all of which result in economic losses (FAA 2017). The infrequency of waterfowl strikes does not lessen the need to prevent damage to aircraft. In addition, some species addressed in this EA pose minimal strike hazards at airports but their presence on airport property can attract other species which pose higher risks of aircraft strikes.

Similar to strikes between waterfowl and aircraft, strikes between vehicles and waterfowl are often unreported (Sargeant 1981, Loss et al. 2014). Loss et al. (2014) estimated that between 89 and 340 million birds die annually in vehicle collisions in the United States. The possibility exists for any collision with waterfowl or any evasive action taken by a driver to avoid a collision to result in a collision with something else (e.g., another vehicle, a tree). Costs associated with waterfowl-vehicle collisions include vehicle repair costs, towing, accident attendance and investigation.

Damage and Threats to Pets

Damage to property also includes attacks on cats, dogs and other pets. For example, geese and swans will attack cats and dogs (Smith et al. 1999). This is of particular concern because these birds often nest in areas used by humans for recreational purposes such as parks. If people or their pets approach waterfowl, their nests, or young, injuries could occur if birds react aggressively to the presence of those people or pets (Conover 2002).

Additionally, waterfowl can transmit diseases to pets. For example, dogs, may become infected with avian influenza after consuming infected ducks (Songserm et al. 2006, Song et al. 2008). Diseases and parasites affecting pets are many of the same diseases that can infect livestock (***Damage and Threats to Livestock***, *Disease*) and humans (***Threat of Disease Transmission***).

Damage to Infrastructure and Other Property

Those species addressed in this EA can cause damage to many different types of infrastructure and property. Examples include but are not limited to the following.

Waterfowl have the ability to cause substantial damage to turf, landscaping plants and backyard gardens when they consume plants or plant parts, when they excavate the roots of plants or when they trample plants (Washburn and Seamans 2012). Birds can also cause damage when they trample or consume vegetation which stabilizes shorelines, resulting in erosion and the movement of soil sediments into lakes, ponds, rivers and wetlands (USFWS 2005, Atlantic Flyway Council 2011).

Property damage associated with waterfowl also involves the accumulation of fecal matter and feather debris (Conover and Chasko 1985). Accumulations may occur on docks, piers, boats, rafts, beaches, shorelines, golf courses, athletic fields, track facilities, parks, play grounds, pools, foot paths, cemeteries and other similar areas. Feces may clog filters, pumps and intakes (of pools, water features, etc.), kill vegetation, and act as an attractant for insects (USFWS 2005). Although damage can occur throughout the year, it is greatest during periods when birds are concentrated into large flocks. Damage costs associated with unacceptable accumulations of feces include; labor and materials to clean and sanitize, loss of property use, loss of aesthetic value, loss of customers or visitors (and associated income), and costs associated with the implementation of damage management methods. For example, in Maryland, the annual costs associated with removing goose fecal droppings from lawns, walkways, beaches and the efforts to prevent further accumulations of droppings is estimated to exceed $150,000 a year (USFWS 2005). The annual costs of reestablishing overgrazed lawns and cleaning waterfowl feces from sidewalks have been estimated at more than $60 per bird (Allan et at. 1995).

1.3 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) AND WS DECISION-MAKING:

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). In addition, WS follows the USDA (7 CFR 1b), and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities to be accomplished as

part of any project: public involvement, analysis, documentation, implementation, and monitoring. The NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated in part by the CEQ through regulations in 40 CFR 1500-1508. In accordance with the CEQ and USDA regulations, APHIS guidelines concerning the implementation of the NEPA, as published in the Federal Register (44 CFR 50381-50384) provide guidance to WS regarding the NEPA process.

Pursuant to the NEPA and the CEQ regulations, this EA documents the analyses of potential federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing significant effects, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions. This EA was prepared by integrating as many of the natural and social sciences as warranted, based on the potential effects of the alternatives. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

1.4 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. Management of migratory birds is the responsibility of the USFWS while the VDGIF manages resident bird populations. Therefore, the lethal removal of waterfowl by WS to alleviate damage or reduce threats of damage as described in this EA could only occur within the parameters established by the USFWS and/or the VDGIF. The VDGIF establishes and enforces regulated hunting seasons under frameworks determined by the USFWS, including the establishment of seasons that allow the take of some of the bird species addressed in this assessment. Cooperation between USFWS and/or the VDGIF and WS ensures WS' actions are incorporated into population objectives.

Based on the scope of this EA, the decisions to be made are:

- How can WS best respond to the need to address damage caused by waterfowl in Virginia?
- Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

1.5 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Affected Environment

Waterfowl can be found across the Commonwealth throughout the year. Therefore, damage or threats of damage associated with waterfowl could occur wherever waterfowl occur as would requests for assistance to manage damage or threats of damage. Assistance would only be provided by WS when requested by a landowner or manager and WS would only provide direct operational assistance on properties where a MOU, Cooperative Service Agreement (CSA), or other comparable document had been signed between WS and the cooperating entity.

Upon receiving a request for assistance, the proposed action alternative, or those actions described in the other alternatives could be conducted on private, federal, Commonwealth, tribal, and municipal lands in Virginia to reduce damage and threats associated with waterfowl. The analyses in this EA are intended to apply to actions taken under the selected alternative that could occur in any locale and at any time within the analysis area. This EA analyzes the potential impacts of waterfowl damage management and addresses activities in Virginia that are currently being conducted under a MOU, CSA, or other

comparable document with WS. This EA also addresses the potential impacts of waterfowl damage management in the Commonwealth where additional agreements may be signed in the future.

Federal, Commonwealth, County, City, and Private Lands

Under two of the alternatives analyzed in detail, WS could continue to provide assistance on federal, state, county, municipal, and private land when a request was received for such services from the appropriate resource owner or manager. Actions taken on federal lands have been analyzed in the scope of this EA.

Native American Lands

The WS program would only conduct damage management activities on Native American lands when requested by a Native American Tribe. Activities would only be conducted after a MOU or CSA had been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance was required and what activities would be allowed. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage and threats associated with waterfowl on federal, Commonwealth, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the use of those methods had been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon between the Tribe and WS.

Site Specificity

This EA analyzes the potential impacts of alternative approaches to managing damage and threats associated with waterfowl that could be conducted on private and public lands in Virginia where WS and the appropriate entities have entered into an agreement through the signing of a MOU, CSA, or other comparable document. WS would only conduct damage management activities when requested by the appropriate resource owner or manager. This EA also addresses the potential impacts of conducting damage management activities in areas where additional MOUs, CSAs or other comparable documents may be signed in the future. Because the need for action is to reduce damage and because the goals and directives of WS are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of such efforts as part of the alternatives.

Waterfowl can be found across the Commonwealth throughout the year. Therefore, damage or threats of damage associated with waterfowl could occur wherever these birds occur. Planning for the management of damage and threats associated with waterfowl must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events, such as natural disasters, for which the actual site and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Some of the sites where damage could occur can be predicted; however, all specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS to manage damage and threats associated with waterfowl is often unique to the individual; therefore, predicting where and when such a request for assistance will be received by WS would be difficult. This EA emphasizes major issues as those issues relate to specific

areas whenever possible; however, many issues apply wherever damage or the threat of damage could occur and those issues are treated as such in this EA.

Chapter 2 of this EA identifies and discusses issues relating to the management of damage and threats associated with waterfowl in Virginia. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS (see Chapter 2 for a description of the Decision Model and its application). Decisions made using the model would occur in accordance with WS' directives and Standard Operating Procedures (SOPs) as described in Chapter 2 of this EA, as well as relevant laws and regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Virginia. In this way, WS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with the NEPA and still be able to address damage and threats associated with waterfowl.

1.6 AUTHORITY OF FEDERAL AND STATE AGENCIES

The authorities of WS and other agencies as those authorities relate to conducting activities to alleviate animal damage are discussed by agency below:

Wildlife Services (WS):

The primary statutory authorities for the WS program are the Act of March 2, 1931 (7 U.S.C. 8351-8352) as amended, and the Act of December 22, 1987 (7 U.S.C. 8353). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities managing animal damage and threats.

United States Fish and Wildlife Service (USFWS):

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitat. The USFWS has specific responsibilities for the protection of migratory birds, threatened and endangered species, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters managed by the agency in the National Wildlife Refuge System. The USFWS has statutory authority for enforcing the Fish and Wildlife Improvement Act of 1978 (16 USC 7.12), the Fish and Wildlife Act of 1956 (16 USC 742 a-j), and the Migratory Bird Treaty Act (16 USC 703-711).

United States Environmental Protection Agency (USEPA):

The U.S. Environmental Protection Agency (USEPA) is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides, including repellents and pesticides available for use to manage damage associated with animals.

United States Food and Drug Administration (FDA):

The U.S. Food and Drug Administration (FDA) is responsible for protecting the public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping to speed innovations that make medicines and foods more

effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health.

Virginia Department of Game and Inland Fisheries (VDGIF):

The VDGIF, under the direction of the Governor-appointed Board of Directors, is specifically charged by the General Assembly with the management of the Commonwealth's wildlife resources. Although many legal mandates of the Board and the Department are expressed throughout the Code of Virginia, the primary statutory authorities include wildlife management responsibilities (§ 29.1-103), public education charges (§ 29.1-109), law enforcement authorities (§ 29.1-109), and regulatory powers (§29.1-501). The mission of the VDGIF is:

- Conserve and manage wildlife populations and habitat for the benefit of present and future generations.
- Connect people to Virginia's outdoors through boating, education, fishing, hunting, trapping, wildlife viewing, and other wildlife-related activities.
- Protect people and property by promoting safe outdoor experiences and managing human-wildlife conflicts.

The VDGIF is responsible for classifying animals as nuisance species. It is responsible for establishing and enforcing hunting seasons for migratory game birds listed under the MBTA under frameworks developed by the USFWS (Title 29.1, Chapter 5, Section 515). Additionally, the Board of Directors is responsible for the classification and protection of endangered and threatened species.

VDGIF has a MOU with WS to facilitate the planning, coordination, and implementation of policies developed (1) to prevent or minimize damage caused by wildlife to public and private resources, including threatened and endangered species, agriculture, property, and natural resources; (2) to address public health and safety issues associated with wildlife damage and wildlife diseases; (3) to facilitate a regular exchange of information; and (4) to provide a framework for procedures and authorizations required to conduct wildlife damage management activities in the Commonwealth of Virginia.

Virginia Department of Agriculture and Consumer Services (VDACS):

Under § 3.2-102 of the Code of Virginia, the Commissioner of Agriculture and Consumer Services is charged with regulating pesticides. The VDACS has the authority to classify restricted pesticides, certify and register pesticide applicators, license pesticide dealers, businesses and consultants, and conduct investigations and enforce these measures. Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act. The VDACS may provide assistance to persons in the Commonwealth in order to reduce damage to agricultural resources and property, and to protect public health and safety from damage involving nuisance birds (§ 3.2-901).

VDACS has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife conflicts in Virginia.

Virginia Department of Environmental Quality (VDEQ):

The Virginia Department of Environmental Quality (VDEQ) is the Commonwealth's primary environmental regulatory agency.

1.7 DOCUMENTS RELATED TO THIS ENVIRONMENTAL ASSESSMENT

WS' Environmental Assessments Re-Evaluated Under this EA:

WS previously developed an EA in cooperation with the USFWS that identified the need to manage damage associated with waterfowl (USDA 2011). This EA identified the issues associated with managing waterfowl damage in the Commonwealth and analyzed alternative approaches to meet the specific need identified while addressing the identified issues. Changes in the need for action, primarily a need to address damage and threats of damage associated with additional species of waterfowl, and changes in the affected environment, have prompted WS and the USFWS to initiate a new analysis. Since activities conducted under the previous EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA will be superseded by this analysis and the outcome of the Decision issued, based on the analyses in this EA.

Mute Swan Management Plan:

The VDGIF has developed a plan to guide the management of mute swans in the Commonwealth of Virginia (VDGIF 2012). The plan includes goals that specify the general direction for the mute swan population, mute swan-related impacts and conflicts in Virginia.

Atlantic Flyway Mute Swan Management Plan:

In response to the increasing population of mute swans along the Atlantic Flyway and documented impacts on the ecological integrity of wetlands and wildlife associated with this increased population, the Atlantic Flyway Council developed a management plan to reduce mute swan populations (Atlantic Flyway Council 2003). This plan was updated in 2015 to address the continued need to reduce mute swan populations to a level that eliminates impacts to habitat and native species, reduces human conflicts and prevents range expansion (Costanzo et al. 2015).

Atlantic Flyway Resident Population Canada Goose Management Plan:

In response to an increasing population of and damage and conflicts associated with resident Canada geese along the Atlantic Flyway, the Atlantic Flyway Council developed a management plan in 1999 (Atlantic Flyway Council 1999). The plan was updated in 2008 and again in 2011 to address the continued need to "achieve a socially acceptable balance between the positive values and negative conflicts" associated with resident Canada geese (Davies and Hindman 2008, Atlantic Flyway Council 2011). Specific objectives include reducing the population, relief of damage and conflicts, opportunities for use and appreciation, compatible management with migrant goose populations and monitoring to evaluate effectiveness of management (Atlantic Flyway Council 2011).

Resident Canada Goose Final Environmental Impact Statement:

To address the increasing population of resident Canada geese and the personal and public property damage and public health concerns associated with this increase, the USFWS developed a final environmental impact statement (FEIS) that evaluated alternative strategies to reduce, manage, and control the population and related damages (USFWS 2005). The selected alternative in the FEIS establishes regulations that; 1) establishes specific control and depredation orders (airports, nests and eggs, agricultural and public health) designed to address resident Canada goose depredation, damage and conflict, 2) provides expanded hunting methods and opportunities to increase the number of resident Canada geese harvested during existing September seasons, 3) authorizes the implementation of a resident Canada geese population control program. More specifically, the selected alternative in the FEIS

modified 50 CFR 20.11, 20.21, and 21.3 to include the definition of resident Canada geese, change restrictions on shotgun capacity and allow for the use of electronic calls during the early September season designed to target resident Canada geese. It also added 50 CFR 21.49, 21.50, 21.51 and 21.52 to subpart D which establishes the control order for resident Canada geese at airports, a depredation order for nests and eggs, a depredation order for resident Canada geese at agricultural facilities and a public health control order for resident Canada geese. Finally the selected alternative added 50 CFR 21.61 to subpart E to establish the resident Canada geese population control program. A Record of Decision (ROD) and Final Rule were published by the USFWS on August 10, 2006 (71 FR 45964–45993). On June 27, 2007, WS issued a ROD and adopted the USFWS FEIS (72 FR 35217).

Light Goose Management Final Environmental Impact Statement:

To address problems associated with overabundant light goose populations, USFWS developed a FEIS which evaluated management alternatives (USFWS 2007*a*). The light geese referred to in the FEIS include the lesser snow geese (*Chen caerulescens caerulescens*), greater snow geese (*C. c. atlantica*), and Ross's geese (*C. rossii*) that nest in Arctic and sub-Arctic regions of Canada and migrate and winter throughout the U.S.. The selected alternative in the FEIS establishes regulations that; 1) provides expanded hunting methods during the light goose season to increase the number of light geese taken and 2) establishes a conservation order for taking light geese. More specifically, the selected alternative in the FEIS modified 50 CFR 20.21, 20.22, 20.23 and 21.60 to reduce restrictions on shotgun capacity and allow for the use of electronic calls during the light-goose-only season, extend the number of days and the hours per day these birds can be hunted, and authorizes the conservation order. A Record of Decision (ROD) and Final Rule were published by the USFWS on November 5, 2008 (73 FR 65925).

North American Waterfowl Management Plan:

First drafted in 1986, the North American Waterfowl Management Plan is an international plan to conserve populations of waterfowl by protecting and restoring habitat. The goals set forth in the 2012 revision are to have 1) abundant and resilient waterfowl populations to support hunting and other uses without imperiling habitat, 2) wetlands and related habitats sufficient to sustain waterfowl populations at desired levels while providing ecological services and recreational benefits to society, and 3) growing numbers of waterfowl hunters, conservationists, and other citizens who enjoy and actively support waterfowl and wetlands conservation (NAWMPC 2012).

Birds of Conservation Concern:

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS, "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973". Birds of Conservation Concern 2008 is the most recent effort to carry out this mandate (USFWS 2017*a*) (Appendix E).

Proposal to Permit Take as provided under the Final Programmatic Environmental Impact Statement for the Eagle Rule Revision:

Developed by the USFWS, this EIS evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the "*take*" of bald eagles and golden eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EIS evaluated the management on an eagle management unit level (similar to the migratory bird flyways) to establish limits on the amount of eagle take that the USFWS could authorize in order to maintain stable or increasing populations. This alternative further establishes a maximum duration for permits of 30 years with

evaluations in five year increments (USFWS 2016*a*). A Record of Decision was made for the preferred alternative in the EIS. The selected alternative revised the permit regulations for the "*take*" of eagles (see 50 CFR 22.26 as amended) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27 as amended). The USFWS published a Final Rule on December 16, 2016 (81 FR 91551-91553).

1.8 PUBLIC INVOLVEMENT

Issues related to the management of damage and threats associated with waterfowl and the alternatives to address those issues were initially developed by WS. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. This EA will be noticed to the public through legal notices published in local print media, through the APHIS stakeholder registry, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlifedamage/nepa.

WS will make the EA available for a minimum of 30 days comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. New issues or alternatives identified after publication of notices announcing the availability of the EA will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a Decision.

1.9 RATIONALE FOR PREPARING AN ENVIRONMENTAL ASSESSMENT RATHER THAN AN EVIRONMENTAL IMPACT STATEMENT

WS has the discretion to determine the geographic scope of their analyses under the NEPA. The intent in developing this EA is to determine if the proposed action would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS or a finding of no significant impact (FONSI). In terms of considering cumulative effects, one EA analyzing impacts for the entire state will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA that the proposed action or the other alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared.

1.10 ENVIRONMENTAL STATUS QUO

As defined by the NEPA implementing regulations, the *"human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment"* (40 CFR 1508.14). Therefore, when a federal agency analyzes its potential impacts on the *"human environment,*" it is reasonable for that agency to compare not only the effects of the proposed federal action, but also the potential impacts that could or would occur from a non-federal entity conducting the action in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency, invasive species, or unprotected species.

Most wildlife species are protected under Commonwealth and / or federal law. To address damage associated with these species, a permit must be obtained from the appropriate entity. However, in some situations, species can be managed without the need for a permit. In Virginia, free-ranging domestic and feral waterfowl, mute swans, and the nests and eggs of these birds are not protected and may be lethally removed at any time. Muscovy ducks, and their nests and eggs, although protected under the Migratory Bird Treaty Act, may be removed or destroyed without a depredation permit from the USFWS at any time

under a depredation order (50 CFR 21.54). Method restrictions apply in all instances (e.g., firearms restrictions, trapping restrictions, pesticide regulations).

When a non-federal entity (e.g., agricultural producers, individuals, or any other non-federal entity) takes an action involving waterfowl, the action is not subject to compliance with the NEPA due to the lack of federal involvement[5] in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed.

Therefore, in those situations in which a non-federal entity has decided that a management action directed towards waterfowl should occur and even the particular methods that should be used, WS' involvement in the action would not affect the environmental status quo because the entity could take the action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action.

1.11 LAWS AND STATUTES RELATED TO THIS DOCUMENT

Several laws or statutes authorize, regulate, or otherwise would affect WS' activities. WS complies with all applicable federal, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations relevant to managing damage in the Commonwealth are addressed below:

Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711; 40 Stat. 755), as amended:

The Migratory Bird Treaty Act (MBTA) makes it unlawful to, "to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase" some migratory bird species, or their parts, or active nests (16 USC 703-711). Active nests (nests with eggs or chicks present) are protected under the MBTA. Inactive nests (nests without eggs or chicks present) may not be collected or possessed but are not protected from destruction (USFWS 2003). However, some inactive nests are legally protected by statutes other than the MBTA (e.g., Endangered Species Act, Bald and Golden Eagle Protection Act). A list of bird species protected under the MBTA can be found in 50 CFR 10.13. Free-ranging domestic and feral waterfowl, and mute swans, addressed in this EA are not protected under the MBTA (70 FR 12710-12716). The MBTA provides the USFWS with statutory authority for enforcing the MBTA. Under this authority, the USFWS may issue depredation orders or depredation permits to resolve damage caused by bird species protected under the Act (50 CFR 13 and 50 CFR 21). Additionally, the act grants the USFWS the authority to establish hunting seasons for migratory game birds (50 CFR 20). All actions conducted in this EA comply with the regulations of the MBTA, as amended.

- ***Depredation Orders for Canada Geese (see 50 CFR 21.49, 50 CFR 21.50, 50 CFR 21.51, 50 CFR 21.52, and 50 CFR 21.61)***
  Depredation orders which allow the lethal take of Canada geese without a depredation permit have been established for managing damage associated with Canada Geese when specific criteria are met (see **Resident Canada Goose Final Environmental Impact Statement**). Under 50 CFR 21.49, resident Canada geese can be lethally taken at airports and military airfields by airport authorities or their agents when those geese are causing damage or posing a threat of damage to aircraft. Under 21.50, the nests and eggs of resident Canada geese causing or posing a threat to people, property, agricultural crops, and other interests can be destroyed once the

[5] If a federal permit were required to conduct damage management activities, the issuing federal agency would be responsible for compliance with the NEPA for issuing the permit.

participant has registered with the USFWS. Under 50 CFR 21.51, resident Canada geese can be lethally taken in designated states, including Virginia, when geese are causing damage to agricultural resources. Under 50 CFR 21.52, resident Canada Geese can be addressed using lethal and non-lethal methods by State agencies, Tribes, and the District of Columbia when those geese pose a direct threat to human health. Finally, 50 CFR 21.61 subpart E establishes the resident Canada geese population control program. Under these depredation orders for Canada geese, no depredation permit is required from the USFWS once the criteria of those orders have been met. However, a Commonwealth permit may still be required to lethally take geese.

- ***Depredation Order for Muscovy Ducks (50 CFR 21.54)***
  Muscovy ducks are native to South America, Central America, and Mexico with a small naturally occurring population in southern Texas. Muscovy ducks have also been domesticated and have been sold and kept for food and as pets in the United States. In many States, Muscovy ducks have been released or escaped captivity and have formed feral populations, especially in urban areas, that are non-migratory. The USFWS has issued a Final Rule on the status of the Muscovy ducks in the United States (75 FR 9316-9322). Since naturally occurring populations of Muscovy ducks are known to inhabit parts of south Texas, the USFWS has included the Muscovy duck in the list of bird species afforded protection under the MBTA under 50 CFR 10.13 (75 FR 9316-9322). To address damage and threats of damage associated with Muscovy ducks, the USFWS has also established a depredation order for Muscovy ducks under 50 CFR 21.54 (75 FR 9316-9322). Under 50 CFR 21.54, Muscovy ducks, and their nests and eggs, may be removed or destroyed without a depredation permit from the USFWS at any time in the United States, except in Hidalgo, Starr, and Zapata Counties in Texas (75 FR 9316-9322).

- ***Conservation Order for Light Geese (50 CFR 21.60)***
  Allows the lethal take of snow geese without a permit under the supervision of state or tribal governments under specific circumstances, given the criteria of the order has been met.

Bald and Golden Eagle Protection Act (16 USC 668-668c), as amended:

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as "endangered" under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The "endangered" status was extended to all populations of bald eagles in the lower 48 states, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as "threatened" in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as "threatened". In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of bald eagles is prohibited without a permit from the USFWS. Under the Act, the definition of "take" includes actions that "*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb*" eagles. The regulations authorize the USFWS to issue permits for the take of bald eagles and golden eagles on a

limited basis (see 81 FR 91551-91553, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

Endangered Species Act (ESA) (16 USC 1531-1544):

The Endangered Species Act (ESA) recognizes that our natural heritage is of *"esthetic, ecological, educational, recreational, and scientific value to our Nation and its people*." The purpose of the Act is to protect and recover species that are in danger of becoming extinct. It is administered by the USFWS and the Department of National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater species while the NMFS is primarily responsible for marine organisms. Under the ESA, species may be listed as endangered or threatened. Endangered is defined as a species that is in danger of becoming extinct throughout all or a significant portion of its range while threatened is defined as a species likely to become endangered in the foreseeable future. Under the ESA, *"all federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* (Sec.2(c)). Additionally, the Act requires that, *"each Federal agency shall in consultation with and with the assistance of the Secretary, insure that any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species…..each agency will use the best scientific and commercial data available"* (Sec.7 (a) (2)). WS consults with the USFWS or the NMFS to ensure that the agencies actions, including the actions proposed in this EA, are not likely to jeopardize the existence of endangered or threatened species or their habitat.

