ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN MICHIGAN

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SUMMARY

Michigan wildlife has many positive values and is an important part of life in the state. However, as human populations expand, and land is used for human needs, there is increasing potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) analyzes the potential environmental impacts of alternatives for United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) involvement in the reduction of conflicts with mammals in Michigan, including damage to property, agricultural and natural resources and risks to human and livestock health and safety. The proposed wildlife damage management activities could be conducted on public and private property when the property owner or manager requests assistance and/or when assistance is requested by an appropriate state, federal, tribal or local government agency.

The preferred alternative considered in the EA, would be to continue the current Integrated Wildlife Damage Management (IWDM) program in Michigan. The IWDM strategy encompasses the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. Under this action, WS could provide technical assistance and direct operational assistance including non-lethal and lethal management methods, as described in the WS Decision Model (Slate et al. 1992). When appropriate, non-lethal methods like physical exclusion, cultural practices, habitat modification, repellents or harassment would be recommended and utilized to reduce damage. In other situations, mammals would be removed as humanely as possible using shooting, trapping, snare/cable restraints, aerial shooting from aircraft (feral swine only), or registered euthanasia drugs. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or could include instances where application of lethal methods alone would be the most appropriate strategy. Other alternatives examined in the EA include an alternative in which WS is restricted to the use and recommendation of only non-lethal mammal damage management (MDM) methods; and an alternative in which WS provides no assistance (Chapter 3). WS involvement in mammal damage management is closely coordinated with the Michigan Department of Natural Resources (MDNR). All WS activities are conducted in accordance with applicable state, federal, tribal, and local laws, and regulations.

The EA provides a detailed analysis of the impacts of each alternative on target mammal populations; non-target species including state and federally-listed threatened and endangered species; human health and safety; and humaneness of the alternatives used; impacts on stakeholders, including impacts on aesthetic values.

ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CDC	Center for Disease Control
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWD	Chronic Wasting Disease
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMIA	Federal Meat Inspection Act
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MDM	Mammal Damage Management
MDNR	Michigan Department of Natural Resources
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	Natural Historic Preservation Act
NRMP	National Rabies Management Program
SOP	Standard Operating Procedure
TB	Tuberculosis
T&E	Threatened and Endangered
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Department of the Interior, Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services

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CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife 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 wildlife which increases the potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS involvement in mammal damage management (MDM) in Michigan.

Wildlife damage management (WDM) is the science of reducing damage or other problems associated with wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 2015). Human/wildlife conflict issues are complicated by the wide range of public responses to wildlife and wildlife damage. What may be unacceptable damage to one person may be a normal cost of living with nature to someone else. Wildlife has either positive or negative values to individuals, depending on varying human perspectives and circumstances (Decker and Goff 1987). Wildlife are generally regarded as providing economic, recreational and aesthetic benefits and the mere knowledge that wildlife exists is a positive benefit to many people. However the activities of some wildlife may result in economic losses to agriculture, damage to property, or risks to human health and safety. Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well.

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 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c)). WS' activities are conducted to prevent or reduce wildlife damage to agricultural, industrial, natural resources, property, livestock, and threats to public health and safety when requested by the property owner/manager on private and public lands in cooperation with federal, state and local agencies, tribes, private organizations, and individuals. The WS program uses an IWDM approach (WS Directive 2.105) in which a combination of methods may be used or recommended to reduce wildlife damage. These methods may include non-lethal techniques like alteration of cultural practices, habitat management, repellents, frightening devices, and physical exclusion to prevent or reduce damage. The reduction of wildlife damage may also require removal of individual animals, reducing the local animal populations through lethal means. In some instances, the goal may be to eradicate an invasive species. 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 wildlife damage management from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies.

WS prepared this EA to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of individual 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 and planned damage management program.

1.1 PURPOSE OF THIS EA

This EA addresses and evaluates the potential impacts on the human environment from alternatives for WS involvement in the protection of agricultural and natural resources, property, livestock, and public health and safety from damage and risks associated with mammals in Michigan. Under the Proposed Action, MDM could be conducted on private, federal, state, tribal, county, and municipal lands upon request. A variety of native mammal species have potential to be the subject of WS MDM activities, including: American marten (*Martes americana*), badger (*Taxidea taxus*), beaver (*Castor Canadensis*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*), coyotes (*Canis latrans*), Eastern chipmunk (*Tamias striatus*), Eastern cottontail (*Sylvilagus floridanus*), elk (*Cervus elaphus),* ermine/short-tailed weasel (*Mustela ermine*), fisher (*Martes penanti*), fox squirrel (*Sciurus niger*), gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carlolinensis*), least weasel (*Mustela rixosa*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), muskrat (*Ondatra zibethica*), Northern flying squirrel (*Glaucomys sabrinus*), Norway rat (*Rattus norvegicus*), pocket gophers (*Geomys* spp.), porcupine (*Erethizon dorsatum),* raccoons (*Procyon lotor*), red fox (*Vulpes vulpes*), red squirrel (*Tamiasciurus hudsonicus*), river otter (*Lontra canadensis*), snowshoe hare (*Lepus americanus*), Southern flying squirrel (*Glaucomys volans*), striped skunk (*Mephitis mephitis*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), Virginia opossums (*Didelphis virginianus*), and woodchuck/groundhog (*Marmota monax*). WS MDM activities will potentially involve feral species such as: feral cats (*Felix* sp.), feral dogs (*Canis sp.*), feral rabbits (*Oryctolagus cuniculus*), and feral swine (*Sus scrofa*). This EA will also address limited removal of miscellaneous mice, shrews, moles, and voles during small mammal surveys at airports.

This analysis also includes management of free ranging white-tailed deer (*Odocoileus virginianus*) and multiple species of captive cervids (including; white-tailed deer, elk (*Cervus Canadensis*), mule deer (*O. hemionus*), and other species in the Family Cervidae). Management of damage by these species is currently addressed in an environmental assessment on white-tailed deer damage management in Michigan (USDA 2002). Once completed, this analysis will replace the existing Michigan white-tailed deer EA.

The issues and alternatives associated with mammal damage management were initially developed by WS with review by the cooperating and consulting agencies. Cooperating and consulting agencies assisted with the identification of additional issues pertinent to managing damage associated with mammals in Michigan. This EA will be made available to the public for review and comment prior to the issuance of a decision regarding the alternative to be implemented and its environmental impacts.

1.2 NEED FOR ACTION

Conflicts between humans and wildlife are common in Michigan. The Michigan WS program has a long history of partnering with Michigan Department of Natural Resources (MDNR) and other agencies and cooperators on a wide variety of wildlife species causing damage to numerous resources. WS and the MDNR receive requests for assistance with wildlife damage from the public, tribes, and state, federal and local government agencies. Comprehensive surveys of mammal damage in Michigan have not been conducted, but WS does maintain a Management Information System (MIS) database to document assistance that the program provides. Table 1.1 summarizes technical assistance projects (advice/ recommendations) completed by the Michigan WS program for Fiscal Years 2009-2013 for species covered by this EA. MIS data are limited to information that is collected from people who have requested services or information from WS. The data does not include requests received or responded to by local, state or other federal agencies or private companies. Consequently, the number of requests for assistance to WS does not reflect the full extent of need for action, but does provide an indication that needs exists.

The MDNR has state management responsibility for resident mammals, and conducts mammal management programs for furbearers, game species, and non-game mammals. The MDNR provides technical assistance and issues damage management permits, but rarely provides any operational assistance with damage management. WS potential involvement in the area of mammal damage management would be to provide basic recommendations, refer callers to the MDNR or private pest control companies as appropriate, and to provide direct management assistance with the implementation of mammal damage management programs upon request and as permitted or otherwise authorized by the MDNR or the Tribes. To date, some examples of operational programs conducted by WS in Michigan have included mammal damage management at airports, management of crop and natural resource damage by feral swine, and reduction of nuisance complaints and personal property damage by white-tailed deer in urban/suburban settings. Additionally, WS cooperates with state and federal agencies to assess and manage disease risks involving wild and feral mammals and captive wildlife. WS has provided information on mammal damage management in response to over 70 requests during FY 2009-2013 (Table 1.1).