National Historic Preservation Act (NHPA) (16 USC 470 et seq.), as amended:

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on such undertakings if an agency determines that the agency's actions are "*undertakings*". Undertakings are defined in Sec. 800.16(y) as a *"project, activity, or program funded in whole or part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license or approval"*. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under Section 106. None of the methods described in this EA that would be available for use under the alternatives cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they were used that could result in effects on the character or use of historic properties. Therefore, the methods that could be used by WS under the relevant alternatives are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources were planned under an alternative selected because of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted, as necessary.

Noise-making methods, such as firearms, that are used at or in close proximity to historic or cultural sites for the purposes of hazing or removing animals have the potential for audible effects on the use and enjoyment of historic property. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use would be to the benefit of the historic property. A built-in minimization factor for this issue is that virtually all the methods involved would only have temporary effects on the audible nature of a site and can be ended at

any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by the Section 106 of the NHPA would be conducted as necessary in those types of situations.

Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations - Executive Order 12898:

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minorities and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with the NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS would only use or recommend legal, effective, and environmentally safe methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income.

Protection of Children from Environmental Health Risks and Safety Risks - Executive Order 13045:

Children may suffer disproportionately from environmental health and safety risks because their physical and mental systems are still developing. Each federal agency must therefore, *"make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children"* and *"ensure that its policies, programs, activities and standards address disproportionate risks to children"*. WS would only employ and/or recommend legally available and approved methods under the alternatives where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

Responsibilities of Federal Agencies to Protect Migratory Birds - Executive Order 13186:

Executive Order 13186 requires, *"each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations"*.

Invasive Species - Executive Order 13112:

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that, *"each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species"*.

The Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq.):

The Native American Graves Protection and Repatriation Act (NAGPRA) establishes procedures for federal agencies when Native American "*cultural items*" are inadvertently discovered on federal or tribal lands. Cultural items may include human remains, funerary objects, sacred objects, and objects of cultural patrimony. In part, the NAGPRA requires federal agencies making such discoveries to notify the Secretary of the Department that manages the federal lands or the tribal leaders on tribal lands on which the discovery was made. Additionally, once a discovery is made, work must be stopped and reasonable efforts must be made to protect the item.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC 136 et seq.):

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration, classification, and regulation of all pesticides used in the United States. The USEPA is responsible for implementing and enforcing the FIFRA. All chemical methods described in Appendix B, are registered with and regulated by the USEPA and used or recommended by WS in compliance with labeling procedures and requirements.

Federal Food, Drug, and Cosmetic Act (21 USC 360):

This law places administration of pharmaceutical drugs, including those immobilizing drugs used for wildlife capture and handling, under the Food and Drug Administration (FDA).

> ***Investigational New Animal Drug (21 CFR 511, 512(j)):***
> Gives the Food and Drug Administration (FDA) the authority to allow investigations into the safety and effectiveness of new animal drugs under the Federal Food, Drug, and Cosmetic Act. Alpha-chloralose is an anesthetic drug that causes sedation by depressing the central nervous system. It is approved for use as an Investigational New Animal Drug for waterfowl, coots, pigeons and ravens. Alpha-chloralose's use as a method to resolve damage and threats associated with waterfowl is discussed in this document.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA):

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those animal drugs used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period after a drug was administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (e.g., use of ear tags) and labeled with appropriate warnings.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33):

The Coastal Zone Management Act established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for

federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. As appropriate, a consistency determination would be conducted by WS to assure management actions would be consistent with the state's Coastal Zone Management Program.

Protection of Wetlands – Executive Order 11990:

Executive Order 11990 was signed to "*minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands*". To meet those objectives, Executive Order 11990 requires federal agencies to consider alternatives to wetland sites, in planning their actions, and to limit potential damage, if a federal agency cannot avoid an activity affecting a wetland.

Nuisance Birds (Code of Virginia § 3.2-900 and 901):

This section of the Code states that, *"the Commissioner* (of Agriculture and Consumer Services) *shall conduct investigations and surveys to determine economic losses or public nuisances caused by nuisance birds and may develop a plan of action when he has determined that they are causing or about to cause economic losses in the Commonwealth, are detrimental to the public health and welfare, or otherwise create a public nuisance"*. It also states that the Commissioner may, *"provide technical assistance to persons for the suppression of nuisance birds", "appoint an advisory committee to evaluate facts in any particular situation and to make recommendations to him on the course of action", "upon receipt of complaint…make an investigation…*(and if necessary) *recommend acceptable means and methods", "provide assistance and cooperate with federal agencies, other state agencies…in the exercise of the duties imposed"*. In this Chapter "*Nuisance Birds*" are defined as "*…any other species so declared …when causing or about to cause economic losses in the Commonwealth; becoming detrimental to the public health and welfare; defacing or defiling public or private property or otherwise creating a public nuisance."*

The VDACS may provide assistance to persons in the Commonwealth in order to reduce damage to agricultural resources and property, and to protect public health and safety from damage involving nuisance birds (VAC § 3.2-901). VDACS currently has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife conflicts in Virginia.

Open Season on Nuisance Species (Code of Virginia § 29.1-511):

"There shall be a continuous open season for killing nuisance species…". In this chapter, "*those species designated as such by regulations of the Board, and those species committing or about to commit depredation upon ornamental or shade trees, agricultural crops, wildlife, livestock or other property or when concentrated in numbers and manner as to constitute a health hazard or other nuisance…not include*(ing) *(i) animals designated as endangered or threatened…(ii) animals classified as game or fur-bearing animals…"* are included in the definition of *"nuisance species"* (§ 29.1-100).

Localities may prohibit feeding of migratory and nonmigratory waterfowl (Code of Virginia § 29.1-527.1):

"any locality may prohibit by ordinance the feeding of migratory and nonmigratory …The terms "migratory" and "nonmigratory" waterfowl shall include those waterfowl defined as such in a listing as provided by the Department…"

Rules and Regulations for Enforcement of the Virginia Pesticide Law (The Virginia Administrative Code (2 VAC 5-670, 680, 685)):

Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act. Chapters 670, 680 and 685 of Title 2, Agency 5 of the Virginia Administrative code contain the implementing regulations of the Act. These regulations include the classification and registration of pesticides, the handling, storage and application of pesticides, as well as the certification and registration of sellers and users.

Nuisance Species Designated (The Virginia Administrative Code (4 VAC 15-20-160):

In this section of the Code, the VDGIF includes in its definition of nuisance species, "*other nonnative species as defined in the Migratory Bird Treaty Reform Act of 2004 and regulated under 50 CFR 10.13"*. Mute swans meet this definition.

Importation Requirements, Possession and Sale of Nonnative (Exotic) Animals (The Virginia Administrative Code (4 VAC 15-30-40)):

Under this section of the code, a permit is required to import, possess, or sell mute swans.

Possession, Transportation, and Release of Wildlife by Authorized Persons (The Virginia Administrative Code (4 VAC 15-30-50)):

Under the Virginia Administrative Code (VAC), "*...U.S. government agencies' employees whose responsibility includes fisheries and wildlife management...will be deemed to be permitted...to capture, temporarily hold or possess, transport, release, and when necessary humanely euthanize wildlife, provided that the methods of and documentation for the capture, possession, transport, release and euthanasia shall be in accordance with board policy.*

Unauthorized Feeding of Wildlife (The Virginia Administrative Code (4 VAC 15-40-286)):

"It shall be unlawful for any person …to place, distribute, or allow the placement of food, minerals, carrion, trash, or similar substances when it attracts any species of wildlife in such numbers or circumstances to cause property damage, endanger any person or wildlife, or create a public health concern....This section shall not be construed to restrict bona fide agronomic plantings (including wildlife food plots), bona fide distribution of food to livestock, or wildlife management activities conducted or authorized by the department or U.S. government agencies with wildlife management responsibilities."

Poisoning of Wild Birds and Wild Animals Prohibited; certain control programs excepted (The Virginia Administrative Code (4 VAC 15-40-50)):

"It shall be unlawful to put out poison at any time for the purpose of killing any wild birds and wild animals, provided that rats and mice may be poisoned on one's own property. The provisions of this section shall not apply to the Commissioner of Agriculture and Consumer Services, the United States

Department of Agriculture, or their representatives or cooperators, and those being assisted in a control program authorized by those agencies."

CHAPTER 2: ISSUES AND ALTERNATIVES

This chapter contains a discussion of the issues which were used to develop alternatives to address the need for action. It also contains a discussion of Integrated Wildlife Damage Management (IWDM) as well as a description of WS' strategies, decision making process and standard operating procedures (SOPs). Finally, this chapter presents alternatives developed to address the issues and meet the need for action. It also presents alternatives considered but not analyzed in detail, with rationale.

2.1 ISSUES USED TO DEVELOP THE ALTERNATIVES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues related to managing damage associated with waterfowl in Virginia were developed through discussions with partnering agencies, cooperators, and stakeholders.

The issues as they relate to the possible implementation of the alternatives, including the proposed action alternative, are discussed in Chapter 3. The issues analyzed in detail are the following:

Issue 1 - Effects of Damage Management Activities on Target Waterfowl Populations and Regulated Harvest

A common issue when addressing damage caused by animals are the potential impacts of management actions on the populations of target species. A related issue commonly identified as a concern is that damage management activities conducted by WS could affect the ability of hunters to harvest species targeted by management activities. Methods available to resolve damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the immediate area. Lethal methods remove individuals or the active nests of target species causing the damage, thereby reducing the presence of those species in the area and reducing the local population. The number of target species lethally removed under the alternatives is dependent upon the magnitude of the damage occurring, the level of damage acceptable to individual persons experiencing the damage, the numbers of individual animals involved, and the efficacy of methods employed. Under certain alternatives, both non-lethal and lethal methods could be recommended, as governed by federal, state, and local laws and regulations.

The analysis for the magnitude of impact on the populations of target animals is based on a measure of the number of individuals from each species lethally removed in relation to that species' abundance and/or status (e.g., nuisance species, game species, etc.). Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest or lethal removal levels, and actual harvest or lethal removal data. Qualitative determinations are based on population trends and harvest trend data, when available.

The analysis to determine the magnitude of impacts on the populations of those species addressed in this EA from the use of lethal methods would be based on a measure of the number of individuals lethally removed in relation to that species' abundance or status. Lethal removal would be monitored by comparing the number of animals lethally removed with overall populations or trends. Lethal methods would only be used by WS at the request of those persons seeking assistance. Lethal removal of

waterfowl can occur either without a permit if those bird species are not native, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS pursuant to the MBTA or during hunting seasons. All of the native species addressed in this EA may be harvested by hunters in the Commonwealth.

Any activities conducted by WS under the alternatives addressed would occur along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of habitat.

Information on waterfowl populations and trends are derived from several sources including surveys and harvest data. Additional information on those sources of information is provided below.

Breeding Bird Survey (BBS)

Bird populations can be monitored by using trend derived from data collected during the Breeding Bird Survey (BBS). The BBS is conducted annually in the United States and Canada, across a large geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey (USGS), Patuxent Wildlife Research Center (Sauer et al. 2017). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend is statistically significant. Current estimates of population trends from BBS data are derived from hierarchical model analysis (Link and Sauer 2002, Sauer and Link 2011) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is also determined using BBS data (Sauer et al. 2017).

Atlantic Flyway Breeding Waterfowl Plot Survey (AFBWPS)

The Atlantic Flyway Breeding Waterfowl Plot Survey has been conducted annually since 1989 in Virginia and other Atlantic Flyway states from Virginia to New Hampshire. Established 1-km^2 plots are surveyed for ducks and geese once each year from the ground or air between mid-April and early May. This data is then used to estimate breeding population trends. The survey methodology has been described in detail by Heusmann and Sauer (1997, 2000). Reports which summarize this data are published annually (e.g., Klimstra and Padding 2012).

Waterfowl Breeding Population and Habitat Survey (WBPHS)

Additional breeding survey data for areas not covered by the Atlantic Flyway Breeding Waterfowl Plot Survey are obtained during the Waterfowl Breeding Population and Habitat Survey. The number of waterfowl observed are recorded by aerial crews flying along established transect lines. In areas where access is possible, ground crews survey a sub-set of aerial transects to determine factors needed to adjust the aerial figures for birds which could not be observed from the air. This survey is conducted cooperatively by USFWS and Canadian Wildlife Service. The primary purpose of the survey is to obtain information on spring population of waterfowl. The survey methodology has been described in detail by Smith (1995). Reports which summarize this data are published annually (e.g. USFWS 2016*b*).

Mid-Summer Mute Swan Survey (MSMSS)

Conducted every three years from1986 to 2011 in the Atlantic Flyway, this survey provided a "snap-shot" of mute swan populations and distributions. Observations were taken during the birds' molt period (mid-July through late August). There were no standardized survey guidelines or implementation and participation was limited to areas which had a known population of mute swans (Costanzo et al. 2015).

The Virginia Breeding Bird Atlas Project (VBBAP)

In 1983, the Virginia Society of Ornithology appointed a committee to facilitate and direct a Breeding Bird Atlas in the Commonwealth (Virginia Society of Ornithology 1989). After a one year trial period, data for the atlas was collected from January 1, 1985 through December 31, 1989 (Trollinger and Reay 2001). During this period, volunteer observers recorded the species, location, date and category of breeding behavior observed for all species under a standard methodology. All unusual sightings were verified. All occurrences of breeding behavior observed (1985–1989) were then consolidated and geographically displayed by species (Trollinger and Reay 2001). In 2016, a second Virginia Breeding Bird Atlas collection effort was launched. A collaboration between the Virginia Society of Ornithology, the Virginia Department of Game and Inland Fisheries (VDGIF), and others data will be collected over 5 years (VBBAP 2017).

Atlantic Flyway Mid-winter Waterfowl Survey (AFMWS)

The Midwinter Waterfowl Survey is an index of the number of ducks and geese overwintering in Atlantic Flyway States. States in the Atlantic Flyway, including Virginia, conduct this survey, primarily from aircraft, each January on major coastal and inland waterfowl wintering areas. These surveys provide information on population status, distribution, and habitats used by waterfowl species. The survey methodology has been described in detail by Eggeman and Johnson (1989). Reports which summarize this data are published annually (e.g. Roberts 2016).

Christmas Bird Count (CBC)

The CBC is conducted on an annual basis, in December and early January by numerous volunteers under the guidance of the National Audubon Society. The CBC reflects the number of birds frequenting a location during the winter months. Participants count the number of birds observed within a 15-mile diameter circle around a central point (177 mi^2). The CBC data does not provide a population estimate, but the count can be used as an indicator of trends in the population of a particular bird species over time. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (National Audubon Society 2010).

Annual Hunter Harvest Estimates

Hunting seasons for game birds classified as migratory under the MBTA are established under frameworks developed by the USFWS and implemented by the VDGIF. Species that fall into this category that are addressed in this EA include: tundra swan, Canada goose, brant, snow goose, black-bellied whistling-duck, wood duck, mallard, American black duck, gadwall, northern pintail, American wigeon, northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, ring-necked duck, greater scaup, lesser scaup, common eider, harlequin duck, long-tailed duck, surf scoter, black scoter, white-winged scoter, common goldeneye, bufflehead, hooded merganser, common merganser, red-breasted merganser, ruddy duck, and American coot. Canada geese can also be taken under Depredation Orders and light geese can be taken under Conservation Orders, established by the USFWS pursuant to the MBTA.

The USFWS and state wildlife agencies have in place a program whereby licensed migratory game bird hunters must register annually in the state in which they hunt. Each state wildlife agency is responsible for collecting the name, address, and date of birth from each migratory bird hunter, asking them general questions about their harvest and sending this information to the USFWS. The USFWS then utilizes this data to conduct detailed surveys to estimate and prepare reports on the number of birds harvested annually (Raftovich et al. 2016, Roberts 2016).

Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species

A common issue when addressing damage caused by animals are the potential impacts of management actions on non-target species, including threatened and endangered species. Non-lethal methods have the potential to inadvertently disperse or otherwise impact non-targets. Lethal methods remove individuals of the species causing the damage, thereby reducing the presence of those species in the area and the local population. However, lethal methods also have the potential to inadvertently capture or kill non-targets.

The Endangered Species Act (ESA) makes it illegal for any person to '*take*' any listed endangered or threatened species or their critical habitat. The ESA defines take as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1531-1544). Critical habitat is a specific geographic area or areas that are essential for the conservation of a threatened or endangered species. The ESA requires that federal agencies conduct their activities in a way to conserve species. It also requires that federal agencies consult with the appropriate implementing agency (either the USFWS or the NMFS) prior to undertaking any action that may take listed endangered or threatened species or their critical habitat pursuant to Section 7(a)(2) of the ESA.

There may also be concerns that WS' activities could result in the disturbance of eagles that may be near or within the vicinity of WS' activities. Under 50 CFR 22.3, the term "disturb", as it relates to take under the Bald and Golden Eagle Act, has been defined as "to agitate or bother a bald and golden eagles to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The environmental consequences evaluation conducted in Chapter 3 of this EA will discusses the potential for WS' activities to disturb eagles as defined by the Act.

Issue 3 - Effects of Damage Management Activities on Human Health and Safety

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage caused by waterfowl. Both chemical and non-chemical methods have the potential to have adverse effects on human health and safety. Risks can occur to persons employing methods, to persons coming into contact with methods or persons harvesting and then consuming animals which have been previously immobilized with drugs. Risks can be inherent to the method itself or related to the misuse of the method.

Safety of Chemical Methods Employed

Potential risks to human health and safety associated with chemical methods are related to the potential for human exposure either through direct or indirect contact with the chemical. Under the alternatives analyzed in detail, chemical methods could be employed or recommended including, euthanasia chemicals, repellants, and immobilization drugs. All of these chemical methods except for alpha-chloralose would be available under all of the alternatives analyzed in detail.

The use of chemical methods is strictly regulated by the DEA, USEPA, FDA and VDACS. Restricted use chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. All of the chemical methods listed above, including methods available for use to the public, have specific requirements for their handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code. Additional information about these methods can be found in Appendix B.

Safety of Non-Chemical Methods Employed

Most methods available to manage damage and threats associated with waterfowl are considered non-chemical methods. Non-chemical methods available can be grouped into two categories: non-lethal and lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the area. Examples of non-lethal methods include resource management, physical exclusion, frightening devices or deterrents, capture with live capture devices, or repellants. All of these methods are designed to disperse, exclude or make the area where damage is occurring unattractive or unavailable to the animals which are associated with the damage. Lethal methods remove individuals of target species causing the damage, thereby reducing the presence of those species in the area and reducing the local population. Lethal methods include egg and active nest destruction, shooting, capture and euthanasia, or the reduction of a local population by hunting. All of these non-chemical methods available to address damage would be available for use under any of the alternatives and could be employed by any entity, when permitted.

Like chemical methods, non-chemical methods, if misused, could potentially be hazardous to human health and safety. The primary safety risk of most non-chemical methods occurs directly to the person employing the method. However, risks to others do exist when employing non-chemical methods, such as when using firearms. All of the non-chemical methods available to address damage would be available for use by any entity, when permitted, under all of the alternatives analyzed in detail.

Issue 4 – Humaneness and Animal Welfare Concerns

The issue of humaneness and animal welfare, as it relates to the killing or capturing of animals is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate damage management for societal benefits could be compatible with animal welfare concerns, if "*…the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process*."

Suffering has previously been described by the American Veterinary Medical Association (AVMA), as a *"…highly unpleasant emotional response usually associated with pain and distress"* (AVMA 1987). However, suffering "*…can occur without pain…,"* and "*…pain can occur without suffering…"* because suffering carries with it the implication of occurring over time, a case could be made for "*…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain. However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The AVMA has previously stated that *"[f]or wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible"* (AVMA 2001).

Pain and suffering, as it relates to methods available for use to manage animal damage has both a professional and lay point of arbitration. The professional community and the public would be better served to recognize the complexity of defining suffering, because *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991). Research suggests that some methods can cause *"stress"* (Kreeger et al. 1990). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

The decision-making process can involve trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

The issue of humanness and animal welfare concerns, as those concerns relate to the methods available for use, will be further discussed under the alternatives in Chapter 3. SOPs to alleviate pain and suffering are discussed later in this chapter.

Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Waterfowl

An additional issue raised is that activities to alleviate damage and threats associated with waterfowl would result in the loss of the aesthetic benefits of these birds to persons in the area where damage management activities take place. Animals are generally regarded as providing utilitarian, monetary, recreational, scientific, ecological, existence and historic values (Conover 2002). These benefits can be tangible or intangible. Both recreational and existence values are related in part to aesthetics. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature and dependent upon what an observer regards as beautiful.

Many people enjoy watching or hearing wildlife and take pleasure from knowing they exist. In modern societies a large percentage of households have pets. However, some people may consider individual wild animals as "pets" and exhibit affection towards these animals.

The values people place on animals is unique to the individual and can be based on many factors. Because these values differ, public attitudes toward animals vary considerably. To alleviate damage, some people support lethal removal, some people believe that all animals should be captured and relocated or handed over to local law enforcement or animal control authorities while others strongly oppose any management and want management agencies to teach tolerance. Some of the people who oppose removal do so because of human-affectionate bonds with individual animals. Attitudes can also differ significantly depending upon if the individual is affected by the damage or threats of damage. As stated previously, methods available to alleviate damage or reduce threats either disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, or alternatively lethally remove individuals of the species causing the damage. These activities reduce the presence of target species in the area where damage is occurring. Therefore, these activities have the potential to affect the aesthetic values of waterfowl depending upon the values, philosophies, attitudes and opinions of individuals.

2.2 DAMAGE MANAGEMENT STRATEGIES

Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to use an adaptive integrated approach that may call for the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement methods in the most effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., crop selection), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, elimination of invasive species (e.g., mute swans) or any combination of these, depending on the circumstances of the specific damage problem.

The IWDM Strategies Employed by WS

Direct Operational Assistance
Direct operational assistance includes damage management activities that are directly conducted or supervised by WS personnel. Direct operational assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when a Memorandum of Understanding, Cooperative Service Agreement, or other comparable document provides for direct damage management by WS. The initial investigation defines the nature, history, and extent of the problem, species responsible for the damage, and methods available to resolve the problem.

Technical Assistance Recommendations
Technical assistance is the provision of information, recommendations and demonstrations on available and appropriate wildlife damage management methods and approaches. The implementation of damage management actions is the responsibility of the requester with no direct involvement by WS. In some cases, WS provides supplies or materials that are not readily available. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on the level of risk, need, and the practicality of their application. In some instances, wildlife-related assistance provided to the requestor by WS results in tolerance and / or acceptance of the situation. In other instances, management options are discussed and recommended.

Under APHIS NEPA implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

Education
An important component of technical assistance is education. Education is important because wildlife damage management is about finding compromise and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the dissemination of information and recommendations to those persons requesting assistance with reducing damage or threats, WS provides lectures, courses, and demonstrations to producers, homeowners, Commonwealth and county agents, colleges and universities, and other interested groups on damage management. Additionally, technical papers are presented at professional meetings and conferences so that other natural resource professionals are kept up to date on recent developments in damage management technology, programs, agency policies, laws and regulations.

Research and Development

Another important component of technical assistance is the development of new methods. The National Wildlife Research Center (NWRC) functions as the research unit of WS. NWRC uses scientific expertise to develop methods to resolve conflicts between humans and animals while maintaining the quality of the human environment. NWRC research biologists work closely with wildlife managers, researchers, and others to develop and evaluate damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected worldwide for their expertise.

Wildlife Services Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model and described by Slate et al. (1992) (Figure 2.1). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate to reduce damage. WS personnel assess the problem and evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social factors. Methods deemed practical for the situation are then developed into a management strategy. WS would continue to monitor and evaluate the situation as assistance (either technical or direct) is provided, modifying the strategy and methods used to reduce the damage to an acceptable level. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions.

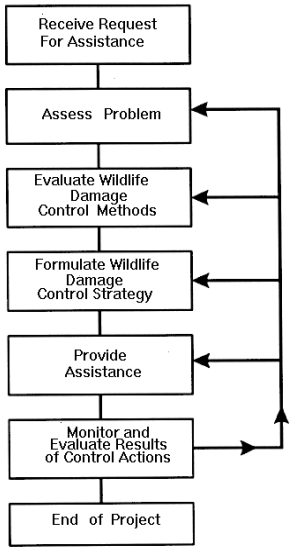


Figure 2.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

Community-based Decision Making

The WS program follows the "co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of waterfowl and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods depending on the alternative selected. WS and other state, tribal and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available.

Requests for assistance to manage damage caused by wildlife often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on waterfowl damage management activities. This process allows decisions on waterfowl damage management activities to be made based on local input. They may implement management recommendations provided by WS or others on their own, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

2.3 STANDARD OPERATING PROCEDURES FOR WATERFOWL DAMAGE MANAGEMENT

WS' directives and standard operating procedures (SOPs) improve the safety, selectivity, and efficacy of animal damage management activities. WS' directives and SOPs would be incorporated into activities conducted by WS when addressing damage and threats associated with waterfowl.