Table 1.1 WS' Technical assistance projects conducted in Michigan FY2009 - FY2013

Species	# Projects
Beaver	1
Black Bear	1
Coyote	9
Fallow Deer	1
Feral Swine	18
Gray Fox	1
Ground Squirrel (Other)	1
Raccoon	5
Red Fox	3
Red Squirrel	1
Striped Skunk	1
White-Tailed Deer (Free Ranging)	10
Woodchuck/Groundhog	2
TOTAL	**72**

As shown in Table 1.2 damages to property and agricultural resources associated with mammals that have been reported to or verified by WS and have totaled $13,771 between FY 2009 and FY 2013. An additional $15,725 in damages to property and agricultural resources were documented during direct control activities conducted by WS during the same period. Although monetary damages to natural resources and human safety have been reported and verified by WS, requests for assistance often address threats that mammals can pose to human safety and natural resources for which monetary losses are difficult to determine. For human safety, requests for WS' assistance have often been received to reduce the threat of disease transmission and the threat of aircraft striking mammals at airports.

Most requests for assistance received by WS involving threats to human safety arise from the risks associated with disease transmission in areas where the public may encounter mammals. Additional requests result from concerns over aircraft or vehicle strikes. Aircraft striking mammals can cause catastrophic failure of the aircraft, which has the potential to threaten passenger safety. The difficulties of placing a monetary value on reducing threats to human safety and natural resources are similar.

Table 1.2 Animal species and type of damage for which WS provided assistance during FY2009-FY2013

Species	Resource[a]			
	A	N	P	H
Beaver				X
Black Bear				X
Coyote	X		X	X
Fallow Deer	X			
Feral Swine	X	X	X	X
Gray Fox				X
Ground Squirrel (Other)				X
Raccoon			X	X
Red Fox			X	X
Red Squirrel			X	
Striped Skunk				X
White-Tailed Deer (Free Ranging)	X		X	X
Woodchuck/Groundhog			X	X

[a]A=Agriculture, N =Natural Resources, P=Property, H=Human Safety

1.2.1 Need for Mammal Damage Management to Protect Human Health and Safety

Human health and safety concerns and problems associated with mammals include, but are not limited to, the potential for transmission of zoonotic diseases to humans, mammal hazards at airports, and risks and actual instances of mammals injuring humans.

Zoonotic Diseases

Zoonotic diseases are diseases of animals which are communicable to humans. Some wild and feral mammals may carry disease causing organisms or parasites including viruses, bacteria, fungi, protozoans and rickettsial organisms, which pose a risk to humans (Table 1.3). Disease transmission to humans from wildlife is uncommon with few documented occurrences. However, the infrequency of such transmission does not diminish the concerns of individuals requesting assistance that are fearful of exposure to a diseased animal because disease transmissions have been documented to occur. Usually, MDM is requested because of a perceived risk to human health or safety associated with wild animals living near humans, from animals acting out of character in human-inhabited areas during the day, or showing no fear when humans are present. WS actively attempts to educate the public about the risks associated with disease transmission from wildlife to humans through technical assistance and by providing technical leaflets on the risks of exposure. It is the goal of agricultural and human health programs to prevent disease/illness from occurring. WS works with cooperators on a case-by-case basis to assess the nature and magnitude of the wildlife conflict regarding the health risks

associated. It is the choice of the individual cooperator to tolerate the potential health risks or to seek to reduce those risks.

WS' primary involvement in the management of zoonotic diseases would be to aid other government and research entities in monitoring for the presence or absence of diseases in wildlife and provide advice on risk reduction methods. Monitoring data can be used to predict potential risks to human health and safety and aid agencies in directing management efforts. Most disease sampling occurs ancillary to other wildlife damage management activities (i.e., disease sampling occurs opportunistically after wildlife have been captured or lethally taken for other purposes). For example, WS may sample deer harvested during the annual hunting season or during other damage management programs for tuberculosis, or may collect ticks from raccoons that were lethally taken to alleviate damage occurring to property. WS could sample feral hogs taken by hunters or during damage management activities to test for several diseases of concern to human or agricultural animal health. In the event of a disease outbreak or an imminent realistic threat of an outbreak, WS could also be requested to conduct localized wildlife population reduction or removal of captive wildlife to prevent spread of disease to other areas.

This section includes examples of zoonotic diseases for which WS could provide surveillance or management assistance. This discussion on zoonoses is intended to briefly address the more common known zoonoses for those species specifically addressed in this EA but is not intended to be an exhaustive discussion of all potential zoonoses. The transmission of diseases from wildlife to humans is neither well documented nor well understood for most diseases. 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 animal 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 foreign countries.

Table 1.3. Wildlife Diseases That Pose Potential Human Health Risks in the United States (modified from Davidson and Nettles 2006).

Disease	**Causative Agent**	**Hosts**
Anthrax	bacterium (*Bacillus antracis*)	cattle, sheep, horses, swine, white-tailed deer, dogs, cats
Bovine Brucellosis	bacterium (*Brucela abortus*)	Cattle, bison, swine (evidence from Texas that organism has infected coyotes that scavenged aborted fetuses and placentas of infected cattle)

Disease	Causative Agent	Hosts
Bovine Tuberculosis	bacterium (*Mycobacterium bovis*)	Cattle, deer (wildlife reservoir), scavengers such as coyotes, raccoons, opossums are spill over hosts
Demodectic Mange	mite (*Demodex odocoilei*)	White-tailed deer
Dermatophilosis	bacterium (*Dermatophilus congolensis*)	mammals (wild and domestic)
Echinococcus Infection	tapeworm (*Echinococcus multilocularis*)	foxes, coyotes, wolves
Giardiasis	protozoan parasite (*Giardia lambia*, *G. Duodenalis*, and other *Giardia* sp.- taxonomy controversial)	beavers, coyotes, dogs, cats
Hantavirus Pulmonary Syndrome	Hantaviruses	Rodents
Histoplasmosis	fungus (*Histoplasma capsulatum*)	fungus occurs in bat guano
Larval Migrans	nematode (*Baylisascaris procyonis*)	raccoons, skunks
Leptospirosis	bacteria (*Leptospira interrogans*) over 180 different serovars	all mammals
Lyme Disease	spirocheate (*Borelia burgdorferi*)	Rodents
Murine Typhus	bacteria (*Rickettsia mooseri* = R. typhi)	rats, mice, as hosts for primary flea, louse or mite host
Plague	*Yersinia pestis*	Rodents
Rabies	virus (Rhabidovirus)	all mammals (high risk wildlife: raccoons, fox, skunks, bats)
Rocky Mountain Spotted Fever	bacterium *(Rickettsii rickettsia)*	dogs and rodents
Sarcoptic Mange	mite (*Sarcoptes scabiei*)	red foxes, coyotes, wolves, domestic dogs
Spirometra Infection	tapeworm, (*Spirometra mansonoides*)	bobcats, raccoons, foxes, dogs, cats
Swine brucellosis	bacterium (*Brucella suis*)	Swine
Toxoplasmosis	protozoan parasite (*Toxoplasma gondii*)	cats, such as bobcats, are definitive hosts, mammals and birds are intermediate hosts
Trichinosis	nematode (*Trichinella spiralis*)	swine, bears, raccoons, foxes, rats
Tularemia	Bacterium	rodents, rabbits, hares

Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal. Rabies is preventable, but it is fatal without prior vaccination or post-exposure treatment. All mammals including humans are susceptible to rabies. Over the last 100 years, the vector of rabies in the United States has changed dramatically. About 90% or greater of all

animal cases reported annually to CDC now occur in wildlife (Krebs et al. 2000, CDC 2013c). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild omnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or two people per year in the 1990s. Modern day prophylaxis, which is the series of vaccine injections given to people who have been potentially or actually exposed, has proven nearly 100% successful in preventing mortality when administered promptly (CDC 2013c). In the United States, human fatalities associated with rabies occur in people who fail to seek timely medical assistance, usually because they were unaware of their exposure to rabies. Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, exceeding $300 million annually. Those costs include the vaccination of companion animals, maintenance of rabies laboratories, medical costs such as those incurred for exposure case investigations, rabies post-exposure prophylaxis (PEP), and animal control programs (CDC 2013c).