Some key SOPs pertinent to the proposed action and the alternatives include the following:

- WS would use the WS Decision model to identify and determine the most appropriate damage management strategies and their potential impacts (WS Directive 2.201).

- WS would apply an integrated approach (WS Directive 2.101) and evaluate methods for appropriateness (WS Directive 2.105).

- All pesticides have to be registered with the USEPA and the VDACS, and must have labels approved by the agency which details the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment as well as directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. WS would follow and use all pesticides according to their label.

- All personnel who would use chemicals would be trained and certified to use such substances or would be supervised by trained or certified personnel.

- All personnel using firearms would be trained according to WS' Directives.

- Alpha-chloralose, an FDA registered drug, would be stored, transported, used and disposed of in compliance with use guidelines outlined in the Alpha-chloralose training manual.

- WS' use of traps or other capture devices would comply with WS Directive 2.450.

- Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.

- Carcasses of animals retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.

- WS would comply with all applicable federal, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210.

- WS' personnel would use bait, trap placements, and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

2.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs would be applicable to the alternatives and the issues identified in Chapter 2 including the following:

Issue 1 - Effects of Damage Management Activities on Target Waterfowl Populations and Regulated Harvest

- Lethal removal of waterfowl by WS would be monitored by the USFWS and the VDGIF to ensure cumulative lethal removal is considered as part of population management objectives.

- WS would monitor waterfowl damage management activities to ensure activities do not adversely affect their populations in the Commonwealth.

- The use of non-lethal methods would be considered prior to the use of lethal methods when providing technical assistance and direct operational assistance.

- Management actions would be directed toward specific animals or groups of animals causing damage or threats.

Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species

- When appropriate, suppressed firearms would be used to minimize noise impacts.

- Non-target animals captured in traps would be released unless it was determined that the animal would not survive and/or that the animal could not be released safely.

- WS has evaluated the potential risks to federally listed threatened and endangered species in accordance with the ESA.

- WS would review the current federal threatened and endangered species list for Virginia each year to determine if new species have been added and will evaluate potential impacts to those species from waterfowl damage management activities.

- WS would use alpha-chloralose in compliance with use guidelines outlined in the Alpha-Chloralose Training Manual.

Issue 3 - Effects of Damage Management Activities on Human Health and Safety

- Damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (e.g., early morning) whenever possible.

- All chemicals used by WS or recommended by WS would be registered with the USEPA, FDA and/ or the VDACS, as appropriate.

- All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401.

- Controlled chemical immobilization and euthanizing agents will be used by WS in compliance with applicable state and federal laws and regulations to reduce risks to human health and safety (WS Directive 2.430).

- WS would not administer alpha-chloralose to harvestable waterfowl during and 30 days prior to hunting seasons in which said birds could be hunted.

- WS identifies hazards in advance of work assignments and provides employees with personal protective equipment (PPE). Employees must adhere to safety requirements and use appropriate PPE. WS employees are required to work cooperatively to minimize hazards and immediately report unsafe working conditions (WS Directive 2.601).

Issue 4 – Humaneness and Animal Welfare Concerns

- WS personnel would be trained in the latest and most humane devices and methods for removing waterfowl.

- WS' use of traps or other capture devices would comply with WS Directive 2.450.
- WS' use of immobilization and euthanasia methods would comply with WS Directive 2.505 and WS Directive 2.430.

Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Waterfowl

- WS would set capture devices to minimize visibility of captured animals in compliance with WS Directive 2.450.

2.5 ALTERNATIVES CONSIDERED IN DETAIL

Alternatives were developed for consideration based on the issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed analysis in Chapter 3. Chapter 2 also discusses alternatives considered but not analyzed in detail, with rationale.

The following alternatives were developed to address the identified issues associated with managing damage and threats associated with waterfowl:

Alternative 1 – WS Would Continue to Address Waterfowl Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats associated with waterfowl. Under this alternative, WS could respond to requests for assistance for managing damage and threats associated with waterfowl by: 1) taking no action, if warranted, 2) providing technical assistance to property owners or managers on actions they could take to reduce damage or threats of damage, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage or threats of damage. Direct operational assistance could be provided when funding is available through federal appropriations or cooperative funding. WS' response to requests for assistance is dependent upon on those persons initiating the request. Those persons receiving technical assistance could 1) take no action, 2) choose to implement WS' recommendations on their own, 3) use the services of a private nuisance wildlife control

agent, 4) use volunteer services of private individuals or organizations (e.g., hunters), 5) use the services of local law enforcement or animal control authorities (in the case of free-ranging domestic and feral waterfowl) or 6) use the services of WS (direct operational assistance) when available. Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.

The most effective approach to resolving any animal damage problem is to use an adaptive integrated approach (IWDM) that may call for the use of several methods simultaneously or sequentially. This approach is used by WS for providing both technical and direct operational assistance. WS personnel use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model (See ***Wildlife Services Decision Making***). IWDM may incorporate both non-lethal and lethal methods depending upon the circumstances of the specific damage problem. Non-lethal methods disperse or otherwise make an area where the damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the area. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if those requesting assistance have already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods because their use has already been proven ineffective in adequately resolving the damage or threat. When effective, non-lethal methods would disperse waterfowl from the area resulting in a reduction in the presence of those birds at the site.

Lethal methods remove individuals or active nests (nests with eggs or chicks present) of the species causing the damage, thereby reducing the presence of those species in the area and the local population. Lethal methods are often employed or recommended to reinforce non-lethal methods and to remove waterfowl that have been identified as causing damage or posing a threat of damage as part of an integrated approach. The number of birds or active nests removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of individual birds or active nests involved with the associated damage or threat, and the efficacy of methods employed. Under this alternative, WS may recommend individual birds or active nests be lethally removed in an attempt to reduce the number of birds causing damage.

Depredation Permits

Lethal take of individual birds or active nests can occur either: without a permit (if those species are non-native), during hunting seasons, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS. Currently, as part of the application process, the USFWS requires that permittees contact WS to obtain a recommendation (technical assistance) for how to address the wildlife damage problem. Under the proposed action, WS would evaluate the situation and then issue a recommendation that describes the damage, species involved, number of individual birds involved, previous actions taken to address the problem and recommendations for how to address the problem. Recommendations could include non-lethal actions and when appropriate, the recommendation that USFWS issue a depredation permit for lethal actions. However, the USFWS requires that available non-lethal actions are used where possible and practical and shown ineffective prior to issuing a permit for lethal actions. USFWS also requires permittees continue long-term non-lethal actions to eliminate or reduce the need for permitted lethal removal. USFWS then reviews the application completed by the property owner or manager and the recommendation issued by WS and makes a determination to issue or not issue a depredation permit. Upon a receipt of a depredation permit, the property owner or manager or an appropriate designated sub-permittee may then commence the authorized activities. Permittees must submit a written report

of their activities upon expiration of the permit. Permits may be renewed annually as needed to resolve continuing damage or threats of damage.

Appendix B contains a thorough discussion of the methods available for use in managing damage and threats associated with waterfowl under this alternative. All of the methods listed in the Appendix would be available under this alternative although not all methods would be available for direct implementation by all persons (alpha-chloralose is only available for use by WS).

The WS program follows the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, when numerous people are being affected by damage or threats associated with waterfowl, and a request for assistance is made, WS advocates providing technical assistance to the affected persons or local decision maker(s). Requests for assistance often originate from community representatives who have been notified by community members concerned about damage and threats associated with waterfowl. By involving decision-maker(s) in the process, damage management actions can be presented to allow decisions on damage management to involve those individuals that the decision maker(s) represent. Local decision-maker(s) could represent the local community's interest and make decisions for the community or they could relay technical assistance information to a higher authority or the community for discussion and decision-making. Local decision-maker(s) could also request that WS present technical assistance information at public meetings to allow for involvement of the community. Involving the appropriate representatives of the community ensures a community-based decision is made. In the case of private property, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1 (WS could recommend both non-lethal and lethal techniques in an adaptive integrated approach). Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. When the circumstances of a specific damage problem called for the use of lethal methods, WS could recommend those persons requesting assistance: 1) implement lethal methods on their own, 2) use the services of a private nuisance wildlife control agent, 3) use volunteer services of private individuals or organizations (e.g., hunters), or 4) use the services of local law enforcement or animal control authorities (in the case of free-ranging domestic and feral waterfowl). WS would not provide direct operational assistance utilizing lethal techniques. Appendix B contains a thorough discussion of the methods available for use in managing damage and threats associated with waterfowl. All methods listed in the Appendix could be available under this alternative.

This alternative would place the immediate burden of lethal operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage associated with waterfowl as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Alternative 3 – WS Would Not Address Waterfowl Damage

Under this alternative, WS would not conduct technical or direct operational assistance to reduce threats or alleviate damage associated with waterfowl. WS would not be involved with any aspect of managing damage associated with waterfowl. All requests for assistance received by WS to resolve damage caused

by waterfowl would be referred to the USFWS, VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities. This alternative would not prevent other federal, Commonwealth, and/or local agencies, including private entities from conducting damage management activities directed at alleviating damage and threats associated with waterfowl. With the exception of alpha-chloralose, all methods listed in the Appendix could be available under this alternative.

This alternative would place the burden of technical and operational damage management on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage associated with waterfowl as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

2.6 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives analyzed in detail, several alternatives were identified by WS that will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

WS Would Implement Non-lethal Methods before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats associated with waterfowl. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the damage. If the use of all non-lethal methods failed to resolve the damage or threat, lethal methods would then be employed to resolve the damage.

Those persons experiencing damage or threats often employ non-lethal methods prior to contacting WS for assistance. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 1) described is similar to a non-lethal before lethal alternative because the use of non-lethal methods must be considered before lethal methods by WS (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

WS Would Use Non-lethal Methods Only

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with waterfowl would be the non-lethal methods described in Appendix B. The non-lethal methods recommended or used under this alternative would be identical to those identified under Alternatives 1, 2 and 3.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS would refer requests for information regarding lethal methods to the VDGIF, the VDACS and/or private entities. Although not recommended or used by WS, lethal methods could continue to be used by others in resolving damage or threats associated with waterfowl under this alternative. All lethal methods listed in the Appendix would be available under this alternative except for alpha-chloralose.

Under this alternative, resource owners or managers frustrated by a lack of WS' assistance with the full range of management methods may try methods not recommended by WS (e.g., poisons). In some cases, resource owners or managers may misuse methods or use methods in excess of what is necessary.

This alternative was not analyzed in detail since the lethal removal of waterfowl could continue at the levels analyzed in Alternative 1, despite the lack of WS' involvement.

WS Would Use Lethal Methods Only

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with waterfowl would be the lethal methods described in Appendix B. This is in direct conflict with WS Directive 2.101, which directs that WS must consider the use of non-lethal methods before lethal methods. Therefore, this alternative was not considered in detail.

WS Would Only Trap and Translocate Waterfowl

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods described in Appendix B followed by translocation (the transport and release of an animal from one area to another). Waterfowl are managed by the USFWS, the VDGIF and/or local law enforcement and animal control authorities and translocation of them could only occur under their authority.

Translocation of animals is generally ineffective in reducing damage and would therefore be ineffective at meeting the need for action because birds are highly mobile and can easily return to damage sites from long distances, and translocation may result in damage problems at the new location (Fischer and Lindenmayer 2000, Seddon et al. 2012). Many animals show strong homing behavior (Holevinski et al. 2006) and may return to the site after being relocated. Flockhart and Clarke (2017) found that translocated Canada geese returned at high rates and that translocating geese was an ineffective way to reduce goose abundance. Additionally, given the scope of the issue described in the need for action (Chapter 1), it would be unrealistic to translocate the numbers of animals necessary to reduce damage. There is a perception among some individuals that animals which are translocated because they are causing damage 'live happily ever after' (Craven et al. 1998). Unfortunately however, these animals typically have high mortality rates because of the stress of capture, transport and release, aggression by animals of the same species already occupying the new location, disorientation, unsuitable habitat, difficulties finding resources (food, water, shelter) at the new location, attempts to return to the site of capture and increased susceptibility to predation or disease (Nielsen 1988, Craven et al. 1998, Fischer and Lindenmayer 2000, Seddon et al. 2012). Translocation of animals may also result in the transmission of diseases from one area to another (Nielsen 1988). For these reasons, translocation of the majority of wildlife species, including waterfowl, is discouraged by WS policy (see WS Directive 2.501) and was not analyzed further.

WS Would Use Regulated Hunting to Manage Damage Associated With Waterfowl

Under this alternative, all requests for assistance received by WS would be addressed by recommending the use of regulated hunting to reduce populations of those waterfowl causing damage. The VDGIF establishes and enforces regulated hunting seasons under frameworks determined by the USFWS. Hunting by private individuals when based on biological information and properly regulated can be effectively used to manage wildlife populations. However, regulated hunting is often not allowed in all locations where damage occurs (e.g., airports, urban areas), during times of year when damage occurs (e.g., when agricultural crops are most vulnerable), is not allowed for all species (e.g., free-ranging domestic and feral waterfowl), or may not remove enough animals to reduce the damage (e.g., because of method restrictions).

The hunting of waterfowl can only occur at the discretion of the USFWS and/or the VDGIF, which ensures that removal occurs to achieve desired population objectives for each species. Therefore, regulated hunting could continue to occur under any of the alternatives analyzed in detail at the discretion of the appropriate regulatory authority. Under Alternative 1 (the proposed action alternative) and Alternative 2, WS could recommend, when appropriate, that hunting be used by the resource owner or manager on property they own or manage where damages were occurring. However, allowing hunting and/or trapping would be the decision of the owner or manager of the property. Since WS does not have the ability to require hunting to resolve damage, this alternative was not analyzed in detail.

WS Would Eradicate or Suppress Populations of Waterfowl in the Commonwealth that are Causing Damage

Under this alternative, all requests for assistance would be addressed using the eradication or suppression of, or the recommendation of eradication or suppression of waterfowl populations that are causing damage. Wild birds are managed by the USFWS and/or the VDGIF and eradication or suppression of their populations could only occur under the authority of the appropriate regulatory authority. The eradication of any native species is not a desired management goal. Since eradication is not a desired management goal for native species an eradication alternative was not considered in detail.

The suppression of waterfowl populations would require that WS respond to requests for assistance by using or recommending the managed reduction of populations of waterfowl causing damage. In areas where damage can be attributed to localized populations of waterfowl, WS could decide to implement local population suppression using the WS Decision Model. Typically, WS' activities would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species. However, it is not realistic or practical to consider large-scale population suppression as the basis of the WS program. Nor is the large-scale population suppression of native animals a desired management goal. Therefore, this alternative was not considered in detail.

WS Would Use Reproductive Control to Reduce Populations of Waterfowl in the Commonwealth that are Causing Damage

Under this alternative, the only method available by WS for recommendation or use in resolving damage or threats associated with waterfowl would be reproductive control. Reproductive control for wildlife can be accomplished either through sterilization (permanent) or contraception (reversible). However, the use and effectiveness of reproductive control as a wildlife population management tool is limited by characteristics of the species (e.g., life expectancy, age at onset of reproduction, population size, etc.), the nature of the local environment (e.g., isolation of target population, access to target individuals, etc.), and other biological factors. In general, if the time needed to reduce damage is a factor in selecting a management method, lethal control will always be more efficient than reproductive control because reproductive control cannot generate a more rapid population decline (Dolbeer 1998). In addition to being biologically feasible, reproductive control methods need to be logistically feasible and economically practical.

Although research is ongoing, no known reproductive inhibitors have been registered by the USEPA for use in many species of wildlife (Fagerstone et al. 2010, Yoder and Miller 2006). Current technology requires direct contact with animals for both the application of sterilization and contraception methods. The need to capture or make direct contact with a sufficiently large number of target animals with multiple treatments (in the case of contraceptives) to effectively implement this method places considerable logistic and economic constraints on the adoption of reproduction control as a wildlife management tool for many species. Given these constraints, and the lack of availability of chemical reproductive inhibitors for the management of many species, this alternative was not evaluated in detail.

Currently, the only reproductive inhibitor that is registered with the USEPA for use in any of the species addressed in this document is nicarbazin (OvoControl® G). Nicarbazin was officially registered by the USEPA in 2005 for use in reducing fertility in resident Canada geese, domestic mallard ducks, domestic Muscovy ducks, and domestic hybrids in urban areas (Bynum et al. 2007). It is a restricted use pesticide and is therefore only available for use by certified pesticide applicators. However, in order for nicarbazin to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. Nicarbazin is not currently registered for use in Virginia. However, if Nicarbazin or other reproductive inhibitors become available to manage those species addressed in this document in the Commonwealth, their use could be evaluated under the proposed action alternative as a method available that could be used in an integrated approach to managing damage.

WS Would Use Egg and Active Nest Destruction to Reduce Populations of Waterfowl in the Commonwealth that are Causing Damage

Under this alternative, the only method available by WS for recommendation or use in resolving damage or threats associated with waterfowl would be egg and active nest destruction. While egg removal or destruction can reduce production of young, merely destroying an egg does not reduce a population as quickly as removing adults (Cooper and Keefe 1997). To equal the effect of removing an adult bird from a population, all eggs produced by that bird during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal efforts must be nearly complete in order to prevent recruitment from a small number of surviving nests that would offset control efforts (Smith et al. 1999). Cooper and Keefe (1997), Rockwell et al. (1997), and Schmutz et al. (1997) reported that egg destruction is only fractionally effective in attaining population reduction objectives, and that nest and egg destruction is not an efficient or cost-effective damage management or population reduction approach. If the time needed to reduce damage is a factor in selecting a management method, lethal removal of adult birds will always be more efficient because other methods cannot generate as rapid a population decline (Dolbeer 1998). Additionally, methods need to be logistically feasible and economically practical (e.g., time and ability to locate and destroy all active nests).

WS Would Provide Financial Compensation for Damage Associated with Waterfowl

Under this alternative, WS would provide financial compensation to those persons requesting assistance who were experiencing damage associated with waterfowl. This alternative would include site visits to verify damage and identify the species involved. WS would not provide direct operational assistance. The assumption of financial compensation programs for animal damage is that offsetting damages financially can reduce or eliminate any incentive for those persons experiencing damage to lethally remove animals (Bulte and Rondeau 2005). WS does not have the legal authority to provide financial compensation for damage; only manage the damage or threats of damage.

This EA evaluates different alternatives to meet the need for action. The need for action is to reduce damage and threats associated with waterfowl. Providing financial compensation to those persons experiencing damage would be ineffective at meeting the need for action because it does not reduce damage and threats. Because providing financial compensation would fail to meet the need for action, this alternative was not considered further.

CHAPTER 3: ENVIRONMENTAL EFFECTS

This chapter provides the information needed for making an informed selection among the alternatives identified and described in Chapter 2; a selection which not only addresses the need for action identified in Chapter 1 but also addresses the issues identified in Chapter 2. Specifically, this chapter analyzes the environmental consequences of each of the alternatives as those alternatives relate to the issues identified in Chapter 2. Additionally, this chapter compares the environmental consequences of the proposed action / no action alternative to the environmental consequences of the other alternatives.

Environmental consequences can be direct, indirect, and/or cumulative.

Direct Effects: Caused by the action and occur at the same time and place.

Indirect Effects: These are impacts caused by an action that occur later in time or further removed in distance but are still reasonably foreseeable.

Cumulative Effects: As defined by CEQ (40 CFR 1508.7), these are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

3.1 ISSUES CONSIDERED IN DETAIL AND THEIR ASSOCIATED ENVIRONMENTAL CONSEQUENCES BY ALTERNATIVE

The proposed action / no action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and Virginia state agencies.

Issue 1 - Effects of Damage Management Activities on Target Waterfowl Populations and Regulated Harvest

The issue of the potential direct and cumulative impacts of conducting the alternatives on the populations of target waterfowl populations is analyzed for each alternative below.

Alternative 1 – WS Would Continue to Address Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

The proposed action / no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats associated with waterfowl as described in Chapter 2.

The issue of the effects on target species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats; however, the primary concern would be from the use of lethal methods to address damage. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species (target species) causing the damage, thereby reducing the presence of those species in the area. When effective, non-lethal methods would disperse waterfowl from the area resulting in a reduction in the presence of those animals at the site. However, birds

responsible for causing damage or threats are moved to other areas with minimal impact on those species' populations. WS would not employ or recommend these methods be employed over large geographic areas or at such intensity that essential resources would be unavailable and that long term adverse impacts to bird populations would occur. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife because individuals of those species are unharmed. The use of non-lethal methods would not have adverse population impacts under any of the alternatives.

The lethal removal of waterfowl would be monitored by comparing the number of each species lethally removed with that species' overall population trend (when available) and / or the magnitude of lethal removal in comparison to other known lethal removal occurring (when available) to assure the magnitude of lethal removal is maintained below the level that would cause adverse effects to the viability of species' populations. Population estimates are unavailable for most species of waterfowl in Virginia. The potential impacts on waterfowl populations from the implementation of the proposed action / no action alternative are analyzed for each species below.

Mute Swan Population Impact Analysis

Native to Eurasia, mute swans were introduced into the U.S. beginning in the mid-1800s (Ciaranca et al. 1997). Today, mute swans can be found across much of the northeastern U.S., the Upper Great Lakes region and the Pacific Northwest (Ciaranca et al. 1997). Mute swans inhabit fresh, salt and brackish wetland habitats (Ciaranca et al. 1997). Social birds, mute swans can be observed in pairs with young during the breeding season (Ciaranca et al. 1997). During the non-breeding season, birds can be observed in groups of 12 to more than 600 (Ciaranca et al. 1997).

According to BBS trend data, mute swan populations in the Eastern U.S. have increased 1.8% annually since 1966, and 4.4% annually from 2005 to 2015 (Sauer et al. 2017). Observations from the Atlantic Flyway Mid-Summer Mute Swan Survey (MSMSS), indicate that the Atlantic Flyway population increased by 125% between 1986 and 2002 before declining by 36% between 2002 and 2011 (Costanzo et al. 2015). Similarly, the number of mute swans observed in the Commonwealth during the CBC showed an increasing trend from 1966 to 2005 and a declining trend since 2006 (National Audubon Society 2010). The MSMSS estimated the Atlantic Flyway population at 9,202 swans in 2011 (Costanzo et al. 2015) while the Atlantic Flyway Breeding Waterfowl Plot Survey (AFBWPS) estimated the Atlantic Flyway population at 13,684 (Standard Error (SE) 3,056) swans in 2016 (Roberts 2016). In 2012, the Commonwealth's mute swan population was estimated to be about 300 birds (VDGIF 2012).

The number of mute swans dispersed or lethally removed by WS to alleviate damage and threats from 2010 to 2015 is shown in Table 3.1. Mute swans are not protected under federal or state law. In Virginia, mute swans, and the nests and eggs of these birds may be lethally removed at any time (4 VAC 15-20-160, § 29.1-511). It is also illegal to import, possess or sell mute swans without a permit (4 VAC 15-30-40). The total number of mute swans lethally removed by other entities is unknown.

Table 3.1 – Number of mute swans lethally removed or dispersed in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	WS' Lethal Removal or Destruction[1]	
		Adults	Nests
2010	0	2	0
2011	1	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
AVERAGE	**<1**	**<1**	**0**

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 100 mute swans and remove and destroy 50 mute swan nests annually under the proposed action / no action alternative to manage damage or threats of damage.

Mute swans are a non-native species and are not afforded any protection by the state or federal government. Mute swans are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of mute swans, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health. While reduction in mute swan numbers would be beneficial to the environment, the removal of 100 mute swans and 50 nests annually would not pose any significant direct or cumulative impacts to the mute swan population throughout the Eastern U.S.

Canada Goose Population Impact Analysis

Historically, in the Atlantic flyway, Canada geese resided in Canada and other northern latitudes during the breeding season and migrated south to spend the winter in more temperate climates (USFWS 2005). However, releases of domestic and semi-domestic birds from captive flocks and the relocation and artificial introduction of these geese by management agencies has resulted in populations of geese which breed and reside year-round south of their natural range (Robinson 1924, Mowbray et al. 2002, USFWS 2005, USFWS 2011). Canada geese, thought to be escaped or released birds, were first recorded nesting in the wild in Virginia in 1940 (Rottenborn and Brinkley 2007). Preferred habitat includes prairie, arctic plains, mountain meadows, agricultural areas, reservoirs, sewage lagoons, parks, golf courses, lawn-rich suburban areas, or other similar areas not far from permanent sources of water (Mowbray et al. 2002). Canada geese nest once per year, laying 2 to 8 eggs; with birds re-nesting if the first nest is destroyed (Mowbray et al. 2002). Canada geese are highly social birds gathering in flocks which number in the thousands (Mowbray et al. 2002). Flocks as large as 50,000 geese have been observed during the winter on the Commonwealth's coastal plain (Rottenborn and Brinkley 2007).

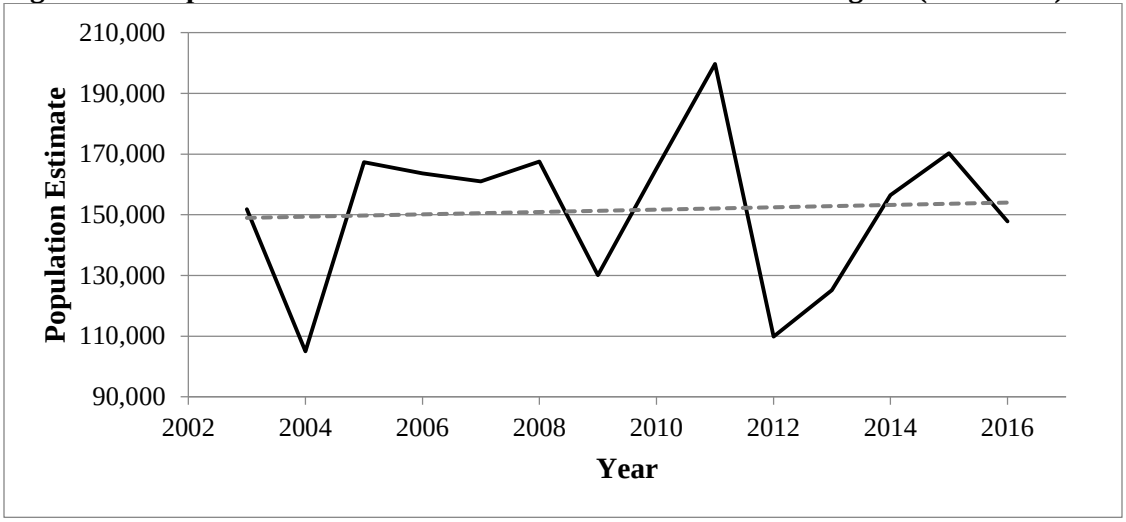
The number of Canada geese observed in the Commonwealth during both the CBC and the AFMWS have shown increasing trends since 1966 (National Audubon Society 2010, USFWS 2017*b*). Geese residing in the Commonwealth during the CBC and the AFMWS could be either migratory or resident geese.

Resident Canada Geese

Canada geese are considered "resident" when one of the following criteria is met: 1) nest and/or reside on a year round basis within the contiguous United States; 2) nest within the lower 48 States during the months of March, April, May, or June; or 3) reside within the lower 48 States and the District of Columbia in the months of April, May, June, July, and August (see 50 CFR 20.11, USFWS 2005). Therefore, during much of the year, the majority of Canada geese present in the Commonwealth are resident, not migratory.

According to BBS trend data, Canada goose populations in the Eastern U.S. have increased 11.92% annually since 1966 and 12.42% annually from 2005 to 2015 (Sauer et al. 2017). Similarly, in Virginia, BBS trend data shows Canada goose populations have increased 19.28% annually since 1966, and increased 14.74% annually from 2005 to 2015 (Sauer et al. 2017). The number of resident Canada geese observed in the Commonwealth during the Atlantic Flyway Breeding Waterfowl Plot Survey has remained stable since 2003 (Figure 3.1) (Roberts 2016). Canada geese were the second most abundant species observed during the first year of the second Virginia Breeding Bird Atlas Project (2016) (A. Peele, VBBAP, personal communication, 2017). The AFBWPS estimated the Virginia population at 147,869 (SE 34,298) geese and the Atlantic Flyway population at 949,989 (SE 80,129) geese during the breeding season in 2015 (Roberts 2016).

Figure 3.1– Population Estimates for Resident Canada Geese in Virginia (2003-2016)[1].



[1]Atlantic Flyway Breeding Waterfowl Plot Survey data (Roberts 2016)

The number of Canada geese dispersed by WS, lethally removed by WS or other entities to alleviate damage and threats under depredation permits or agricultural depredation orders as well as the number of geese harvested by hunters from 2010 to 2015 is shown in Table 3.2. Table 3.3 shows the number of Canada goose nests destroyed by WS or other entities under depredation permits, agricultural depredation orders or depredation orders in Virginia from 2010 to 2015. In Virginia, Canada geese can be harvested during a regular hunting season, a September and a late season. The expansion of traditional regular hunting season frameworks (to September and late seasons) was initiated in an attempt to reduce the growth of resident Canada geese populations (56 FR 49111 (September 26, 1991) see also USFWS 2005). Similarly, the agricultural depredation order was established to address damage to agricultural resources caused by overabundant resident Canada geese (71 FR 45964-45993 (August 10, 2006) see also USFWS 2005). September and late seasons as well as agricultural depredation orders target resident Canada geese by restricting lethal removal to months or locations where the majority of the geese present are resident, not migratory. A population objective of 125,000 resident Canada geese has been proposed by the

Atlantic Flyway Council to "provide significant aesthetic and recreation benefits while reducing economic damages…alleviating nuisance issues, and minimizing threats to human health and safety" (Atlantic Flyway Council 2011).

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 7,500 Canada geese and remove or destroy up to 500 active nests annually under the proposed action / no action alternative to manage damage or threats of damage. Because lethal removal could occur year round and visually distinguishing resident from migratory Canada geese is impossible, WS' lethal removal will be analyzed here as if all birds lethally removed were resident Canada geese.

The lethal removal of up to 7,500 Canada geese annually by WS would represent 17.5% of the average number of resident geese harvested by hunters in Virginia during all seasons (42,883 Canada geese). Alternatively, it would represent 5.0% of the estimated population (147,869) in the state and 0.78% of the estimated population in the Atlantic Flyway during the breeding season (949,989). Given the lethal removal proposed by WS to alleviate damage and threats when compared to the hunter harvest, and that the current population exceeds the population objective by an estimated 22,869 geese, WS' proposed lethal removal should not have any significant direct or cumulative impact on resident Canada goose populations. Most requests to address Canada geese received by WS are from airports and urban or suburban areas where hunting is not permitted. Therefore, WS' lethal removal of Canada geese is likely to occur in locations where it will not limit the ability to harvest geese. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring and could be considered of low magnitude when compared to the number of geese being harvested and lethally removed. Harvest and lethal removal of Canada geese can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of Canada geese lethally removed annually to the USFWS.

Additionally, impacts due to removal and destruction of active nests should have little adverse impact on the Canada goose population. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult birds. Nest and egg destruction is not used by WS as a population management method. This method is used by WS to inhibit nesting in an area experiencing damage due to nesting activity and is employed only at the localized level. The destruction of up to 500 active Canada goose nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on goose populations would occur. As with the lethal removal of adults, the removal and destruction of active nests must be authorized by the USFWS. Therefore, the number of nests removed by WS annually would occur at the discretion of the USFWS.

Migratory Canada Geese

Migratory Canada geese nest across Alaska and Canada, migrating south to the U.S. and Mexico during the winter months (Mowbray et al. 2002). The migratory Canada geese that can be observed in Virginia come from several distinct populations; the North Atlantic Population (NAP), Atlantic Population (AP), and the Southern James Bay Population (SJBP) (USFWS 2016*b*). The NAP of Canada geese nest in Newfoundland and Labrador wintering in coastal areas as far south as North Carolina (USFWS 2016*b*). The AP of Canada geese nest throughout much of Quebec and the eastern shore of Hudson Bay and winters from New England to South Carolina, with the largest concentrations on the Delmarva Peninsula. The SJBP of Canada geese nest on Akimiski Island and in the Hudson Bay lowlands to the west and south of James Bay, wintering from Southern Ontario and Michigan south to Mississippi, Alabama, Georgia, and South Carolina. Migratory Canada geese may be present in the Commonwealth from September 25 to March 11 (G. Costanzo, VDGIF, personal communication, 2010).

The number of Canada geese observed in the Commonwealth during the CBC when migratory birds are present has shown an increasing trend since 1990 (National Audubon Society 2010). On average, 100,260 Canada geese (range 77,017 to 126,742 geese) were observed overwintering in Virginia in the last decade during the CBC (2006–2007 to 2015–2016) (National Audubon Society 2010). An average of 128,640 Canada geese (range 105,520 to 162,156 geese) were observed overwintering in Virginia in the last decade during the AFWMS (2006–2015) (Roberts 2015). The number of migratory Canada geese present in the Commonwealth during the winter or during the spring and fall migration is unknown (because both resident and non-resident geese are present in the Commonwealth during those periods). The number of breeding geese in the NAP was estimated at 49,100 pairs (range: 36,400–70,300) in 2016 (USFWS 2016*b*). The AP was estimated at 663,500 geese (range: 506,500–820,500) in 2016 (USFWS 2016*b*). The number of geese in the SJBP was estimated at 60,700 geese (range: 45,900–75,500) in 2015 (USFWS 2015).

The total number of resident and migratory Canada geese dispersed by WS, lethally removed by WS or other entities to alleviate damage and threats under depredation permits or agricultural depredation orders as well as the number of geese harvested by hunters from 2010 to 2015 is shown in Table 3.2. In Virginia, Canada geese can be harvested during a regular hunting season as well as September and late seasons.

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 1,000 Canada geese annually under the proposed action / no action alternative to manage damage or threats of damage during times of the year when the geese present in the Commonwealth could potentially be migratory (September 25 through March 11). (Cumulative annual lethal removal of all Canada geese both resident and migratory by WS would be 7,500 geese).

Table 3.2 – Number of Resident (R*), Migratory (M†), and Unknown (U‡) Canada Geese dispersed by WS, or lethally removed under depredation permits or agricultural depredation orders or harvested by Hunters in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	Lethal Removal Under Depredation Permits			Lethal Removal Under Agricultural Depredation Orders[4]	Hunter Harvest[5]	
		Authorized Lethal Removal[2]	WS' Lethal Removal[1] (R / U)	Total Lethal Removal by Other Entities[3] (U)	Estimated Lethal Removal (R)	September Season (R / M)	Regular Season (R / M)
2010	8,647	11,333	3,978 / 228	836	266	15,569 / 31	40,977 / 14,623
2011	13,776	10,734	2,593 / 288	766	311	14,671 / 29	33,902 / 12,098
2012	8,996	10,774	2,480 / 190	650	280	9,681 / 19	30,954 / 11,046
2013	8,788	10,997	2,167 / 239	431	308	10,679 / 21	34,713 / 12,387
2014	22,745	10,986	1,982 / 193	466	374	7,485 / 15	27,589 / 9,941
2015	28,660	11,285	2,066 / 207	841	213	6,088 / 12	24,984 / 8,916
AVERAGE	**15,269**	**11,018**	**2,544 / 224**	**665**	**292**	**10,696 / 21**	**32,187 / 11,502**

* Resident (R) birds are those birds lethally removed by WS or other entities between March 12th and September 24th.
† Migratory (M) birds. See Number 5.
‡ Unknown (U) birds are those birds removed by WS between September 25th and March 11th when both resident and non-resident geese may be present in the commonwealth OR alternatively birds removed by other entities (reporting of specific month of removal is not required for depredation permits).
[1]Data reported by federal fiscal year.
[2]Permitted by USFWS; includes WS' authorized lethal removal. Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
[3]Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
[4]Data reported by calendar year, G. Costanzo, VDGIF, personal communication, 2016.
[5]Total harvest data obtained from Roberts 2016. Roberts 2016 estimated late season harvest to be 0 for 2010─2013 and 2016. Late season harvest was not estimated for 2014. Harvested birds were determined to be from either the resident (R) or migratory (M) population based on a percentage of harvest. 99.8% of the Canada geese harvested during the September season and 73.7% of the Canada geese harvested during the regular season in Virginia are resident birds (G. Costanzo, VDGIF, personal communication, 2017).

Table 3.3 – Number of active Canada goose nests destroyed by WS or other entities under depredation permits, agricultural depredation orders or depredation orders in Virginia from 2010 to 2015.

Year	Under Depredation Permits (WS)[1]	Under Agricultural Depredation Orders[2]	Under Nest and Egg Depredation Order[3]
2010	102	14	699
2011	95	14	495
2012	78	10	949
2013	66	0	787
2014	65	8	123
2015	76	8	489
AVERAGE	**80**	**9**	**590**

[1]Data reported by federal fiscal year, destruction by WS
[2]Estimated number of nests, data reported by calendar year, G. Costanzo, VDGIF, personal communication, 2016.
3USFWS 2017*c*, C. Dwyer, USFWS, personal communication 2012.

The lethal removal of up to 1,000 Canada geese annually by WS during times of the year when the geese present in the Commonwealth could be migratory would represent 8.6% of the average number of migratory geese harvested by hunters in Virginia during all seasons (11,523 Canada geese). Alternatively, it would represent 0.12% of the estimated populations (NAP, AP and SJBP) (822,400) of migrant geese which winter or spend time in Virginia during the spring and fall migrations (147,869). Given the lethal removal proposed by WS to alleviate damage and threats when compared to the hunter

harvest, WS proposed lethal removal should not have any significant direct or cumulative impact on Canada goose populations. Most requests to address Canada geese received by WS are from airports and urban or suburban areas where hunting is not permitted. Therefore, WS' lethal removal of Canada geese is likely to occur in locations where it will not limit the ability of hunters to harvest geese. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring. WS' lethal removal could be considered of low magnitude when compared to the number of geese being harvested and lethally removed by other entities. Harvest and lethal removal of Canada geese can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of Canada geese lethally removed annually to the USFWS.

Snow Goose Population Impact Analysis

Arctic breeders, snow geese can be observed during migration and the winter months over much of the continental U.S. (Mowbray et al. 2000). Preferred habitat during this period consists of coastal areas, rivers, lakes, wet grasslands, freshwater marshes, coastal prairies and cultivated fields (Mowbray et al. 2000). Snow geese are highly social birds which have been known to form flocks in the tens of thousands (Mowbray et al. 2000). Flocks as large as 65,000 geese have been observed during the winter on the Commonwealth's coastal plain (Rottenborn and Brinkley 2007).

Because they are arctic breeders, no BBS data or AFBWPS population estimates are available for snow geese in Virginia (Sauer et al. 2017). The number of snow geese observed in the Commonwealth during the CBC has shown an increasing trend since 1966 (National Audubon Society 2010). On average, 37,400 snow geese (range 18,154 to 64,967 geese) were observed overwintering in Virginia in the last decade during the CBC (2006–2007 to 2015–2016) (National Audubon Society 2010). An average of 17,146 snow geese (range 7,100 to 35,950 geese) were observed overwintering in Virginia in the last decade during the AFWMS (2006–2015) (Roberts 2015). The population of snow geese which winters along the Atlantic coast (greater snow geese) is estimated at 915,000 (range: 812,000–1,018,000) geese (USFWS 2016*b*).

The number of snow geese dispersed by WS, lethally removed by WS or other entities to alleviate damage and threats, and the number of geese harvested by hunters from 2010 to 2015 is shown in Table 3.4. Snow geese can be harvested during a regular hunting season as well as an extended season authorized under the Light Goose Conservation Order (50 CFR 21.60). The Conservation Order is intended to allow for the maximum number of snow geese to be harvested annually in an attempt to reduce the overall population of snow geese. The population of snow geese has increased dramatically since the mid-1970s and has reached historic highs (Mowbray et al. 2000). The current population level of snow geese has led to serious damage of its arctic breeding habitat, and in some areas its wintering habitat (Mowbray et al. 2000). Current populations could be considered to be environmentally unsustainable (Mowbray et al. 2000). Despite the introduction of special seasons, biologists remain concerned about their high population (USFWS 2016*b*).

Table 3.4 – Number of snow geese lethally removed or dispersed in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	Lethal Removal Under Depredation Permits			Hunter Harvest[4]
		Authorized Lethal Removal[2]	WS' Lethal Removal[1]	Total Lethal Removal by Other Entities[3]	
2010	35	280	0	0	700
2011	365	280	0	0	300
2012	10,595	280	1	0	300
2013	0	580	0	50	100
2014	14,125	288	0	0	1,100
2015	622	258	3	0	500
AVERAGE	**4,290**	**328**	**<1**	**8**	**500**

1Data reported by federal fiscal year
2Permitted by USFWS; includes WS' authorized lethal removal. Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
3Data reported by calendar year; includes WS' lethal removal. C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
4Data obtained from Roberts 2016

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 500 snow geese annually under the proposed action / no action alternative to manage damage or threats of damage.

The number of snow geese present in the Commonwealth fluctuates throughout the year. The lethal removal of up to 500 snow geese annually by WS would represent 100% of the average number of snow geese harvested by hunters in Virginia (500 geese), 1.34% of the average number of snow geese observed overwintering in Virginia during the past decade or 0.05% of the estimated population (915,000 geese). Given the increasing or stable population trends observed for snow geese and the desire of management agencies to reduce the overall population to alleviate the damage occurring to fragile arctic habitat, the limited lethal removal proposed by WS should not have any significant direct or cumulative impact on snow goose populations. Most requests received by WS to address snow geese are received from airports. Airports are restricted areas where hunting is not permitted. Therefore, WS' lethal removal of snow geese is likely to occur in locations where it will not limit the ability to harvest snow geese. WS' lethal removal could be considered of very low magnitude when compared to the number of snow geese being harvested. Harvest and lethal removal of snow geese can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired population objectives. WS would report the number of snow geese lethally removed annually, which would ensure cumulative impacts would be considered as part of USFWS population management objectives for snow geese.

Mallard Population Impact Analysis

Found across most of North America, the mallard is the most abundant and one of the most recognizable waterfowl species (Drilling et al. 2002). Mallards can be found year-round throughout the Commonwealth (Drilling et al. 2002). They are often associated with wetlands, streams, ponds, and lakes; however, mallards are flexible and adaptable and can be found in a variety of habitats (Drilling et al. 2002). Mallards nest once per year, laying an average of 8.72 eggs (range: 1 to 13) (Drilling et al. 2002). However, birds will re-nest if their first nest is destroyed and mallards in urban environments will raise a second brood (Drilling et al. 2002). With the exception of mating season, mallards are highly social, congregating in flocks that can number in the thousands during the winter and spring and fall

migration (Drilling et al. 2002). Flocks as large as 19,000 ducks have been observed during the fall on the Commonwealth's coastal plain (Rottenborn and Brinkley 2007).

According to BBS trend data, mallard duck populations in the Eastern U.S. have decreased 1.17% annually since 1966, and increased 0.46% annually from 2005 to 2015 (Sauer et al. 2017). Observations from the Waterfowl Breeding Population and Habitat Survey (WBPHS) eastern survey area indicate that the population of mallards has been stable since 1990 (USFWS 2016*b*). Similarly, the number of mallards observed in the Commonwealth during both the CBC and the AFMWS have shown stable trends since 1966 (National Audubon Society 2010, USFWS 2017*b*). The AFBWPS estimated the Virginia population at 42,523 (SE 12,266) mallards and the Atlantic Flyway population at 551,257 (SE 45,110) mallards during the breeding season in 2015 (Roberts 2016).

The number of mallards lethally removed by WS or other entities to alleviate damage and threats and the number of mallards harvested by hunters from 2010 to 2015 is shown in Table 3.5. Table 3.5 also shows the number of mallards dispersed by WS and the number of active mallard nests destroyed by WS and other entities. In Virginia, mallards can be harvested during a regular hunting season.

Table 3.5 – Number of mallards lethally removed or dispersed in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	Removal under Depredation Permits						Hunter Harvest[4]
		Adults			Active Nests			
		Authorized Lethal Removal[2]	WS' Lethal Removal[1]	Total Lethal Removal by Other Entities[3]	Authorized Lethal Removal[2]	WS' Lethal Removal[1]	Total Lethal Removal by Other Entities[3]	
2010	1,520	2,288	281	18	575	4	0	60,000
2011	1,292	2,336	216*	20	775	0	0	34,900
2012	953	2,286	205	10	979	0	12	25,300
2013	1,432	2,286	178	1	1,149	3	44	33,200
2014	984	1,861	197	0	1,279	1	0	41,300
2015	1,480	2,131	189	0	1,279	0	15	37,200
AVERAGE	**1,277**	**2,198**	**211**	**8**	**1,006**	**1**	**12**	**38,650**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized lethal removal. Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
[3]Data reported by calendar year; includes WS' lethal removal. C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
[4]Data obtained from Roberts 2016
*includes non-target lethal removal

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 750 mallards and remove or destroy up to 200 active mallard nests annually under the proposed action / no action alternative to manage damage or threats of damage.

The number of mallards present in the Commonwealth fluctuates throughout the year. The lethal removal of up to 750 mallards annually by WS would represent 1.9% of the average number of mallards harvested by hunters in Virginia (38,650 mallards). Alternatively, it would represent 1.76% of the estimated population (42,523) in the state and 0.13% of the estimated population in the Atlantic Flyway during the breeding season (551,257). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the hunter harvest, WS proposed lethal removal should not have any significant direct or cumulative impact on mallard populations. Most requests received by WS to address mallards are received from airports. Airports are restricted areas where hunting is not permitted. Therefore, WS'

lethal removal of mallards is likely to occur in locations where it will not limit the ability to harvest mallards. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring and could be considered of low magnitude when compared to the number of mallards being harvested and lethally removed. Harvest and lethal removal of mallards can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of mallards lethally removed annually to the USFWS.

Additionally, impacts due to the destruction of active nests should have little adverse impact on the mallard population. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest and egg destruction, this activity has no long term effect on breeding adult birds. Nest and egg destruction is not used by WS as a population management method. This method is used by WS to inhibit nesting in an area experiencing damage due to nesting activity and is employed only at the localized level. The destruction of up to 200 active mallard nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on mallard populations would occur. As with the lethal removal of adults, the removal of active nests must be authorized by the USFWS. Therefore, the number of active nests removed by WS annually would occur at the discretion of the USFWS.

Muscovy Duck Population Impact Analysis

Native to Mexico, central and South America, wild Muscovy ducks have expanded their range into the lower Rio Grande Valley of Texas (Cornell University, Lab of Ornithology 2015*a*). Muscovy ducks are also one of the oldest domesticated species of waterfowl (Donkin 1989). When these domesticated birds escape or are abandoned, dumped, or released they can become feral and form self-sustaining populations. Feral birds can be observed in locations such as business parks, universities, parks, wildlife management areas, military bases, and residential communities. These birds can nest several times a year, in some cases laying 12 to 18 eggs at a time (Robinson 1924). Currently, there are no population estimates for Muscovy ducks in the Commonwealth.

Muscovy ducks were dispersed or lethally removed by WS to alleviate damage and threats from 2010 to 2015, however, these birds were recorded as free ranging domestic and feral ducks. Additionally, no active Muscovy duck nests were destroyed during this time period. Individual Muscovy ducks, and their active nests, although protected under the Migratory Bird Treaty Act, may be removed or destroyed in the Commonwealth without a depredation permit from the USFWS at any time under a depredation order (50 CFR 21.54). The total number of Muscovy ducks lethally removed by other entities is unknown.

Direct, Indirect, and Cumulative Effects:
Based on requests for assistance, WS could lethally remove up to 200 Muscovy ducks and remove or destroy up to 50 active Muscovy duck nests annually under the proposed action / no action alternative to manage damage or threats of damage. Muscovy ducks are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given their impacts, (outlined in Chapter 1), any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. WS proposed lethal removal should not have any significant direct or cumulative impact on statewide populations.

Additionally, impacts due to the destruction of active nests should have little adverse impact on the Muscovy duck population. The destruction of up to 50 active Muscovy duck nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where direct or cumulative impacts on statewide duck populations would occur.

Hooded Merganser Population Impact Analysis

Hooded mergansers can be found across the Commonwealth throughout the year (Dugger and Dugger 2009). Preferred habitat includes marshes, swamps, lakes, ponds, creeks, rivers, and brackish coastal areas (Dugger and Dugger 2009). Hooded mergansers nest once per year, laying five to 13 eggs (Cornell University Lab of Ornithology 2015*b*). Birds are commonly observed in pairs or groups of less than 40 birds (Dugger and Dugger 2009). Large flocks (300 birds or more) have been observed during the fall and winter in the Commonwealth (Rottenborn and Brinkley 2007).

According to BBS trend data, hooded merganser populations in the Eastern U.S. have increased 4.68% annually since 1966, and 6.29% annually from 2005 to 2015 (Sauer et al. 2017). Observations from the WBPHS eastern survey area indicate that the population of mergansers (all species) has been stable since 1990 (USFWS 2016*b*). The number of hooded mergansers observed in the Commonwealth during the CBC and the AFMWS have both shown increasing trends since 1966 (National Audubon Society 2010, USFWS 2017*b*). The AFBWPS estimated the Virginia population at 1,497 (SE 1,496) mergansers and the Atlantic Flyway population at 37,225 (SE 6,603) mergansers during the breeding season in 2015 (Roberts 2016).