In Michigan, rabies is rarely diagnosed in humans. However, in 2009 a man died of rabies after not seeking treatment following an exposure to a bat (Michigan Emerging Diseases 2013). Prior to this, the last human case in Michigan was reported in 1983. In Michigan, bats and skunks are primary reservoirs of the rabies virus (CDC 2013c). Occasionally, they transmit the virus to other wild animals such as fox or raccoons, or unvaccinated domestic animals. Bats are the species most often tested for rabies in Michigan, followed by cats and dogs (Michigan Emerging Diseases 2013).

Raccoon Roundworm (*Baylisascaris procyonis*, BP) is a common roundworm found in the small intestine of raccoons which causes severe or fatal encephalitis in a variety of birds and mammals, including humans (CDC 2013e). BP also can cause eye and organ damage in humans. Humans become infected with raccoon roundworm by ingesting soil or other materials (e.g., bark or wood chips) contaminated with raccoon feces containing *Baylisascaris* eggs. Young children are at particular risk for infection as a result of behaviors such as placing potentially contaminated fingers and objects like toys into their mouths (CDC 2013e). Raccoons are the primary host for the roundworm, but other animals including birds and small mammals can also be infected. Predator animals including dogs may also become infected by eating animals that are infected. In some dogs, *Baylisascaris* may develop to adult worms and pass eggs in the dogs' feces (CDC 2013e).

Raccoons infected with *Baylisascaris* inhabit most of the United States. Despite the prevalence of infection in raccoons, infection of humans is rare and less than 25 cases have been documented in the U.S. (CDC 2013e). Cases have been reported in California, Illinois, Louisiana, Massachusetts, Michigan, Minnesota, Missouri, New York, and Pennsylvania. As of 2012, there were 16 reported human neurological cases in the U.S.; six of the infected persons died (CDC 2013e).

The risk for *Baylisascaris* infection is greatly reduced by avoiding direct contact with raccoons and their urban habitats, by removing raccoon access to food and potential denning sites,

excluding raccoons from children's play areas, and by limiting human exposure to areas and materials that might be contaminated by raccoon feces.

Tuberculosis (TB) is a contagious disease in mammals and can be caused by different species of *Mycobacterium* bacteria. Tuberculosis in humans is primarily caused by *M. tuberculosis*. The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. If not treated properly, TB can be fatal and was once the leading cause of death in the United States. TB is typically spread through the air from one person or animal to another. In rare instances, TB in humans can also be caused by a species of *Mycobacterium* called *M. bovis*, which primarily infects cattle and other bovine-like animals (e.g., bison, deer, and goats). Humans most commonly become infected with *M. bovis* through consumption of unpasteurized milk products from infected cows (CDC 2013d). Human TB caused by *M. bovis* in the U.S. is rare because of milk pasteurization and culling of infected cattle herds. However, in 2013, bovine TB-infected milk caused an infection in a Michigan family after drinking milk from their cows prior to pasteurization. In January 2005, the first-known case of transmission of TB from deer to humans was reported in Michigan. The hunter was infected when he cut his hand while field dressing an infected deer. The hunter was treated with antibiotics and made a full recovery (Wilkins et al. 2008).