The number of hooded mergansers lethally removed by WS or other entities to alleviate damage and threats and the number of hooded mergansers harvested by hunters from 2010 to 2015 is shown in Table 3.6. Table 3.6 also shows the number of hooded mergansers dispersed by WS. No hooded merganser nests were destroyed during this time period. In Virginia, hooded mergansers can be harvested during a regular hunting season.

Table 3.6 – Number of adult hooded mergansers lethally removed or dispersed in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	Removal under Depredation Permits			Hunter Harvest[4]
		Authorized Lethal Removal[2]	WS' Lethal Removal[1]	Total Lethal Removal by Other Entities[3]	
2010	75	45	4	0	6,600
2011	239	70	17	36	6,100
2012	239	100	38	0	4,000
2013	367	100	17	9	3,900
2014	379	110	26	0	1,500
2015	47	105	19	0	2,200
AVERAGE	**224**	**88**	**20**	**8**	**4,050**

1Data reported by federal fiscal year
2Permitted by USFWS; includes WS' authorized lethal removal. Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
3Data reported by calendar year; includes WS' lethal removal. C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
4Data obtained from Roberts 2016

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 100 hooded mergansers and remove or destroy up to 20 hooded merganser nests annually under the proposed action / no action alternative to manage damage or threats of damage.

The number of hooded mergansers present in the Commonwealth fluctuates throughout the year. The lethal removal of up to 100 hooded mergansers annually by WS would represent 2.5% of the average number of hooded mergansers harvested by hunters in Virginia (4,050 mergansers). Alternatively, it

would represent 6.6% of the estimated population (1,497) in the state and 0.26% of the estimated population in the Atlantic Flyway during the breeding season (37,225 (SE 6,603)). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to hunter harvest, WS proposed lethal removal should not have any significant direct or cumulative impact on hooded merganser populations. Most requests received by WS to address hooded mergansers are received from airports. Airports are restricted areas where hunting is not permitted. Therefore, WS' lethal removal of hooded mergansers is likely to occur in locations where it will not limit the ability to harvest mergansers. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring and could be considered of low magnitude when compared to the number of hooded mergansers being harvested and lethally removed. Harvest and lethal removal of hooded mergansers can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of hooded mergansers lethally removed annually to the USFWS.

Additionally, impacts due to the destruction of active nests should have little adverse impact on the hooded merganser population. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult birds. Nest and egg destruction is not used by WS as a population management method. This method is used by WS to inhibit nesting in an area experiencing damage due to nesting activity and is employed only at the localized level. The destruction of up to 20 active hooded merganser nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on merganser populations would occur. As with the lethal removal of adults, the removal and destruction of active nests must be authorized by the USFWS. Therefore, the number of active nests removed by WS annually would occur at the discretion of the USFWS.

Free Ranging Domestic and Feral Waterfowl Population Impact Analysis

Domestic waterfowl refers to birds which have through selective breeding become notably different than their wild ancestors. Examples of domestic waterfowl include, but are not limited to; African geese, call ducks, cayuga ducks, Chinese geese, crested ducks, embden geese, indian runner ducks, khaki Campbell ducks, peking ducks, pilgrim geese, rouen ducks, Swedish ducks, and toulouse geese. It is believed that all breeds of domestic ducks, except for muscovy ducks, were derived from the mallard (Drilling et al. 2002). Crossbreeding has resulted in the development of numerous domestic duck varieties that no longer exhibit the external characteristics of their wild mallard ancestors. When domesticated ducks and geese escape or are abandoned, dumped or released they can become feral and form self-sustaining populations. These birds can be observed in locations such as business parks, universities, parks, wildlife management areas, military bases, and residential communities. Currently, there are no population estimates for free ranging domestic and feral waterfowl in the Commonwealth. Free ranging domestic and feral waterfowl may breed with migratory waterfowl species, creating hybrid offspring (Robinson 1924, Donkin 1989). These hybrid birds are protected under the MBTA. Impacts to hybrid birds are analyzed under their wild parent's species (e.g., impacts of lethally removing a mallard-peking hybrid duck is included in the mallard population impact analysis).

The number of free ranging domestic and feral waterfowl dispersed or lethally removed by WS to alleviate damage and threats from 2010 to 2015 is shown in Table 3.7. Free ranging domestic and feral waterfowl are not protected under federal or state law. However, the MBTA protects hybrids of these birds and migratory waterfowl. Therefore, for the purposes of this analysis any domestic and migratory waterfowl hybrids will be considered to be of migratory waterfowl stock and analyzed as such (e.g., lethal removal of a Canada goose and a domestic goose hybrid is included under Canada goose population

impact analysis). The total number of free ranging domestic and feral waterfowl lethally removed by other entities is unknown.

Table 3.7 – Number of free ranging domestic and feral waterfowl lethally removed or dispersed in Virginia from 2010 to 2015*.

Year	Dispersed by WS[1] (Ducks/Geese)	WS' Lethal Removal[1] (Ducks/Geese)	
		Adults	Active Nests
2010	0	39 / 17	0
2011	2 / 0	28 / 0	0
2012	0	15 / 14	0
2013	0	3 / 1	0
2014	0	0 / 1	0 / 1
2015	0	4 / 26	1 / 0
AVERAGE	**<1 / 0**	**15 / 10**	**<1 / <1**

*Muscovy ducks were dispersed or lethally removed during this period but recorded as free ranging domestic and feral ducks

[1]Data reported by federal fiscal year

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 500 free ranging domestic and feral ducks, 500 free ranging domestic and feral geese, and remove or destroy up to 200 active nests for each of these groups of birds annually under the proposed action / no action alternative to manage damage or threats of damage. Free ranging domestic and feral waterfowl are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given their impacts, (outlined in Chapter 1), any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. WS proposed lethal removal should not have any significant direct or cumulative impact on statewide populations.

Additionally, impacts due to the destruction of active nests should have little adverse impact on the free ranging domestic and feral waterfowl population. The destruction of up to 200 active nests annually by WS for each of these groups of birds would occur in localized areas where nesting takes place and would not reach a level where direct or cumulative impacts on statewide populations would occur.

American Coot Population Impact Analysis

An aquatic, abundant, and widely distributed species of rail, the American coot can be observed in all of the lower 48 states (Brisbin and Mowbray 2002). Present in the Commonwealth primarily during migration and winter, preferred habitat includes both fresh and brackish water wetlands, impoundments, ponds, lakes, slow moving rivers and coastal areas (e.g., tidal mud flats) (Brisbin and Mowbray 2002). Outside of the breeding season, birds congregate in densely packed rafts flocks of greater than 1,000 individuals in areas of open water (Brisbin and Mowbray 2002). Flocks of more than 47,000 birds have been observed in the winter on the Commonwealth's coastal plain (Rottenborn and Brinkley 2007).

According to BBS trend data, American coot populations in the eastern U.S. have declined 2.03% annually since 1966, and decreased 1.79% annually from 2005 to 2015 (Sauer et al. 2017). The number of American coots observed in the Commonwealth during the CBC has shown a relatively stable trend

since 1966 (National Audubon Society 2010). The population of American coots in North America is estimated at six million birds (MANEM 2006).

The number of American coots lethally removed by WS or other entities to alleviate damage and threats and the number of American coots harvested by hunters from 2010 to 2015 is shown in Table 3.8. Table 3.X also shows the number of American coots dispersed by WS. No American coot nests were destroyed during this time period. In Virginia, American coots can be harvested during a regular hunting season.

Table 3.8 – Number of adult American coots lethally removed or dispersed in Virginia from 2010 to 2015.

Year	Dispersed by WS[1]	Removal under Depredation Permits			Hunter Harvest[4]
		Authorized Lethal Removal[2]	WS' Lethal Removal[1]	Total Lethal Removal by Other Entities[3]	
2010	0	65	0	0	1,500[5]
2011	1	65	0	40	2,500
2012	0	65	0	0	2,500
2013	8	65	0	15	3,400
2014	0	65	0	11	800
2015	604	65	18	0	400
AVERAGE	**102**	**65**	**3**	**22**	**1,850**

1Data reported by federal fiscal year
2Permitted by USFWS; includes WS' authorized lethal removal. Data reported by calendar year, C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
3Data reported by calendar year; includes WS' lethal removal. C. Dwyer, USFWS, personal communication, 2016 and S. Slonka, USFWS, personal communication, 2014.
4Data obtained from Raftovich et al. 2012, 2014, 2016
5Sample size was insufficient to provide reliable estimate, so long term (1999–2010) average given for this year (see Raftovich et al. 2012).

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 100 American coots and remove or destroy up to 10 active American coot nests annually under the proposed action / no action alternative to manage damage or threats of damage.

The number of American coots present in the Commonwealth fluctuates throughout the year. The lethal removal of up to 100 American coots annually by WS would represent 5.4% of the average number of American coots harvested by hunters in Virginia (1,850 American coots). Alternatively, it would represent 0.0016% of the estimated population (6 million) of American coots in North America. Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the hunter harvest, WS proposed lethal removal should not have any significant direct or cumulative impact on American coot populations. Most requests received by WS to address American coots are received from airports. Airports are restricted areas where hunting is not permitted. Therefore, WS' lethal removal of American coots is likely to occur in locations where it will not limit the ability to harvest coots. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring and could be considered of low magnitude when compared to the number of American coots being harvested and lethally removed. Harvest and lethal removal of American coots can only occur at the discretion of the USFWS. The USFWS ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of American coots lethally removed annually to the USFWS.

Additionally, impacts due to the destruction of active nests should have little adverse impact on the American coot population. The destruction of up to 10 active nests annually by WS would occur in

localized areas where nesting takes place and would not reach a level where cumulative impacts on statewide populations would occur.

Other Target Species

Other bird species may be lethally removed in limited numbers when a request is received to address damage or threats. Those species include; tundra swan, brant, black-bellied whistling-duck, wood duck, American black duck, gadwall, northern pintail, American wigeon, Northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, ring-necked duck, greater scaup, lesser scaup, common eider, long-tailed duck, surf scoter, black scoter, white-winged scoter, common goldeneye, bufflehead, common merganser, red-breasted merganser, and ruddy duck. WS could lethally remove up to 50 individuals and destroy up to 10 active nests of any of these birds on an annual basis. All of these species can be legally harvested during regular hunting seasons. Additionally, WS could lethally remove up to five harlequin ducks on an annual basis. Lethal removal of these species is not expected to have any adverse direct or cumulative impact on these species' populations or the ability to harvest these birds in Virginia (Table 3.9). These species populations are not of low density and lethal removal would be limited to those individual birds causing damage or posing a threat of damage. Impacts due to active nest destruction should have little adverse impact on the population of these bird species. Although there may be reduced fecundity for the individuals affected by active nest destruction, this activity has no long term effect on adult breeding birds. The destruction of active nests by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects to bird populations would occur. All lethal removal can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all lethal removal including removal by WS, is authorized by USFWS and occurs and their discretion. The lethal removal of these species would only occur at levels authorized by the USFWS which ensures cumulative lethal removal is considered as part of population management objectives for these birds.

Table 3.9. Average number of waterfowl dispersed or lethally removed by WS, or harvested by hunters annually in Virginia from 2010 to 2015 and the percentage of hunter harvest that WS' proposed lethal removal of up to 50 individuals would represent for various species.

Species	Dispersed by WS[1]	WS' Lethal Removal[1]	Hunter Harvest[2]	Percentage of Hunter Harvest
Tundra swan	14	<1	248	20%
Brant	291	0	1,050	5%
Black-bellied whistling-duck	0	0	0	n/a[3]
Wood duck	39	6	18,800	<1%
American black duck	99	3	8,450	<1%
Gadwall	40	1	1,250	4%
Northern pintail	<1	0	1,333	4%
American wigeon	0	0	2,550	2%
Northern shoveler	16	0	1,483	3%
Blue-winged teal	0	0	3,033	2%
Green-winged teal	25	1	8,083	<1%
Canvasback	8	0	1,917	3%
Redhead	405	<1	1,283	4%
Ring-necked duck	74	3	7,450	<1%
Greater scaup	0	0	1,267	4%
Lesser scaup	1752	<1	3,550	1%
Common eider	0	0	0	n/a[4]
Long-tailed duck	0	0	833	6%
Surf scoter	0	0	5,750	<1%
Black scoter	0	0	67	75%[5]
White-winged scoter	<1	0	33	152%[5]
Common goldeneye	0	0	50	100%[5]
Bufflehead	11	<1	19,667	<1%
Common merganser	20	3	350	14%
Red-breasted merganser	0	0	650	8%
Ruddy duck	0	0	1,167	4%

1Data reported by federal fiscal year

2Data obtained from Raftovich et al. 2012, 2014, 2016

3Black-bellied whistling-ducks occur in Virginia sporadically. Although legal to harvest, no harvest data is available. According to BBS trend data, their population in the eastern U.S. have increased 36.8% annually since 1966 (Sauer et al. 2017).

4Common eider occur in Virginia sporadically. Although legal to harvest, harvest was estimated as zero from 2010 to 2015 (Raftovich et al. 2012, 2014, 2016). . WS' proposed lethal removal would represent <1% of the average common eider harvest (10,533) in the Atlantic Flyway (2010–2015) (Raftovich et al. 2012, 2014, 2016).

5These species are found in low numbers in Virginia. WS' proposed lethal removal would represent <1%, 1% and <1% of the average black scoter (14,400), white-winged scoter (3,700), and common goldeneye (11,467) harvest in the Atlantic Flyway (2010–2015) (Raftovich et al. 2012, 2014, 2016).

Wildlife Disease Surveillance and Monitoring

Under the proposed action / no action alterative, WS could sample waterfowl for disease. These birds could have been captured live by WS or other entities, been found dead or been harvested by hunters. The sampling (e.g., drawing blood, swabbing nasal cavities, collecting fecal samples) and the subsequent release of live-captured birds would not result in adverse effects to bird populations since those individuals would be released unharmed on site. Additionally, the sampling of birds that were sick, dying, found dead or harvested by hunters would not result in the additive lethal removal of birds that would not have already occurred in the absence of WS' activities. Therefore, the sampling of waterfowl for disease as described above would not adversely affect the populations or the ability to harvest any of the waterfowl species addressed in this EA.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1. Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. WS would not provide direct operational assistance utilizing lethal techniques. Despite this, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. All methods listed in the appendix would be available under this alternative.

This alternative would place the immediate burden of lethal direct operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action. The provision of technical assistance and non-lethal direct operational assistance by WS is unlikely to increase the number of animals addressed or limit the ability to harvest birds because those individuals experiencing damage likely would employ both lethal and non-lethal methods in the absence of WS' assistance.

Direct, Indirect, and Cumulative Effects:
The number of waterfowl lethally removed under this alternative would likely be similar to the other alternatives. Lethal removal of those species addressed in this EA can occur either without a permit if those bird species are not native, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS pursuant to the MBTA or during hunting seasons.

With the oversight of the USFWS and the VDGIF, it is unlikely that waterfowl populations would be significantly impacted, directly or cumulatively, by the implementation of this alternative. Lethal management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the VDGIF. If lethal direct operational assistance is not provided by WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and threats could lead to the inappropriate use of lethal methods or the use of illegal methods which could lead to unnecessary killing of wildlife. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – WS Would Not Address Waterfowl Damage

Under this alternative, WS would not conduct technical or direct operational assistance to reduce threats or alleviate damage associated with waterfowl. WS would not be involved with any aspect of managing damage associated with waterfowl and therefore would have no direct impact on waterfowl populations or the ability to harvest birds. All requests for assistance received by WS to resolve damage caused by waterfowl would be referred to the USFWS, the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with waterfowl, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. With the exception of alpha-chloralose, all methods listed in the Appendix could be available under this alternative.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Direct, Indirect, and Cumulative Effects:
Lethal removal of those species addressed in this EA could continue to occur either without a permit if those bird species are not native, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS pursuant to the MBTA or during hunting seasons. The number of waterfowl lethally removed under this alternative and any direct or cumulative population impacts would likely be similar to the other alternatives. It is not expected that lethal removal would reach a level where it would have a significant direct or cumulative impact to target waterfowl populations.

Management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the VDGIF. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that a lack of technical knowledge could lead to misidentification and targeting of bird(s) responsible for damage. It is also possible that frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. This may occur if those persons or organizations providing technical assistance have less technical knowledge and experience managing wildlife damage than WS. Illegal, unsafe, and environmentally unfriendly actions could lead to unnecessary killing of wildlife. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species

As discussed previously, a concern is often raised about the potential impacts to non-target animal populations, including threatened and endangered species, from the use of methods to resolve damage associated with waterfowl. The potential effects are analyzed below.

Alternative 1 – WS Would Continue to Address Waterfowl Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

The potential adverse effects to non-targets occur from the employment of methods to address damage associated with waterfowl. Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

Standard Operating Procedures (SOPs) discussed in Chapter 2 ensure risks to non-target animals, including threatened and endangered species, would be reduced or prevented under the proposed action / no action alternative. Pertinent SOPs include not only the WS Decision Model (WS Directive 2.201) but also several other SOPs including the following. WS personnel are trained and experienced in the identification of animal damage, the identification of animals responsible for the damage, and in the selection of and implementation of methods which are as species-specific as possible, thus reducing the risks to non-target animals including threatened and endangered species. Management actions are directed towards specific animals or groups of animals responsible for causing damage or posing threats. WS consults with the USFWS or the NMFS and the VDGIF to determine the potential risks to federally

and state listed threatened and endangered species in accordance with the ESA and Commonwealth laws. Non-lethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Non-target animals captured in traps are released unless it is determined that the animal would not survive and or that the animal cannot be safely released.

Non-Lethal Methods

Non-lethal methods have the potential to cause adverse effects to non-targets primarily though physical exclusion, frightening devices, deterrents or repellants (see Appendix B). Any exclusionary device erected to prevent access to resources could also potentially exclude non-target species; therefore adversely impacting that species. The use of frightening devices, deterrents or repellants may also disperse non-target species from the immediate area where they are employed. However, the potential impacts to non-targets, like the impacts to target species, are expected to be temporary. WS would not employ or recommend these methods be employed over large geographic areas or at such intensity that essential resources would be unavailable and that long term adverse impacts to non-target populations would occur. Other non-lethal methods available for use under any of the alternatives are live-capture devices (see Appendix B). When deploying live-capture devices, WS would use and recommend the use of target-specific attractants and place them or recommend they be placed in areas where target species are active to reduce the risk of capturing non-targets. WS would monitor or recommend devices be monitored frequently so non-target species can be released unharmed. When employing inactive nest destruction, WS would identify the species of birds responsible for building the nest prior to destruction which would eliminate impacts to non-targets.

Of additional concern are the risks to non-target animals, including threatened and endangered species from alpha-chloralose. WS personnel who possess or use alpha-chloralose would be trained and certified in accordance with WS Directive 2.430 and the WS Alpha-Chloralose Training Manual. Potential treatment sites are pre-baited and monitored for non-target use. The bait type selected can be used to limit the likelihood that non-target species would consume treated bait since some bait types are not preferred by non-target species. By acclimating target bird species to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed, making it unavailable to non-targets. Baits must be under the direct supervision of an applicator at all times and baits are not placed if they cannot be retrieved. Persons administering alpha-chloralose assume responsibility for the safety and life of sedated birds which must be protected from predators. Birds subsequently euthanized must be properly disposed of in accordance with the WS Alpha-Chloralose Training Manual. Unconsumed or unused alpha-chloralose must be destroyed or incinerated as outlined in the WS Alpha-Chloralose Training Manual. These measures nearly eliminate the possibility that alpha-chloralose would pose a primary or secondary hazard to non-target or threatened or endangered species.

Non-lethal methods are generally regarded has having minimal impacts on populations because individuals are unharmed. Therefore, non-lethal methods would not have any significant adverse impacts on non-target populations of wildlife including threatened and endangered species under this alternative.

Eagles may occur in or near areas where damage management activities are conducted. Routine activities conducted by WS' personnel under the proposed action / no action alternative could occur in areas where eagles are present, which could disrupt the current behavior of an eagle or eagles that are nearby during those activities. As discussed previously, "take" as defined by the Bald and Golden Eagle Protection Act, includes those actions that "disturb" eagles. Disturb has been defined under 50 CFR 22.3 as those actions that cause or are likely to cause injury to an eagle, a decrease in productivity, or nest abandonment by substantially interfering with their normal breeding, feeding, or sheltering behavior.

WS has reviewed those methods available under the proposed action / no action alternative and the use patterns of those methods. The routine measures that WS conducts would not meet the definition of disturb requiring a permit for the take of eagles. The USFWS states, "Eagles are unlikely to be disturbed by routine use of roads, homes, or other facilities where such use was present before an eagle pair nesting in a given area. For instance, if eagles build a nest near your existing home, cabin, or place of business you do not need a permit." (USFWS 2016*c*). Therefore, activities that are species specific and are not of a duration and intensity that would result in disturbance as defined by the Act would not result in non-purposeful take (e.g., unintentional disturbance of an eagle). Activities, such as walking to a site, discharging a firearm, riding an ATV or driving a boat, generally represent short-term disturbances to sites where those activities take place. WS would conduct activities that are located near eagle nests using the National Bald Eagle Management Guidelines (USFWS 2007). The categories that encompass most of these activities are Category D (off-road vehicle use), Category F (non-motorized recreation and human entry), and Category H (blasting and other loud, intermittent noises). These categories generally call for a buffer of 330 to 660 feet for category D and F, and a ½-mile buffer for category H. WS would take active measures to avoid disturbance of bald eagle nests by following the National Bald Eagle Management Guidelines. However, other routine activities conducted by WS do not meet the definition of "disturb" as defined under 50 CFR 22.3. Those methods and activities would not cause injuries to eagles and would not substantially interfere with the normal breeding, feeding, or sheltering behavior of eagles. The number of bald eagles observed in the eastern U.S. along routes surveyed during the Breeding Bird Survey has shown an increasing trend estimated at 8.6% since 1966 and 13.0% from 2003–2013 (Sauer et al. 2017). The number of both bald and golden eagles observed in the Commonwealth during the Christmas Bird Count has shown a dramatic increasing trend since 1966 (National Audubon Society 2010).

Lethal Methods

Eagles may occur in or near areas where lethal methods outlined under the proposed action / no action alternative are used. WS has reviewed those methods and the use patterns of those methods and determined that SOPs that WS uses while conducting damage management activities makes it nearly impossible that eagles could be lethally removed. However, it is possible that lethal methods could "disturb" eagles as outlined above.

All of the lethal methods listed in Appendix B could be available under this alternative.

> *Shooting* - In cases where shooting was selected as an appropriate method, identification of an individual target would occur prior to application, eliminating risks to non-targets. Additionally, suppressed firearms would be used when appropriate to minimize noise impacts to non-targets. WS' recommendation that shooting be used would not increase risks to non-targets. Shooting would be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method.
>
> *Euthanasia* - Non-target species captured during the implementation of non-lethal capture methods can usually be released prior to euthanasia which occurs subsequent to live-capture. Therefore, no adverse effects to non-targets would occur from the use of euthanasia methods by WS under this alternative. Similarly, WS' recommendation of euthanasia methods would not increase risks to non-targets because these methods are selective for target species and the unintentional euthanasia of non-targets would not likely increase based on WS' recommendation of the method.
>
> *Nest and Egg Destruction* – In situations where nest and egg destruction were selected as an appropriate method, WS would identify the species of birds responsible for laying the egg(s) or

building the nest prior to destruction which would eliminate risks to non-targets. WS' recommendation that nest and egg destruction be used would not increase risks to non-targets. Nest and egg destruction would be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method.

Direct, Indirect, and Cumulative Effects:
The analysis to determine the impacts on non-targets from the use of both lethal and non-lethal methods is based on a measure of the number of individuals lethally removed. Methods would only be used by WS at the request of persons seeking assistance. No non-target species were lethally removed during WS damage management activities outlined in the need for action in Virginia from FY 2010 to FY 2015. The species and number of animals lethally removed unintentionally in the past by WS is representative of animals that could be unintentionally removed by WS under the proposed action / no action alternative. Non-target species could be lethally removed unintentionally during waterfowl damage management activities. However, the lethal removal of those species would occur infrequently and not at levels that would cause significant adverse effects to those species' populations.

WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to non-targets. Additionally, WS would annually report lethal removal to the USFWS or VDGIF, which ensures cumulative impacts are considered as part of population management objectives. As previously mentioned, non-lethal methods are generally regarded as having minimal impacts on populations because individuals are unharmed. Therefore, non-lethal methods, including the live-capture and release of non-targets would not have any adverse impacts on non-target populations under this alternative. Unintentional lethal removal could result in declines in the number of individuals in a population; however, the lethal removal of non-target animals by WS under the proposed action would not reach a magnitude where adverse effects would occur to the population of any species.

Threatened and Endangered Species:
Special efforts are made to avoid jeopardizing threatened and endangered species. Threatened and endangered species listed by the USFWS or the National Marine Fisheries Service (NMFS) under the ESA for the Commonwealth can be found in Appendix C. These lists were obtained and reviewed during the development of this EA.

***Federally Listed Species*-**WS has made a no effect determination for all threatened and endangered species found in Virginia. WS' methods outlined in the Appendix do not intersect with any listed species in a manner that would affect those listed species.

***State Listed Species*-** The current list of species designated as endangered, threatened, or special concern by the state, as determined by the VDGIF, was obtained and reviewed during the development of the EA (see Appendix D). Based on the review of species listed, WS has determined that the proposed activities would have no effect or would not likely adversely affect the species currently listed by the state.

Summary of non-target animal impact analysis
Based on WS' determination, the employment of methods by WS would not likely adversely directly or cumulatively affect any non-targets, including threatened and endangered species. No potential indirect effects were identified. WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to non-targets. Additionally, WS consults with the USFWS and the VDGIF to determine the potential risks to eagles and federally and state listed threatened and endangered species in accordance with the Bald and Golden Eagle Protection Act, ESA and Commonwealth laws and

annually reports to these entities to ensure that any non-target lethal removal by WS is considered as part of management objectives. Potential direct and cumulative impacts to non-targets, including threatened and endangered species, from the recommendation of methods by WS under this alternative would be expected to be insignificant.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1. Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. WS would not provide direct operational assistance utilizing lethal techniques. Despite this, those persons experiencing damage could continue to alleviate damage by employing both non-chemical and chemical methods. All methods except alpha-chloralose listed in the appendix would be available under this alternative.

This alternative would place the immediate burden of lethal direct operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Direct, Indirect, and Cumulative Effects:
If direct lethal operational assistance is not provided by WS or other entities, it is possible that frustration caused by the inability to reduce damage and threats could lead to the inappropriate use of legal methods or the use of illegal methods which could lead to real but unknown effects on other animal populations. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Potential impacts to non-target animals, including threatened and endangered species, from the recommendation of methods by WS under this alternative would be variable. If methods were employed as recommended by WS, potential direct or cumulative risks to non-targets would likely be low and similar to the proposed action / no action alternative. WS' involvement would not be additive to lethal removal that could occur since the individual requesting WS' assistance could conduct damage management activities without WS' involvement. However, if methods were not employed as recommended or methods that are not recommended were employed, potential direct, indirect or cumulative impacts to non-targets are likely to be higher. However, impacts would not be expected to be significant.

Alternative 3 – WS Would Not Address Waterfowl Damage

WS would not be involved with any aspect of managing damage associated with waterfowl. Therefore, WS would have no direct impact to non-targets or threatened and endangered species under this alternative. All requests for assistance received by WS to resolve damage associated with waterfowl would be referred to the USFWS, the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with waterfowl, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Direct, Indirect, and Cumulative Effects:
Potential impacts to non-target species, including threatened and endangered species, would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. Illegal, unsafe, and environmentally unfriendly actions could lead to unnecessary killing of non-target animals. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003). However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing damage associated with waterfowl, the risks would be similar to the other alternatives. However, impacts would not be expected to be significant.

Issue 3 - Effects of Damage Management Activities on Human Health and Safety

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage associated with waterfowl. Both chemical and non-chemical methods have the potential to have adverse direct, indirect or cumulative effects on human health and safety. Risks can occur both to persons employing methods and persons coming into contact with methods. Risks can be inherent to the method itself or related to the misuse of the method. Potential effects of damage management activities on human health and safety under each of the three alternatives are analyzed below.

Alternative 1 – WS Would Continue to Address Waterfowl Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. Standard Operating Procedures (SOPs) discussed in Chapter 2 ensure risks to human health and safety would be reduced or prevented. Pertinent SOPs include not only the WS Decision Model (WS Directive 2.201), an evaluation process for the appropriateness of methods (WS Directive 2.101) and the use of integrated management (WS Directive 2.105), but also several other precautions including the following. WS identifies hazards in advance of work assignments and provides employees with personal protective equipment (PPE). WS employees must adhere to safety requirements and use appropriate PPE. WS employees are required to work cooperatively to minimize hazards and immediately report unsafe working conditions (WS Directive 2.601). Damage management activities would be conducted away from areas of high human activity (e.g., in areas closed to the public) or during periods when human activity is low (e.g., early mornings, at night) to the extent possible. WS would only conduct waterfowl damage management activities on a given property in response to a request for assistance after the property owner or manger has signed a document agreeing to allow the use of specific methods on property they own and/or manage. Although hazards to human health and safety from both non-lethal and lethal methods exist, those methods would generally be regarded as safe when used by individuals trained and experienced in their use and with regard and consideration of possible risks to human health and safety.

Direct, Indirect, and Cumulative Effects:
Non-chemical methods available for use under any of the alternatives are: live-capture devices (e.g., drive traps, cannon/rocket nets), frightening devices (e.g., pyrotechnics, paintballs) and hunting or shooting (see Appendix B). The risk most live-capture devices pose to human health and safety are small to non-existent. These types of devices can only be triggered through direct activation of the device. Therefore, if left undisturbed, these devices would pose no risk. WS would use these devices in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives. WS would not implement these methods in locations or in such a manner in which they would pose hazards to WS staff or the public. When recommending these methods, WS would caution against their misuse. Because the use of these methods would be available under any of the alternatives and their use could occur whether WS was consulted or not, the risks to human health and safety would be similar among all the alternatives.

WS personnel are trained and experienced in the use of cannon/rocket nets, net guns, pyrotechnics, paintball markers, and firearms. WS employees who use these methods must comply with WS Directive 2.615 and all standards described in the WS Firearms Safety Training Manual. Directive 2.615 requires that personnel undergo regular training, adhere to a set of safety standards, submit to drug testing, and are subject to the Lautenberg Amendment. WS' recommendation that cannon/rocket nets, net guns, pyrotechnics, paintball markers, hunting, and/or shooting be used would not increase risks to human health and safety above those already inherent. When used appropriately and with consideration of human safety, risks associated with these methods are minimal. When recommending that these methods be used, WS would caution against their improper use. Because the use of these methods would be available under any of the alternatives and their use could occur whether WS was consulted or not, the risks to human health and safety would be similar among all the alternatives.

All chemical methods listed in Appendix B could be available under this alternative; although not all methods would be available for direct implementation by all persons (alpha-chloralose is only available for use by WS). The use of chemical methods is strictly regulated by the DEA, USEPA, FDA and VDACS. Chemical methods used or recommended by WS would be registered as required by federal and state law (see Appendix B). When recommending chemical methods, WS would caution those persons against their misuse. Following label requirements eliminates risks to human health and safety.

WS personnel who possess or use alpha-chloralose would be trained and certified in accordance with WS Directive 2.430 and the WS Alpha-Chloralose Training Manual. WS personnel that use alpha-chloralose would be required to wear appropriate PPE they are provided with (WS directive 2.601). Additionally, "the acquisition, storage, and use of ...(these substances would be)... in compliance with applicable program, Federal, State, and local law and regulations" (WS Directive 2.430). Baits must be under the direct supervision of an applicator at all times and baits are not placed if they cannot be retrieved. Unconsumed or unused alpha-chloralose would be destroyed as outlined in the WS Alpha-Chloralose Training Manual. These requirements eliminate the likelihood that humans would be exposed to alpha-chloralose in the environment. Of additional concern are the risks to human health and safety from persons consuming birds that have ingested alpha-chloralose. In accordance with FDA restrictions, WS would not use alpha-chloralose during and 30 days prior to periods of time in which waterfowl could be hunted. Waterfowl subsequently euthanized must be properly disposed of in accordance with the WS Alpha-Chloralose Training Manual. Additionally, the FDA does not allow birds or their products (i.e., eggs) which have been treated with alpha-chloralose to be used for food by humans or other animals. This would eliminate risks to human health and safety from persons consuming birds, eggs or other animals that have or potentially had alpha-chloralose in their systems.

No significant impacts to human safety occurred from WS' use of methods to alleviate damage associated with waterfowl in Virginia from FY 2010 to FY 2015.

The direct, indirect or cumulative risks to human safety from the use of chemical and non-chemical methods, when used appropriately and by trained personnel, is considered insignificant. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on potential use patterns, the chemical and physical characteristics of the above mentioned chemical methods, and factors related to the environmental fate, no significant direct, indirect or cumulative impacts are expected from the chemical components used or recommended by the WS program.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1. Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. WS would not provide direct operational assistance utilizing lethal techniques. Despite this, those persons experiencing damage could continue to alleviate damage by employing both non-chemical and chemical methods. All methods listed in the appendix would be available under this alternative.

This alternative would place the immediate burden of lethal direct operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Direct, Indirect, and Cumulative Effects:
Risks to human health and safety from WS use of or recommendation of non-lethal methods under this alternative would be similar to the proposed action / no action alternative.

Private use of lethal methods would be expected to increase under this alternative. This may result in less experienced persons implementing lethal damage management methods which may result in greater risks to human health and safety than the proposed action/no action alternative. Potential impacts to human health and safety from the recommendation of lethal methods by WS under this alternative would be variable. If lethal methods were employed as recommended by WS and according to label requirements, in the case of chemical methods, impacts to human health and safety would likely similar to the proposed action / no action alternative. However, if lethal methods were not employed as recommended or methods that are not recommended were employed, impacts could increase. However, impacts would not be expected to be significant.

Alternative 3 – WS Would Not Address Waterfowl Damage

Under this alternative, WS would not be involved in any aspect of managing damage associated with waterfowl. Therefore, WS would have no direct impact on human health and safety under this alternative. All requests for assistance received by WS to resolve damage caused by waterfowl would be referred to the USFWS, the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with waterfowl, those persons experiencing damage could continue to alleviate damage by employing both non-chemical and chemical

methods. This alternative would place the immediate burden of lethal operational damage management work on the resource owner, other government agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Direct, Indirect, and Cumulative Effects:
Potential impacts to human health and safety would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. Illegal, unsafe, and environmentally unfriendly actions could lead to higher risk to health and safety. However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing damage caused by waterfowl, the risks would be similar to the other alternatives. Additionally, impacts would not be expected to be significant.

Issue 4 – Humaneness and Animal Welfare Concerns

As described in Chapter 2, humaneness and animal welfare concerns associated with methods available to reduce damage associated with waterfowl has been identified as an issue. The humaneness and animal welfare concerns of the methods as they relate to the alternatives are discussed below.

Alternative 1 – WS Would Continue to Address Waterfowl Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

Humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. Under this alternative, WS could employ or recommend methods viewed as inhumane by some persons. This could include WS killing, capturing and subsequently killing, or immobilizing and subsequently killing target animals using the best and most appropriate method(s) available. WS' use of methods under the proposed action / no action alternative would adhere to applicable state and local laws and regulations as well as WS' Directives (see Appendix B for WS Directives specific to methods). These include but are not limited to guidelines for the types of devices or drugs which can be used, frequency in which capture devices must be checked and manner in which they must be applied. When recommending methods, WS would caution against their misuse.

The AVMA states "... euthanasia is the act of inducing humane death in an animal" and that "... if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible" (AVMA 2013). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness." Although use of euthanasia methods to end an animal's life is desirable, as noted by the AVMA, for wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible (AVMA 2007).

AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to

differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions (Yeates 2010). Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used."

AVMA (2013) recognizes that there is "an inherent lack of control over free-ranging wildlife," accepting that firearms may be the most appropriate approach to their euthanasia, and acknowledging that the quickest and most humane means of terminating the life of free-ranging wildlife in a given situation may not always meet all criteria established for euthanasia (i.e., distinguishes between euthanasia and methods that are more accurately characterized as humane killing). Because of the variety of situations that may be encountered, it is difficult to strictly classify methods for termination of free-ranging wildlife as acceptable, acceptable with conditions, or unacceptable. Furthermore, classification of a given method as a means of euthanasia or humane killing may vary by circumstances. These acknowledgments are not intended to condone a lower standard for the humane termination of wildlife. The best methods possible under the circumstances must be applied, and new technology and methods demonstrated to be superior to previously used methods must be embraced.

Direct, Indirect, and Cumulative Effects:
The efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing methods. WS personnel are experienced professionals skilled in their use of methods. When selecting methods, WS evaluates all potential tools for their humaneness, effectiveness, ability to target specific species and individuals, as well as other factors. Consequently, management methods would be implemented by WS in the most humane manner possible. With the exception of alpha-chloralose, all methods listed in the Appendix B would be available for use under any of the alternatives. (Alpha-chloralose would not be available under Alternative 3). Therefore, the issue of humaneness associated with methods and any direct impacts would be similar across any of the alternatives since those methods could be employed in the absence of WS' involvement. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods were used by WS as humanely as possible are listed in Chapter 2.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. No indirect adverse impacts were identified for this issue.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1. Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. WS would not provide direct operational assistance utilizing lethal techniques. Despite this, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. All methods listed in the appendix would be available under this alternative.

Despite no direct involvement by WS in the application of lethal methods, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. The issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed under the proposed action / no action alternative. This perceived similarity is derived from WS' recommendation of lethal methods that some consider inhumane. WS would not directly be involved with lethal damage management activities under this alternative. However, the recommendation of the use of lethal methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action / no action alternative.

Direct, Indirect, and Cumulative Effects:
Private use of lethal methods would be expected to increase under this alternative. WS could instruct and demonstrate the proper use of lethal methodologies to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by an individual would be based on the skill and knowledge of the requester in resolving the damage despite WS' demonstration. Therefore, a lack of understanding of the behavior of waterfowl or the improper identification of the animal causing damage along with inadequate knowledge and skill in using lethal methodologies to alleviate the damage or threats could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action / no action alternative. However, if those persons requesting assistance from WS apply lethal methods recommended by WS as intended, with skill and knowledge similar to that of WS, then those methods would be applied as humanely as possible to minimize pain and distress and the issue of humaneness would be similar to the proposed action / no action alternative. Additionally, if those persons provided technical assistance by WS apply lethal methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of animals would likely be higher.

Alternative 3 – WS Would Not Address Waterfowl Damage

Under this alternative, WS would not be involved with any aspect of managing damage associated with waterfowl. All requests for assistance received by WS to resolve damage associated with waterfowl would be referred to the USFWS, the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with waterfowl, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods. A method considered inhumane would still be perceived as inhumane regardless of the person or entity applying the method. However,

even methods generally regarded as being humane could be employed in inhumane ways. Methods could be employed inhumanely by those people inexperienced in the use of those methods or if those people were not as diligent in attending to those methods.

Direct, Indirect, and Cumulative Effects:
The efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public to use to alleviate damage and threats associated with waterfowl. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing damage apply those methods considered humane methods as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If those persons experiencing damage were not provided with information and demonstration on the proper use of those methods and employed humane methods in ways that were inhumane, the issue of method humaneness could be greater under this alternative. However, the level at which people would apply humane methods inhumanely under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives.

Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Waterfowl

People often enjoy watching or hearing waterfowl and take pleasure from knowing they exist as part of the natural environment. The aesthetic value of waterfowl may for some people be linked to their status (i.e., owned and under the owner's direct control, owned but free-ranging or feral). Some owners may never confine or restrain their pets and enjoy knowing they have the freedom of being free-ranging. These people may view their pets differently than an un-owned free-ranging or feral animal. Methods available to alleviate damage are intended to disperse and/or remove waterfowl in the area where damage is occurring. Therefore, these activities have the potential to affect the aesthetic values of waterfowl depending upon the values, philosophies, attitudes and opinions of individuals. The effects on the aesthetic value of waterfowl as it relates to the alternatives are discussed below. No indirect effects were identified for this issue.

Alternative 1 – WS Would Continue to Address Waterfowl Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The implementation or recommendation of methods by WS under this alternative would likely result in the dispersal, exclusion, or removal of individual animals to alleviate damage and threats. In some instances when animals were dispersed, excluded or removed, the ability of interested persons to observe and enjoy these animals could temporarily decline. Those animals dispersed or removed by WS under this alternative, would likely be those same animals that could and likely would be dispersed, excluded or removed by those individuals experiencing damage in the absence of assistance from WS. Since those animals dispersed or removed by WS under this alternative could be removed by other entities, WS' involvement would not likely be additive to the number of animals that could be removed in the absence of WS' involvement. Lethal removal of those species addressed in this EA could occur either without a permit if those bird species are not native, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS pursuant to the MBTA or during hunting seasons.

Direct, Indirect, and Cumulative Effects:
WS' lethal removal of waterfowl over the last six years has been of low magnitude when compared to the private harvest of waterfowl (see Issue 1, Alternative 1 for additional information on impacts to target animals). Given the limited lethal removal proposed by WS under this alternative when compared to the known sources of mortality and population information, waterfowl damage management activities conducted by WS pursuant to the proposed action / no action alternative would not adversely affect the aesthetic value of waterfowl.

When damage associated with waterfowl has occurred, any removal of animals by the property or resource owner would likely occur whether WS was involved with taking the animals or not. Therefore, the activities of WS are not expected to have any direct, indirect or cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager.

Alternative 2 – WS Would Address Waterfowl Damage by Providing Technical Assistance and Non-lethal Direct Operational Assistance

Under this alternative, WS could continue to provide those persons requesting assistance with managing damage and threats associated with waterfowl with technical assistance as described in Alternative 1. Additionally, WS could provide direct operational assistance, but would only utilize non-lethal techniques. WS would not provide direct operational assistance utilizing lethal techniques. Despite this, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. All methods listed in the appendix would be available under this alternative. The number of animals addressed under this issue is likely to be the same as the number addressed under the proposed action / no action alternative.

Direct, Indirect, and Cumulative Effects:
Since animals could continue to be dispersed, excluded or removed under this alternative, despite WS' lack of direct involvement in the application of lethal methods, the aesthetic values associated with waterfowl would likely be similar to the other alternatives. The lack of WS' direct involvement in the implementation of lethal methods would not lead to a reduction in the number of animals lethally removed since WS has no authority to regulate the dispersal, exclusion or removal of waterfowl. That authority rests with the USFWS, the VDGIF, VDACS, or local law enforcement or animal control authorities. Because those individuals experiencing damage could and likely would continue to employ both lethal methods, despite WS' lack of direct involvement under this alternative, the impacts to the aesthetic value of waterfowl and any direct, indirect or cumulative impacts would be similar to the other alternatives. Impacts would only be lower than the proposed action / no action alternative if those individuals experiencing damage were not as diligent in employing methods as WS would be if conducting lethal direct operational assistance. If those people experiencing damage abandoned the use of those methods then those birds associated with the damage would likely remain in the area and available for observing by those people interested in doing so.

Alternative 3 – WS Would Not Address Waterfowl Damage

Under this alternative, WS would not be involved with any aspect of waterfowl damage management. Therefore, WS would have no direct impact on the aesthetic values of waterfowl under this alternative. All requests for assistance received by WS to resolve damage associated with waterfowl would be referred to the USFWS, the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities. Despite no involvement by WS in resolving damage and threats associated with waterfowl, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods.

Direct, Indirect, and Cumulative Effects:
Since animals could continue to be dispersed, excluded or removed under this alternative, despite WS' lack of involvement, the ability to watch or hear these animals would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of animals dispersed, excluded or removed since WS has no regulatory authority. That authority rests with the USFWS, the VDGIF, VDACS, or local law enforcement or animal control authorities. Under this alternative, those individuals experiencing damage could and likely would continue to employ both lethal and non-lethal methods, despite WS' lack of involvement. Therefore, the impacts to the aesthetic value of waterfowl and any direct, indirect or cumulative impacts would be similar to the other alternatives. Impacts would only be lower than the proposed action / no action alternative if those individuals experiencing damage were not as diligent in employing methods as WS would be if conducting direct operational assistance. If those people experiencing damage abandoned the use of those methods then the waterfowl associated with the damage would likely remain in the area and available for observing by those people interested in doing so.

3.2 ISSUES NOT CONSIDERD FOR COMPARATIVE ANALYSIS

The following resource values in the state are not expected to be significantly impacted by any of the alternatives analyzed as none of the alternatives cause any significant ground disturbance: soils, geology, minerals, water quality/quantity, flood plains, critical habitats (areas listed in threatened and endangered species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Therefore, these resources will not be analyzed.

Additional issues were identified by WS during the scoping process of this EA. Those issues were considered by WS during the development of this EA. However, those issues will not be analyzed in detail for the reasons provided. The following issues will not be analyzed in detail in this EA:

Effects of Waterfowl Damage Management Activities on Biodiversity

An issue identified as a concern is that managing waterfowl damage could affect biodiversity or the diversity of species. When managing damage, WS does not attempt to eradicate any species of native wildlife. The purpose of damage management is to reduce or alleviate the damage or threats of damage by targeting individuals or groups of animals identified as causing damage or posing a threat of damage. Waterfowl are managed by the USFWS and or the VDGIF. Lethal removal of these animals can only occur at the discretion of the USFWS and or the VDGIF, which ensures that removal occurs to achieve desired population objectives for these species. Free-ranging domestic and feral waterfowl are managed by local law enforcement and animal control authorities. Therefore, any decision regarding the management of free-ranging domestic and feral waterfowl populations occurs at their discretion. Any reduction of a local population would be temporary because immigration from adjacent areas or reproduction would replace those animals removed. Therefore, damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

An issue commonly identified as a concern is that a threshold of damage or economic loss should be established and reached before lethal methods can be used to resolve damage and that damage caused by waterfowl should be a cost of doing business. For any given damage situation, there are varying thresholds of tolerance exhibited by those people affected. The point at which people begin to implement damage management methods are often unique to the individual and can be based on many factors (e.g., economic, social, aesthetics). How damage is defined is also often unique to the individual and damage

occurring to one individual may not be considered damage by another individual. Therefore the threshold of damage or economic loss that can be tolerated is also unique to the individual.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms. Under any of the alternatives, animals causing damage or posing threats could be lethally removed with firearms. Lead is a metal that can be poisonous to animals. Risk of lead exposure to waterfowl occurs primarily when they ingest lead shot or bullet fragments. Lead ammunition may be used by any person implementing damage management methods under any of the alternatives. However, those persons using shotguns to take waterfowl under depredation orders, under conservation orders, under depredation permits or during hunting seasons must use non-toxic shot.

Deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through an animal, if misses occur, or if the carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns have been raised that lead from bullets introduced into the environment from shooting activities could lead to the contamination of either ground water or surface water from runoff. The amount of lead that becomes soluble in soil is usually very small (0.1-2.0%) (USEPA 2005). Stansley et al. (1992) studied lead levels in water that was directly subjected to high concentrations of lead shot because of intensive target shooting at shooting ranges. The study detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones" at one shooting range, but did not find higher lead levels in a lake into which the stream drained, with the exception of one sample collected near a parking lot (Stansley et al. 1992). Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range. Stansley et al. (1992) also indicated that even when lead shot has accumulated at high levels in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water downstream. Ingestion of lead shot, bullets or associated fragments is not considered a significant risk to fish and amphibians (Rattner et al. 2008). Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "action level" of 15 parts per billion as defined by the Environmental Protection Agency (USEPA) (i.e., requiring action to treat the water to remove lead). These studies suggest that the very low amounts of lead that could be deposited from damage management activities would have minimal effects on lead levels in soil and water.

Lead ammunition (for hunting or target shooting) is only one of many sources of lead in the environment. Other sources which can settle into soil and water include lost fishing sinkers (an approximated 3,977 metric tons of lead fishing sinkers are sold in the United States annually; Rattner et al. 2008), and airborne emissions from metal industries (e.g., lead smelters, iron production, steel production), manufacturing industries, and waste incineration (USEPA 2013). Since lethal removal of those species addressed in this EA can occur at any time or during hunting seasons, WS' assistance with removing animals causing damage would not be additive to the environmental status quo. The amount of lead deposited into the environment may be lowered by WS' involvement in activities due to efforts by WS to ensure projectiles do not pass through, but are contained within the carcass, which would limit the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that animals are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which would further reduce the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement would ensure efforts were made to retrieve and dispose of carcasses lethally removed using firearms to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that would be deposited into the

environment from WS' activities due to misses, the bullet passing through the carcass, or from carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination.

Damage Management Should Not Occur at Taxpayer Expense

An issue was raised that damage management should not be provided at the expense of taxpayers. Activities conducted by WS to manage damage or threats associated with waterfowl in Virginia may be funded by a variety of sources including, but not limited to, federal appropriations, the Commonwealth of Virginia, and other cooperative funding. These activities include both technical assistance and direct operational assistance, when requested. Under the proposed action, funding could come from these and/or other sources. A federal appropriation is allotted for the maintenance of the WS-Virginia program. The remainder of the WS-Virginia program is funded by cooperative, federal, and non-federal funding.

3.3 SUMMARY OF ENVIRONMENTAL CONSEQUENCES UNDER THE PROPOSED ACTION / NO ACTION ALTERNATIVE

No significant cumulative environmental impacts are expected from any of the three Alternatives. Under the proposed action /no action alternative, the lethal removal of waterfowl by WS would not have a significant impact on overall populations, but some short-term local reductions may occur. Additionally, WS would not have a significant direct, indirect, or cumulative impact on the ability of hunters to harvest species targeted by management activities. WS would not have a significant direct, indirect or cumulative impact on non-target animal populations or threatened and endangered species. Under the proposed action / no action alternative, direct impacts to human health and safety would be low, and indirect and cumulative impacts would be eliminated when methods are used appropriately in adherence with SOPs and label requirements by trained personnel. Similarly, adherence to SOPs and selection and implementation of methods by trained personnel insures methods would be implemented in the most humane manner possible under the proposed action / no action alternative. Any direct, indirect or cumulative impacts on humaneness would be in part up to a person's perception of humaneness and similar across the alternatives. Under the proposed action / no action alternative, the aesthetic values of waterfowl are not expected to be impacted directly, indirectly or cumulatively. WS' actions taken to minimize or eliminate damage would be constrained in scope, duration and intensity, for the purpose of minimizing or avoiding impacts. WS' SOPs are designed to reduce the potential negative effects of WS' actions by identifying and responding to both anticipated and unanticipated changes in wildlife populations and the environment. WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing assistance, to not only reduce damage, but also to identify and minimize potentially harmful effects. This process allows WS to take into consideration other influences in the environment in order to avoid adverse impacts. Although some persons will likely be opposed to WS' participation in damage management activities, the analysis in this EA indicates that WS' integrated damage management program to reduce damage or threats associated with waterfowl, as described in the proposed action/ no action alternative, would not result in significant adverse cumulative impacts on the quality of the human environment.

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APPENDIX B: METHODS AVAILABLE FOR PREVENTING, REDUCING AND ELIMINATING DAMAGE AND THREATS ASSOCIATED WITH WATERFOWL IN THE COMMONWEALTH OF VIRGINIA

A variety of methods are potentially available to the WS program. Various federal, Commonwealth, and local statutes and regulations and WS Directives govern WS' use of these methods. The following methods and materials may be recommended or used in technical assistance and direct damage management efforts of the WS program. Not all methods would be considered effective, efficient, practical, or legal in every situation and may not be recommended or utilized.

NON-LETHAL METHODS (NON-CHEMICAL)

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners or managers to reduce the potential for damage associated with waterfowl. Implementation of these practices is appropriate when the potential for damage can be reduced without substantially increasing a resource owner's costs or diminishing their ability to manage resources pursuant to goals. Resource management recommendations are generally made through WS' technical assistance efforts.

Animal Husbandry: This category includes; 1) modifications in the level of care and attention given to livestock (including fish and other commercially raised aquatic organisms), 2) selection of livestock type (e.g., baitfish vs. mollusk) or species, 3) shifts in the timing or location of breeding, 4) moving livestock to locations where predation has historically been low when livestock is most vulnerable, and 5) disposal of dead livestock so that it cannot serve as an attractant. Altering animal husbandry to reduce damage associated with birds has many limitations. The expense associated with a change in husbandry practice may exceed the savings. WS encourages resource owners to use these strategies where they may be beneficial, but does not conduct direct operational assistance.

Crop Selection and Scheduling: In areas where damage to crops from waterfowl occurs, different crops can be planted that are less attractive to the birds causing damage. Alternatively, crops can be planted at an earlier or later date to coincide with periods when there is a greater availability of natural food items. This practice depends on the species causing damage, the availability of alternate food sources, and the market for alternative crops. Research has been conducted on damage resistant crop varieties with little success.

> ***Lure Crops:*** If depredation cannot be avoided by careful crop selection or a modified planting schedule, lure crops can sometimes be used to mitigate the potential loss. Lure crops are crops planted or left for consumption by wildlife as an alternate food source. To improve the efficacy of this technique, frightening devices should be used in nearby non-lure crop fields and wildlife should not be disturbed in lure crop fields. This approach provides relief for critical crops by sacrificing less important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area. Implementation of this method is limited by the authority of those involved to manage the property.

Habitat Management: In general, the type, quality, and quantity of habitat are directly related to the species of wildlife in an area. Therefore, it is possible to manage habitat in a way that discourages its use by specific species. Some examples include; 1) eliminating or modifying ponds or other water sources (e.g., turning off water aerators in ponds to allow the water to freeze in the winter), 2) removing palatable vegetation or making vegetation less palatable, 3) removing potential nesting sites (e.g., platforms), 4) installing vegetation (e.g., cattails) or other physical components (e.g., fencing) to limit waterfowl's line

of site and make them nervous about the possibility of unseen predators, and 5) planting emergent aquatic vegetation (e.g., water lilies) to impede the movement of waterfowl. The limitations of habitat management as a method of reducing wildlife damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats (e.g., wetlands). In most cases, the resource or property owner or manager is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect.

Modification of Human Behavior: Altering human behavior may resolve conflicts between humans and animals. For example, eliminating the feeding of wildlife and free-ranging or feral animals may reduce the presence of animals in a given area and with it, the damage occurring. This includes inadvertent feeding. In Virginia, it is illegal for any person to place, distribute, or allow the placement of food, minerals, carrion, trash, or similar substances when it attracts any species of wildlife in such numbers or circumstances to cause property damage, endanger any person or wildlife, or create a public health concern (4 VAC 14-40-286). The public does not always comply with laws and ordinances and these statutes must be enforced to be effective.

Decoy Birds: Free ranging domestic and feral waterfowl can act as an attractant for wild waterfowl (Ringelman 1990). Avery and Decker (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of free ranging domestic and feral waterfowl removes the birds that act as attractants or "decoys" for other waterfowl.

PHYSICAL EXCLUSION

Physical exclusion methods restrict the access of waterfowl to resources or areas where damage is occurring. These methods can effectively prevent damage in many situations. However, exclusionary devices which are 100% effective at excluding waterfowl can be more costly than the value of the resources being protected, especially for large areas. In addition, some exclusionary devices require labor intensive maintenance which can further reduce their cost-effectiveness.

Fencing: Fences, either temporary or permanent, electric or conventional, can be effective in excluding waterfowl. With any type of fencing the height of the fence must be tall enough, the distance between the fence and the ground or the distance between wires or pickets must be small enough to exclude animals. Birds are able to fly, climb, jump over or move through fences if motivated. For this reason, certain fences may not be effective at excluding waterfowl. Fences work best when waterfowl are flightless, or when the area being excluded is small and birds are not sufficiently motivated to fly, climb, jump over or move through them.

Fladry: Fladry is a barrier technique that attaches small pieces of flagging to either a temporary or permanent electrified or un-electrified fencing. The movement of the flags in the wind makes a visual barrier which acts as a deterrent.

Surface Coverings: Surface coverings may include but are not limited to: netting, wire grid systems, or floating covers. Although not economical for large areas, netting can be used to restrict access to small ponds or other resources. Wire grid systems also called overhead wires, are composed of multiple lines of wire, nylon string or analogous material stretched above the area to be protected (e.g., a pond). Wires may be arranged parallel to one another, in a grid, in spoke like fashion or in a random array (e.g., Terry 1987, Pochop et al. 1990, Steuber et al. 1995, Clark et al. 2013). Although wire grid systems may not create an actual barrier, they interfere with the flight patterns of waterfowl, and may limit their use of the area where the system is installed. Floating covers consist of either a system of plastic sheeting and baffle floats or alternatively plastic balls

or spheres which sit on and fully cover the surface of a body of water. Both the plastic sheet and ball/sphere systems are intended to rise and fall with changing water levels and work by restricting access to the water's surface.

Other Barriers and Exclusionary Methods: Steep vertical banks, large boulders, rip-rap and a variety of other natural and manmade changes (e.g., installation of hedges, coiled wire on edges of docks) to the area where damage is occurring can provide a barrier to waterfowl movement and restrict access to resources. Used in conjunction with other physical exclusion methods these methods can be applied, arranged or designed to effectively exclude waterfowl.

FRIGHTENING DEVICES OR DETERRENTS

Frightening devices are used to repel animals from areas where they are causing damage or posing threats of damage. The success of frightening methods depends on an animal's fear of, and subsequent aversion to, offensive stimuli. A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used scare tactics and ignore them. The time it takes for animals to habituate can generally be lengthened by using devices which are periodic, random or animal activated. As with other methods, these techniques tend to be more effective when used as part of an integrated management program.

Physical Human and Vehicle Harassment or Hazing: Physical human harassment or hazing involves people pursuing animals on foot, clapping their hands, or shouting. Vehicle harassment involves people pursuing animals with remote control vehicles, or with non-motorized or motorized boats or other vehicles. These techniques can be used in conjunction with other methods to disperse animals from areas where they cause damage or threats.

Acoustic Stimuli: This category includes using a variety of noise making devices including but not limited to car horns, air horns, stereo systems, radios, bioacoustics (i.e., alarm or distress calls), ultrasonic devices, propane exploders, pyrotechnics, etc. The effectiveness of noise is generally limited because animals become accustomed to and learn to ignore them. It must be noted that sound-scare devices can also scare people, livestock, pets or non-target wildlife when they are used in their vicinity.

Visual Stimuli: Different types of lights (e.g., floodlights, strobe lights, lasers, revolving lighting units), scarecrows or effigies (which mimic humans or a predator), moving (e.g., flags, windsocks, kites) and or reflective material (e.g., Mylar® tape), and other threatening images (some animals have a fear of new objects) have been used with mixed results. In general, the type of stimuli, the number of devices, and their location are determined by the size of the area to be protected and by the power sources available. However, most animals rapidly become accustomed to such stimuli and they are not generally effective in the long-term. Devices activated by motion, body-heat or radar may delay habituation.

Other Stimuli: Repellants are substances used to discourage or disrupt particular behavior and are effective because they are irritating, cause sickness or stimulate fear. Cayenne pepper, chili powder and other similar substances have been used in an effort to deter waterfowl. Unfortunately, for many species of waterfowl there are no known repellants that are effective after repeated exposure. These and other similar substances are non-restricted substances available for use by the public. (see also **Repellants**).

Devices Using Multiple Stimuli: One device which uses multiple stimuli is called the electronic guard. It is a frightening device composed of a blinking strobe and a siren which are activated by a timer. When operational the device randomly flashes and omits sound for a few seconds at several minute intervals (USDA 2002). The device was designed specifically to reduce predation on livestock (Linhart 1984,

Linhart et al. 1984, Linhart et al. 1992) but can be used in other applications. Another device consists of an illuminated pop-up scarecrow and a CD player with audio tracks likely to elicit fear (e.g., aggressively barking dogs, shotgun barrages) and designed to turn on when activated by the target animal. A similar device, the movement-activated guard uses a strobe light and recorded sound effects to disperse animals when activated by movement (Shivik et al. 2003). These and similar devices can be activated by motion, body-heat or radar. These and other similar devices can be temporarily effective in reducing damage in some situations.

Projectiles: Different types of projectiles (e.g., water from a hose or sprinkler, sticks, small rocks etc.) may be used to frighten animals. Sprinklers activated by motion are also available. These techniques can be used in conjunction with other methods to disperse animals from areas where they cause damage or threats.

Paintball Markers: Paintball markers (or guns) work by using compressed carbon dioxide to propel projectiles. This method can be used in conjunction with other methods to disperse animals from areas where they cause damage or threats.

> ***Paintballs:*** Paintballs are spherical capsules which are made of gelatin and contain a non-toxic glycol and water-based coloring. Paintballs are considered non-toxic and do not pose an environmental hazard as described in Safety Data Sheets. However, consumption may cause toxicosis in dogs, which is potentially fatal without supportive veterinary treatment (Donaldson 2003). Little is known about the mechanism of action and lethal dose for dogs that consume paintballs, but it is suspected that there is an osmotic diuretic effect resulting in an abnormal electrolyte and fluid balance (Donaldson 2003). With treatment, most affected dogs recover within 24 hours (Donaldson 2003).

Animal Harassment or Hazing: The use of a species' natural predator or alternatively competitor to disperse animals from areas where they cause damage or threats.

> ***Dogs:*** This method involves allowing dogs to pursue waterfowl. Dogs trained and used for this purpose must stay with their handler to be effective. Properly trained and disciplined dogs should not make contact with target animals and have minimal effect on non-target animals.
>
> ***Falconry:*** Trained raptors can be used to harass waterfowl from areas where they are causing damage or threats. Raptors should not make contact with target waterfowl. The VDGIF allows persons meeting specific qualifications to use raptors for this purpose with a special permit (4VAC 15-250-10, 4VAC 15-250-20).
>
> ***Mute Swans:*** Due to their aggressive nature, (mute swans will attack and kill other birds and their young or drive them from foraging or shelter areas), mute swans have been translocated by humans in an attempt to reduce or prevent damage and threats by other species of waterfowl (i.e., Canada geese). However, mute swans are ineffective when used for this purpose (Conover and Kania 1994) and cause damage and threats to human health and safety, habitat, native species (via competition) (see **CHAPTER 1**). Additionally, the presence of mute swans at a site may attract other waterfowl (Ringelman 1990). Mute Swans are an invasive species not protected by the MBTA and are designated as a nuisance species in Virginia (4 VAC 15-20-160). A permit is required to import, possess, or sell them (4 VAC 15-30-40). However, no new permits are being issued for these purposes (VDGIF 2016). WS would not use or recommend the use of mute swans in accordance with Executive Order 13112.

CAPTURE WITH LIVE CAPTURE DEVICES

Waterfowl can be live captured through the use of several methods listed and described in detail below. Upon capture, animals could be relocated or euthanized. However, in most situations animals captured in live traps are subsequently euthanized (see lethal methods). For discussion of why animals are not generally relocated see Section 3.2. Wild waterfowl are managed by the USFWS and/or the VDGIF and translocation of them could only occur under their authority. WS would use capture devices in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to reduce risks to persons and non-target animals.

Hand Capture: Hand capture involves using hands to take hold of an animal.

Nets: Open-meshed material fashioned in a manner to trap, catch or ensnare.

> ***Hand Nets:*** Hand nets are used to catch animals in confined areas. These nets resemble fishing dip nets with the exception that they are larger and have long handles. A variation of the hand net is a round throw-net with weights at the edges of the net, similar to that used for fishing.
>
> ***Cannon / Rocket Nets***: Cannon or rocket netting involves setting bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the animals to escape.
>
> ***Net Gun***: This technique fires a net from a shoulder mounted gun which captures the target animal.
>
> ***Bow Nets***: Bow nets are small circular net traps. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source or other attractant (see **ATTRACTANTS** below) and triggered by an observer using a pull cord.
>
> ***Drop Nets:*** Drop nets are set above a food source and triggered by an observer.
>
> ***Drive Traps or Panel Nets:*** Drive traps or panel nets consist of lightweight portable panels, (e.g., supports stretched with netting), that are used to herd and surround flightless waterfowl. May be used in conjunction with corral traps.

Corral Trap: Corral traps may be constructed from steel or wood supports stretched with fencing or netting. They are open at both the top and bottom. Flightless waterfowl enter through door(s) or a narrow entrance way. The entranceway is then blocked by an observer to prevent escape. Birds maybe herded into the trap (see ***Drive Traps or Panel Nets*** above) or alternatively, traps may be baited with food or other items attractive to the target species (see **ATTRACTANTS** below).

Cage Traps: These traps are usually fully enclosed. Traps are typically baited (see **ATTRACTANTS** below) and triggered to close when weight is applied to a pan or treadle or by an observer. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. WS SOPs require that traps be checked frequently so any captured animals can be addressed in a timely manner. Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants further increases the selectivity of this method. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely.

Attractants: Attractants including baits are used to increase the efficacy of other methods by enticing an animal to investigate a particular location where capture methods (e.g., cage traps, corral traps, bow nets etc.) are deployed. Baits include any foods or combination of foods attractive to the target animal. Other attractants (e.g., water) can also be used to entice an animal to investigate a particular location. These are non-restricted substances available for use by the public.

INACTIVE NEST DESTRUCTION: The destruction of inactive nests (nests without eggs or chicks present) is employed at a localized level to discourage nesting in areas experiencing damage or threats. Nest destruction involves manually removing nesting materials. Under the MBTA, inactive nests may not be collected or possessed but are not protected from destruction (USFWS 2003). However, some inactive nests are legally protected by statutes other than the MBTA (e.g., Endangered Species Act, Bald and Golden Eagle Protection Act).

NON-LETHAL METHODS (CHEMICAL)

Repellents: Chemical repellents are non-lethal chemicals used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Effective and practical chemical repellents should be nonhazardous to wildlife; nontoxic to humans, animals and the environment; resistant to weathering; easily applied; reasonably priced; and capable of providing good repellent qualities. The reaction of different individual animals to a single chemical formulation varies and this variation in repellency may be different from one habitat to the next. Chemical repellents are strictly regulated, and suitable repellents are not available for many species or wildlife damage situations. Anthraquinone and methyl anthranilate are two chemical repellants registered with the USEPA for use in waterfowl.

Methyl Anthranilate: Methyl anthranilate is a compound which naturally occurs in plants. Approved by the FDA for human consumption, methyl anthranilate is commonly used as a "grape" flavoring agent (Brown et al. 2014). Registered for use as a bird repellant in the U.S. 1985, it can be applied either directly to the resource being damaged (e.g., turf, certain agricultural resources) or in areas in which the damage is occurring (e.g., non-fish bearing bodies of water, structures) (USEPA 2016*a*, USEPA 2016*b*, USEPA 2017*a*). Application usually involves spraying or using a fog-producing machine which creates an aerosol (USEPA 2016*a*, USEPA 2016*b*). Methyl anthranilate acts as an irritant when the bird's trigeminal nerve (the nerve responsible for sensation in the face) make contact with the compound (Avery 2002). Examples include but are not limited to products sold under the trade names; Rejex-it® Migrate™, Avian Migrate™, Rejex-it® Fog Force™, Avian Fog Force™, Avian Control®, Bird Stop™ Goose and Bird Repellant, Liquid Fence Goose Repellent®, EcoBird® 4.0 and Bird Shield®.

Anthraquinone (9,10-Anthraquinone): Anthraquinone is a naturally occurring chemical. It can be found in animals, plants and bacteria which use it as a defense against predation, parasitism and herbivory (Linz and Homan 2012, Linz et al. 2014). First used as a bird repellant in the U.S. in the 1940's, anthraquinone is applied directly to the resource being damaged (e.g., turf) (Avery 2002, USEPA 2017*b*). When ingested, anthraquinone causes discomfort and birds learn to avoid the area (Avery 2002). Examples include but are not limited to products sold under the trade names; Flight Control®, Flight Control® Plus, Airepel® HC and Avipel®.

A common concern regarding the use of chemicals is the risk to humans, non-target animals and the environment. Methyl anthranilate and anthraquinone would only be used by WS in accordance with label directions, WS Directives and SOPs. These requirements include but are not limited to; training in the application of the method, the use of appropriate personal protective equipment, the use of caution during application; proper storage and disposal. Under the

(FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. USEPA does not expect any adverse effects to humans, non-target animals or the environment from the use of either methyl anthranilate or anthraquinone when used according to label instructions because they are not toxic to animals or birds when ingested and there is little to no contact between animals and the active ingredient (USEPA 2001).

Drugs: The use of chemical methods is strictly regulated by the DEA, EPA, FDA and VDACS. Pharmaceutical drugs, including those used in wildlife capture and handling are registered with the FDA and must be stored and used in compliance with both FDA and DEA regulations. These regulations are intended to ensure minimal adverse effects to humans, animals and the environment. Those possessing or using drugs must be registered to do so with the DEA under the Controlled Substances Act. Those using drugs must also comply with the Animal Medicinal Drug Use Clarification Act (AMDUCA). Additionally, these drugs also have specific requirements for their handling, transport, storage, application and disposal under the Code of Virginia and the Virginia Administrative Code.

All drugs used by WS or recommended by WS would be registered with the FDA, and stored and used in compliance with Federal and state laws and regulations as required. WS personnel that possess or use these substances would be trained and certified in accordance with WS Directive 2.430. Additionally, "*the acquisition, storage, and use of* ...(these substances would be)... *in compliance with applicable program, Federal, State, and local law and regulations*" (WS Directive 2.430).

Reproductive Inhibitors: Reproductive control for wildlife can be accomplished either through sterilization (permanent) or contraception (reversible) means. However, the use and effectiveness of reproductive control as a wildlife population management tool is limited by characteristics of the species (e.g., life expectancy, age at onset of reproduction, population size, etc.), environmental factors (e.g., isolation of target population, access to target individuals, etc.), socioeconomic, and other factors.

Currently, the only reproductive inhibitor that is registered with the EPA for use in any of the species addressed in this document is OvoControl® G. OvoControl® G was officially registered by the EPA in 2005 for use in reducing the hatchability of Canada geese, domestic mallard ducks, domestic Muscovy ducks and domestic hybrid eggs in urban or at airports meeting specific qualifications. However, in order for OvoControl® G to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. OvoControl® G is not currently registered for use in Virginia. However, if OvoControl® G or other reproductive inhibitors become available to manage those species addressed in this document the Commonwealth, their use could be evaluated under the proposed action alternative as a method available that could be used in an integrated approach to managing damage.

Alpha-Chloralose: Alpha-chloralose is an anesthetic drug that causes sedation by depressing the central nervous system. Alpha-chloralose is administered by feeding individual target birds treated baits (i.e., whole corn kernels or small pieces of bread). It is approved for use by WS as an FDA Investigational New Animal Drug for waterfowl, coots, pigeons and ravens. WS personnel who possess or use alpha-chloralose would be trained and certified in accordance with WS Directive 2.430 and the WS Alpha-Chloralose Training Manual. After birds are sedated, they are live-captured (see **CAPTURE WITH LIVE CAPTURE DEVICES**) and subsequently euthanized (see **LETHAL METHODS**) or released. Potential treatment sites are pre-baited and monitored for non-target use. The bait type selected can limit the likelihood that non-target species would consume treated bait since some bait types are not preferred by non-target species. By acclimating target bird species to a feeding schedule, baiting can occur at

specific times to ensure bait is quickly consumed, making it unavailable to non-targets. Baits must be under the direct supervision of an applicator at all times and baits are not placed if they cannot be retrieved. Unconsumed or unused alpha-chloralose must be destroyed or incinerated as outlined in the WS Alpha-Chloralose Training Manual. Additionally, the acquisition, storage, and use of ...(alpha-chloralose would be)... in compliance with applicable program, Federal, State, and local law and regulations" (WS Directive 2.430). Persons administering alpha-chloralose assume responsibility for the safety and life of sedated birds which must be protected from predators. Birds subsequently euthanized must be properly disposed of in accordance with the WS Alpha-Chloralose Training Manual. In accordance with FDA restrictions, WS would not use alpha-chloralose during and 30 days prior to periods of time in which waterfowl could be hunted and the FDA does not allow birds or their products (i.e., eggs) which have been treated with alpha-chloralose to be used for food by humans or other animals. It is unlikely that birds subsequently relocated and released would pose a hazard to predators or scavengers which may consume them because alpha-chloralose is totally excreted 27 to 33 hours after ingestion (Goldade et al. 2014). This would effectively eliminate secondary hazards associated with the consumption of birds or their products that have or potentially had alpha-chloralose in their systems. Drugs are only used on private, public, or tribal property sites with authorization from the property owner or manager.

Egg Oiling: Egg oiling is a method of egg destruction (see also **Egg and Active Nest Destruction**). Application involves coating the entire surface of eggs with oil. The oil blocks the exchange of gases which prevents the embryos from continuing to develop. Only 100% corn oil can be used for this purpose because corn oil (as opposed to similar substances) is exempted from regulation by the EPA under the Federal Insecticide, Fungicide and Rodenticide Act (40 CFR 152.25(f)(1)) (USFWS 2014, USEPA 2015, USEPA 2017*c*). To be most effective, the oil should be applied as soon as it is determined that the last egg has been laid. Like egg addling or puncturing, this method has an advantage over nest or egg destruction because the incubating birds generally continue to sit on the nest long after the expected hatch date and do not re-nest.

LETHAL METHODS (NON-CHEMICAL)

EGG AND ACTIVE NEST DESTRUCTION: The destruction of eggs and / or active nests (nests with eggs or chicks present) is employed at a localized level to inhibit nesting in areas experiencing damage or threats. Egg and active nest destruction is not used as a population management method (see **WS Would Use Egg and Active Nest Destruction to Reduce Populations of Waterfowl in the Commonwealth that are Causing Damage**). Nest destruction involves manually removing nesting materials. Egg destruction can be accomplished through; breaking, puncturing, shaking/addling or oiling (see **Egg Oiling**). Puncturing involves inserting a long pointed metal probe into the end of the egg. Shaking or addling involves shaking an egg vigorously until the embryo is rendered infertile. All egg destruction methods stop the embryo from developing. Whenever the presence of adult birds does not pose an immediate threat, eggs should be punctured, shaken /addled or oiled and placed back in the nest. Adult birds will return and continue to incubate the eggs beyond the expected hatch date, reducing or preventing the potential for re-nesting. Waterfowl are long lived birds which have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individual birds affected by egg and active nest destruction, this activity has no long term effect on breeding adult birds. Egg and active nest destruction can occur either without a permit if those bird species are not native, under depredation orders (i.e., resident Canada geese), or through the issuance of depredation permits by the USFWS pursuant to the MBTA.

Hunting: Where appropriate, WS may recommend that those persons experiencing damage and threats associated with waterfowl consider hunting at the damage site as an option for reducing damage. Lethal

removal of some species of waterfowl addressed in this EA can occur during hunting seasons. Hunting not only has the potential to remove individuals causing damage but also reinforces harassment programs as part of an integrated approach. Valid hunting licenses are required for the implementation of this method.

Shooting: Shooting is the practice of selectively removing target animals using firearms. Shooting, when deemed appropriate, can be highly effective in removing those individual animals responsible for causing damage and posing threats. It is selective for target species. It is also effective in supplementing harassment as part of an integrated approach. Animals removed by WS are killed as quickly and humanely as possible in accordance with WS Directive 2.505. WS employment of this method may include but is not limited to the use of vehicles, elevated platforms, illuminating devices (e.g., spotlights, night vision, Forward Looking Infrared Devices (FLIR)), and suppressors. Lethal removal of those species addressed in this EA can occur either without a permit if those bird species are not native, under depredation orders, under conservation orders or through the issuance of depredation permits by the USFWS pursuant to the MBTA or during hunting seasons.

Live Capture Followed by Non-Chemical Euthanasia: Animals can be live captured through the use of several methods listed and described in detail above (see **CAPTURE WITH LIVE CAPTURE DEVICES**). Upon capture, euthanasia could occur via shooting or cervical dislocation. WS would kill animals as quickly and humanely as possible in accordance with WS Directive 2.505.

> ***Cervical Dislocation:*** This method is sometimes used to euthanize birds which are captured in live traps. The animal is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as a humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry (AVMA 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (AVMA 2001).

LETHAL METHODS (CHEMICAL)

Carbon Dioxide (CO_2): Carbon dioxide is sometimes used to euthanize animals which are captured in live capture devices (see **Live Capture Devices** above). Live animals are placed in a container or chamber which is then sealed. CO_2 gas is released into the chamber and the animals quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (AVMA 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society. Euthanasia conducted by WS would be done in accordance with WS Directive 2.505.

APPENDIX C: SPECIES LISTED BY THE U.S. FISH AND WILDLIFE SERVICE[1]

[1]List obtained from U.S. Fish and Wildlife Service, Virginia Field Office, Ecological Services on 29 August 2017.

Endangered Species

Amphibians	**Status**	**Has Critical Habitat**
Shenandoah salamander *(Plethodon shenandoah)*	Endangered	
Arachnids		
Spruce-Fir Moss spider (*Microhexura montivaga*)	Endangered	Final designated
Birds		
Piping Plover *(Charadrius melodus)*	Threatened	Final designated
Red Knot (*Calidris canutus rufa*)	Threatened	
Red-Cockaded woodpecker (*Picoides borealis*)	Endangered	
Roseate tern (*Sterna dougallii dougallii*)	Threatened	
Clams		
Appalachian monkeyface (pearlymussel) *(Quadrula sparsa)*	Endangered	
Birdwing pearlymussel *(Lemiox rimosus)*	Endangered	
Cracking pearlymussel *(Hemistena lata)*	Endangered	
Cumberland bean (pearlymussel) *(Villosa trabalis)*	Endangered	
Cumberland monkeyface (pearlymussel) *(Quadrula intermedia)*	Endangered	
Cumberlandian combshell *(Epioblasma brevidens)*	Endangered	Final designated
Dromedary pearlymussel *(Dromus dromas)*	Endangered	
Dwarf wedgemussel *(Alasmidonta heterodon)*	Endangered	
Fanshell *(Cyprogenia stegaria)*	Endangered	
Finerayed pigtoe *(Fusconaia cuneolus)*	Endangered	
Fluted kidneyshell *(Ptychobranchus subtentum)*	Endangered	Final designated
Green blossom (pearlymussel) *(Epioblasma torulosa gubernaculum)*	Endangered	
James spinymussel *(Pleurobema collina)*	Endangered	
Littlewing pearlymussel *(Pegias fabula)*	Endangered	
Oyster mussel *(Epioblasma capsaeformis)*	Endangered	Final designated
Pink mucket (pearlymussel) *(Lampsilis abrupta)*	Endangered	
Purple bean *(Villosa perpurpurea)*	Endangered	Final designated
Rough pigtoe *(Pleurobema plenum)*	Endangered	
Rough rabbitsfoot *(Quadrula cylindrica strigillata)*	Endangered	Final designated
Sheepnose Mussel *(Plethobasus cyphyus)*	Endangered	
Shiny pigtoe *(Fusconaia cor)*	Endangered	
Slabside Pearlymussel *(Pleuronaia dolabelloides)*	Endangered	Final designated
Snuffbox mussel *(Epioblasma triquetra)*	Endangered	
Spectaclecase (mussel) *(Cumberlandia monodonta)*	Endangered	
Tan riffleshell *(Epioblasma florentina walkeri (=e. walkeri))*	Endangered	
Yellow lance (*Elliptio lanceolate*)	Proposed Threatened	
Crustaceans		
Big Sandy crayfish *(Cambarus callainus)*	Threatened	

Lee County Cave isopod *(Lirceus usdagalun)*	Endangered	
Madison Cave isopod *(Antrolana lira)*	Threatened	
Fishes		
Blackside dace *(Phoxinus cumberlandensis)*	Threatened	
Duskytail darter *(Etheostoma percnurum)*	Endangered	
Roanoke logperch *(Percina rex)*	Endangered	
Slender chub *(Erimystax cahni)*	Threatened	Final designated
Spotfin Chub *(Erimonax monachus)*	Threatened	Final designated
Yellowfin madtom *(Noturus flavipinnis)*	Threatened	Final designated
Yellowfin madtom *(Noturus flavipinnis)* Population: Holston River, VA, TN	Experimental Population, Non-Essential	
Flowering Plants		
Eastern Prairie Fringed orchid *(Platanthera leucophaea)*	Threatened	
Harperella *(Ptilimnium nodosum)*	Endangered	
Michaux's sumac *(Rhus michauxii)*	Endangered	
Northeastern bulrush *(Scirpus ancistrochaetus)*	Endangered	
Peter's Mountain mallow *(Iliamna corei)*	Endangered	
Roan Mountain bluet *(Hedyotis purpurea var. montana)*	Endangered	
Seabeach amaranth *(Amaranthus pumilus)*	Threatened	
Sensitive joint-vetch *(Aeschynomene virginica)*	Threatened	
Shale barren rock cress *(Arabis serotina)*	Endangered	
Small Whorled pogonia *(Isotria medeoloides)*	Threatened	
Small-Anthered bittercress *(Cardamine micranthera)*	Endangered	
Smooth coneflower *(Echinacea laevigata)*	Endangered	
Swamp pink *(Helonias bullata)*	Threatened	
Virginia Round-Leaf birch *(Betula uber)*	Threatened	
Virginia sneezeweed *(Helenium virginicum)*	Threatened	
Virginia spiraea *(Spiraea virginiana)*	Threatened	
Insects		
Mitchell's Satyr Butterfly *(Neonympha mitchellii mitchellii)*	Endangered	
Northeastern beach tiger beetle *(Cicindela dorsalis dorsalis)*	Threatened	
Rusty Patched Bumble Bee (*Bombus affinis*)	Endangered	
Lichens		
Rock Gnome lichen *(Gymnoderma lineare)*	Endangered	
Mammals		
Carolina Northern Flying squirrel *(Glaucomys sabrinus coloratus)*	Endangered	
Gray bat *(Myotis grisescens)*	Endangered	
Indiana bat *(Myotis sodalis)*	Endangered	
Northern long-eared Bat *(Myotis septentrionalis)*	Threatened	
Virginia Big-Eared bat *(Corynorhinus (=plecotus) townsendii virginianus)*	Endangered	Final designated
Reptiles		
Green sea turtle *(Chelonia mydas)*	Threatened	
Hawksbill sea turtle *(Eretmochelys imbricata)*	Endangered	Final designated
Kemp's Ridley sea turtle *(Lepidochelys kempii)*	Endangered	

Leatherback sea turtle *(Dermochelys coriacea)*	Endangered	Final designated
Loggerhead sea turtle *(Caretta caretta)*	Threatened	Final designated
Snails		
Virginia Fringed Mountain snail *(Polygyriscus virginianus)*	Endangered	

Critical habitat which lie fully or partially within the Commonwealth of Virginia

Clams	**Critical Habitat Type**
Cumberlandian combshell *(Epioblasma brevidens)*	Final designated
Fluted kidneyshell *(Ptychobranchus subtentum)*	Final designated
Oyster mussel *(Epioblasma capsaeformis)*	Final designated
Purple bean *(Villosa perpurpurea)*	Final designated
Rough rabbitsfoot *(Quadrula cylindrica strigillata)*	Final designated
Slabside Pearlymussel *(Pleuronaia dolabelloides)*	Final designated
Fishes	
Slender chub *(Erimystax cahni)*	Final designated
Spotfin Chub *(Erimonax monachus)*	Final designated
Yellowfin madtom *(Noturus flavipinnis)*	Final designated
Mammals	
Indiana bat (*Myotis sodalis*)	Final designated

APPENDIX D: SPECIES LISTED BY THE COMMONWEALTH OF VIRGINIA[1]

[1]List obtained from <https://www.dgif.virginia.gov/wp-content/uploads/virginia-threatened-endangered-species.pdf> on 23 August 2017, Townsend 2016, The Virginia Administrative Code 2 VAC 5-320-10, The Code of Virginia § 3.2-1007 and § 3.2-1009.

Common Name	***Scientific Name***	**Status**
Amphibians		
Mabee's Salamander	*Ambystoma mabeei*	LT
Eastern Tiger Salamander	*Ambystoma tigrinum*	LE
Barking Treefrog	*Hyla gratiosa*	LT
Shenandoah Salamander	*Plethodon shenandoah*	LE
Arachnida (spiders and pseudoscorpions)		
Spruce-fir moss spider	*Microhexura montivaga*	LE
Birds		
Henslow's Sparrow	*Ammodramus henslowii*	LT
Piping Plover	*Charadrius melodus*	LT
Wilson's Plover	*Charadrius wilsonia*	LE
Peregrine Falcon	*Falco peregrinus*	LT
Gull-billed Tern	*Gelochelidon nilotica*	LT
Roseate tern	*Sterna dougallii dougallii*	LE
Loggerhead Shrike	*Lanius ludovicianus*	LT
Black Rail	*Laterallus jamaicensis*	LE
Bachman's Sparrow	*Peucaea aestivalis*	LT
Red-cockaded Woodpecker	*Picoides borealis*	LE
Bewick's Wren	*Thryomanes bewickii altus*	LE
Bachman's warbler (=wood)	*Vermivora bachmanii*	LE
Kirtland's warbler	*Dendroica kirtlandii*	LE
Red Knot	*Calidris canutus rufa*	LT
Bivalvia (mussels)		
Dwarf Wedgemussel	*Alasmidonta heterodon*	LE
Brook Floater	*Alasmidonta varicosa*	LE
Slippershell Mussel	*Alasmidonta viridis*	LE
Spectaclecase	*Cumberlandia monodonta*	LE
Fanshell	*Cyprogenia stegaria*	LE
Dromedary Pearlymussel	*Dromus dromas*	LE
Elephant Ear	*Elliptio crassidens*	LE
Cumberland Combshell	*Epioblasma brevidens*	LE
Oyster Mussel	*Epioblasma capsaeformis*	LE
Tan Riffleshell	*Epioblasma florentina aureola*	LE
Green-blossom (Pearlymussel)	*Epioblasma torulosa gubernaculum*	LE
Snuffbox	*Epioblasma triquetra*	LE
Shiny Pigtoe	*Fusconaia cor*	LE
Fine-rayed Pigtoe	*Fusconaia cuneolus*	LE
Atlantic Pigtoe	*Fusconaia masoni*	LT
Cracking Pearlymussel	*Hemistena lata*	LE

Pink Mucket (Pearlymussel)	*Lampsilis abrupta*	LE
Tennessee Heelsplitter	*Lasmigona holstonia*	LE
Green Floater	*Lasmigona subviridis*	LT
Birdwing Pearlymussel	*Lemiox rimosus*	LE
Fragile Papershell	*Leptodea fragilis*	LT
Black Sandshell	*Ligumia recta*	LT
Little-winged Pearlymussel	*Pegias fabula*	LE
Sheepnose	*Plethobasus cyphyus*	LE
James Spinymussel	*Pleurobema collina*	LE
Ohio Pigtoe	*Pleurobema cordatum*	LE
Rough Pigtoe	*Pleurobema plenum*	LE
Pyramid Pigtoe	*Pleurobema rubrum*	LE
Slabside Pearlymussel	*Pleuronaia dolabelloides*	LE
Fluted kidneyshell	*Ptychobranchus subtentum*	LE
Rough Rabbits Foot	*Quadrula cylindrica strigillata*	LE
Cumberland Monkeyface (Pearlymussel)	*Quadrula intermedia*	LE
Pimple Back	*Quadrula pustulosa*	LT
Appalachian Monkeyface (Pearlymussel)	*Quadrula sparsa*	LE
Purple Liliput	*Toxolasma lividum*	LE
Deertoe	*Truncilla truncata*	LE
Purple Bean	*Villosa perpurpurea*	LE
Cumberland Bean (Pearlymussel)	*Villosa trabalis*	LE
Pistolgrip	*Tritogonia verrucosa*	LT
Rayed Bean	*Villosa fabalis*	LE
Coleoptera (beetles)		
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	LT
Holsinger's Cave Beetle	*Pseudanophthalmus holsingeri*	LE
Thomas’ Cave Bettle	*Pseudanophthalmus holsingeri*	LE
American Buring Bettle	*Nicrophorus americanus*	LE
Crustacea (Amphipods, Isopods, and decapods)		
Madison Cave Isopod	*Antrolana Iira*	LT
Big Sandy Crayfish	*Cambarus veteranus*	LE
Lee County Cave Isopod	*Lirceus usdagalun*	LE
Madison Cave Amphipod	*Stygobromus stegerorum*	LT
Diplopoda (millipedes)		
Ellett Valley Pseudotremia Millipede	*Pseudotremia cavernarum*	LT
Laurel Creek Xystodesmid Millipede	*Sigmoria whiteheadi*	LT
Fish		
Atlantic Sturgeon	*Acipenser oxyrinchus*	LE
Western Sand Darter	*Ammocrypta clara*	LT
Blackside Dace	*Chrosomus cumberlandensis*	LT
Tennessee Dace	*Chrosomus tennesseensis*	LE
Steelcolor Shiner	*Cyprinella whipplei*	LT
Blackbanded Sunfish	*Enneacanthus chaetodon*	LE

Spotfin chub (Turquoise Shiner)	*Erimonax monachus*	LT
Slender Chub	*Erimystax cahni*	LT
Sharphead Darter	*Etheostoma acuticeps*	LE
Greenfin Darter	*Etheostoma chlorobranchium*	LT
Carolina Darter	*Etheostoma collis*	LT
Golden Darter	*Etheostoma denoncourti*	LT
Duskytail Darter	*Etheostoma percnurum*	LE
Whitemouth Shiner	*Notropis alborus*	LT
Emerald Shiner	*Notropis atherinoides*	LT
Yellowfin Madtom	*Noturus flavipinnis*	LT
Orangefin Madtom	*Noturus gilberti*	LT
Roanoke Logperch	*Percina rex*	LE
Sickle darter	*Percina williamsi*	LT
Paddlefish	*Polyodon spathula*	LT
Shortnose sturgeon	*Acipenser brevirostrum*	LE
Variegate darter	*Etheostoma variatum*	LE
Gastropoda (snails)		
Appalachian Springsnail	*Fontigens bottimeri*	LE
Virginia Springsnail	*Fontigens morrisoni*	LE
Shaggy Coil	*Helicodiscus diadema*	LE
Rubble Coil	*Helicodiscus lirellus*	LE
Thankless ghostsnail	*Holsingeria unthanksensis*	LE
Spiny Riversnail	*Io fluvialis*	LT
Spirit Supercoil	*Paravitrea hera*	LE
Brown Supercoil	*Paravitrea septadens*	LT
Virginia Fringed Mountain Snail (=Virginia coil)	*Polygyriscus virginianus*	LE
Spider elimia	*Elimia arachnoidea*	LE
Heteroptera (true bugs)		
Virginia Piedmont Water Boatman	*Sigara depressa*	LE
Rusty Patched Bumble bee	*Bombus affinis*	LT
Homoptera (cicadas and leaf hoppers)		
Buffalo Mountain mealybug	*Puto kosztarabi*	LE
Lepidoptera (butterflies and moths)		
Mitchell's satyr	*Neonympha mitchellii*	LE
Appalachian grizzled skipper	*Pyrgus centaureae wyandot*	LT
Mammals		
Rafinesque's Eastern Big-eared Bat	*Corynorhinus rafinesquii macrotis*	LE
Virginia Big-eared Bat	*Corynorhinus townsendii virginianus*	LE
Carolina Northern Flying Squirrel	*Glaucomys sabrinus coloratus*	LE
Snowshoe Hare	*Lepus americanus*	LE
Southern Rock Vole	*Microtus chrotorrhinus carolinensis*	LE
Gray Bat	*Myotis grisescens*	LE
Indiana Bat	*Myotis sodalis*	LE
Little Brown Bat	*Myotis lucifugus*	LE

Northern Long-eared Bat	*Myotis septentrionalis*	LT
Tri-colored Bat	*Perimyotis subflavus*	LE
American Water Shrew	*Sorex palustris*	LE
Eastern puma	*Puma (Felis) concolor cougar*	LE
Gray wolf	*Canis lupus*	LE
Blue whale	*Balaenoptera musculus*	LE
Finback whale	*Balaenoptera physalus*	LE
Humpback whale	*Meagaptera novaeangliae*	LE
North Atlantic Right whale	*Eubalaena glacialis*	LE
Sei whale	*Balaenoptera borealis*	LE
Sperm whale	*Physeter catodon (=macrocephalus)*	LE
West Indian manatee	*Trichechus manatus*	LE
Reptiles		
Loggerhead Sea Turtle	*Caretta caretta*	LT
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	LE
Eastern Chicken Turtle	*Deirochelys reticularia*	LE
Wood Turtle	*Glyptemys insculpta*	LT
Bog Turtle	*Glyptemys muhlenbergii*	LE
Eastern Glass Lizard	*Ophisaurus ventralis*	LT
Green sea turtle	*Chelonia mydas*	LT
Hawksbill sea turtle	*Eretmochelys imbricata*	LE
Kemp's ridley sea turtle	*Lepidochelys kempii*	LE
Leatherback sea turtle	*Dermochelys coriacea*	LE
Vascular Plants		
Sensitive Joint-vetch	*Aeschynomene virginica*	LT
Sea-beach amaranth	*Amaranthus pumilus*	LT
Virginia Roundleaf birch	*Betula lenta var. uber*	LE
Shale barren rock cress	*Boechera serotina*	LT
Valley Doll’s – daisy	*Boltonia montana*	LE
Small-anthered Bittercress	*Cardamine micranthera*	LE
Juniper sedge	*Carex juniperorum*	LE
Millboro leatherflower	*Clematis viticanlis*	LT
Bentley's coralroot	*Corallorhiza bentleyi*	LE
Smooth Coneflower	*Echinacea laevigata*	LT
Harper's fimbry	*Fimbristylis perpusilla*	LE
Harperella	*Harperella nodosa*	LE
Virginia Sneezeweed	*Helenium virginicum*	LE
Swamp-pink	*Helonias bullata*	LE
Long-stalked Holly	*Ilex collina*	LE
Peters Mountain mallow	*Iliamna corei*	LE
Virginia quillwort	*Isoletes virginica*	LE
Small Whorled Pogonia	*Isotria medeoloides*	LE
New Jersey Rush	*Juncus caesariensis*	LT
Narrow-leaved Spatterdock	*Nuphar sagittifolia*	LT

Ginseng	*Panax quinquefolius L.*	LT
Prairie fringed orchid	*Platanthera leucophaea*	LT
Michaux's Sumac	*Rhus michauxii*	LT
Northeastern Bulrush	*Scirpus ancistrochaetus*	LE
Reclining Bulrush	*Scirpus flaccidifolius*	LT
Virginia Spiraea	*Spiraea virginiana*	LE
Running Glade Clover	*Trifolium calcaricum*	LE
Northern Prostrate Clubmoss	*Lycopodiella marqueritiae*	LT

[2] In the Commonwealth of Virginia, plants and insects fall under one authority while amphibians, wild birds, mussels, fish, gastropods, mammals and reptiles fall under the jurisdiction of another authority. Each authority, as outlined below, has different definitions for listing status.

Plant and Insect Status Codes and Definitions:
Code of Virginia, Title 3.2, Chapter 10, sections 1000–1011. This section of the Code gives the Virginia Department of Agriculture and Consumer Services legislative authority over the listing, protection and taking of threatened and endangered plant and insect species in the Commonwealth.

LE (Endangered): Any species or variety of plant life or insect life determined by the Board to be in danger of extinction throughout all or a significant part of its range other than a species determined by the Commissioner not to be in the best interest of the welfare of man.

LT (Threatened): Any species determined by the Board to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its native range.

Fish and Wildlife Status Codes and Definitions:
Code of Virginia, Title 29.1, Chapter 5, sections 563–568. This section of the Code gives the Virginia Department of Game and Inland Fisheries legislative authority over the listing, protection and taking of threatened and endangered fish and wildlife species in the Commonwealth.

LE (Endangered): Any species which is in danger of extinction throughout all or a significant portion of its range.

LT (Threatened): Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

APPENDIX E: BIRDS OF CONSERVATION CONCERN IN USFWS's NORTHEAST REGION[1]

[1]List obtained from (USFWS 2008).

Common Name	Scientific Name
Red-throated loon	*Gavia stellata*
Pied-billed grebe	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
Greater shearwater	*Ardenna gravis*
Audubon's shearwater	*Puffinus lherminieri*
American bittern	*Botaurus lentiginosus*
Least bittern	*Ixobrychus exilis*
Snowy egret	*Egretta thula*
Bald eagle	*Haliaeetus leucocephalus*
Peregrine falcon	*Falco peregrinus*
Yellow rail	*Coturnicops noveboracensis*
Black rail	*Laterallus jamaicensis*
Wilson's plover	*Charadrius wilsonia*
American oystercatcher	*Haematopus palliatus*
Solitary sandpiper	*Tringa solitaria*
Lesser yellowlegs	*Tringa flavipes*
Upland sandpiper	*Bartramia longicauda*
Whimbrel	*Numenius phaeopus*
Hudsonian godwit	*Limosa haemastica*
Marbled godwit	*Limosa fedoa*
Red knot	*Calidris canutus*
Semipalmated sandpiper	*Charadrius semipalmatus*
Purple sandpiper	*Calidris maritima*
Buff-breasted sandpiper	*Calidris subruficollis*
Short-billed dowitcher	*Limnodromus griseus*
Least tern	*Sternula antillarum*
Gull-billed tern	*Gelochelidon nilotica*
Arctic tern	*Sterna paradisaea*
Black skimmer	*Rynchops niger*
Short-eared owl	*Asio flammeus*
Whip-poor-will	*Antrostomus vociferus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Olive-sided flycatcher	*Contopus cooperi*
Loggerhead shrike	*Lanius ludovicianus*
Bewick's wren	*Thryomanes bewickii*
Sedge wren	*Cistothorus platensis*
Bicknell's thrush	*Catharus bicknelli*
Wood thrush	*Hylocichla mustelina*
Blue-winged warbler	*Vermivora cyanoptera*
Golden-winged warbler	*Vermivora chrysoptera*
Prairie warbler	*Setophaga discolor*

Bay-breasted warbler	*Setophaga castanea*
Cerulean warbler	*Setophaga cerulea*
Worm-eating warbler	*Helmitheros vermivorum*
Swainson's warbler	*Limnothlypis swainsonii*
Kentucky warbler	*Geothlypis formosa*
Canada warbler	*Cardellina canadensis*
Henslow's sparrow	*Ammodramus henslowii*
Nelson's sharp-tailed sparrow	*Ammodramus nelsoni*
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*
Seaside sparrow	*Ammodramus maritimus*
Rusty blackbird	*Euphagus carolinus*