In 1917, the federal government established a bovine TB eradication program. Most states in the U.S. have been declared free of the disease (CDC 2013d). However, bovine TB is found in free-ranging white-tailed deer and in dairy herds in the Northern Lower Peninsula of Michigan. Deer are considered the wildlife reservoir host for bovine TB in Michigan, but other mammals have been found to become infected. Animals such as coyotes, raccoons, opossums, and feral cats can pick up the bacteria through consumption of contaminated deer carcasses, or indirectly from contaminated feed from infected cattle or deer. Although the risk is low, humans could potentially become infected when handling these spill-over hosts. Since these animals are fur-bearers, trappers may be more at risk, especially if not wearing gloves and not washing their hands and tools effectively.

Tularemia is a disease caused by the bacterium *Francisella tularensis* (CDC 2013b). Tularemia typically infects animals such as rodents, rabbits, and hares. Usually, people become infected through the bite of infected ticks or tabanid flies, by handling infected sick or dead animals, by eating or drinking contaminated food or water, or by inhaling airborne bacteria. About 120 human cases of tularemia are reported each year in the U.S (CDC 2013b). Most cases occur in the south-central and western states; however cases have been reported in every state except Hawaii. Without treatment with appropriate antibiotics, tularemia can be fatal (CDC 2013a). The causative agent of tularemia is one of the most infectious pathogenic bacteria known, requiring as few as 10 organisms to cause disease. The Working Group on Civilian Biodefense considers tularemia to be a dangerous potential biological weapon because of its extreme infectivity, ease of dissemination, and substantial capacity to cause illness and death (Dennis et al. 2001). Many wild animal species may be infected, (hares, rabbits, squirrels, muskrats, beavers, deer), and occasionally certain domestic animals can also be infected (sheep and cats). The rabbit is the species most often involved in disease outbreaks. The bacteria can also be

found in ticks and deerflies. Tularemia in humans is relatively rare in Michigan, with two cases reported from 2003-2012 (CDC 2013b).

Diseases in feral swine serve as a significant risk to human health. Feral swine are potential reservoirs for at least 30 viral and bacterial diseases (Davidson 2006, Samuel et al. 2001, Williams and Barker 2001) and 37 parasites (Forrester 1991) that are transmissible to humans. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that can be carried by feral swine that are also known to infect humans (Stevens 1996, Hubalek et al. 2002, Seward et al. 2004). Infection may result from direct exposure to swine (e.g., hunters handling carcasses), through contamination of food crops (California Food Emergency Response Team 2007), or through secondary infection of a third host (West et al. 2009). When diseases are transmitted through a third host, feral swine transmit the diseases to other wild mammals, birds, and reptiles, which in turn may transmit them to domestic livestock or humans. Although incidence of disease transmission from feral swine to humans is relatively uncommon, some diseases like brucellosis, tuberculosis, and tularemia can be fatal if not recognized and treated in a timely manner.

Mammal Hazards to Public Safety at Airports

Airports provide ideal conditions for many wildlife species due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted; so wildlife living within airport boundaries are protected during hunting and trapping seasons and are insulated from many other human disturbances.

The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer et al. 2012). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety, result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Michigan has 236 public use airports, 20 of which are subject to Federal Aviation Administration (FAA) Federal Aviation Regulations Part 139. Airports that are certified under Part 139 are designated based on the size of passenger aircraft that use the airport. This more typically includes larger airports with commercial service. Part 139 airports are held to a much higher standard to reduce wildlife strikes in order to maintain their certification. Although a greater number of wildlife strikes with aircraft involve birds, the most hazardous wildlife species in terms of damage to aircraft, cost of collisions, and effects on flight, is white-tailed deer (Dolbeer et al. 2012). Animals such as bear, coyotes, deer, elk, fox, moose, raccoons and skunks often venture onto airfields and become a direct threat to planes both landing and taking off. Other mammals which pose hazards to aircraft and public safety include woodchucks, muskrat, and beaver, which can pose a direct strike hazard, modify habitats attracting other strike risk species, or damage equipment at the airport. Species such as rabbits and small rodents (mice and voles)

can also damage equipment, cause strike risks or act as prey for mammalian and avian predators compounding strike risks.

WS assists airports with the management of wildlife problems including the removal of mammals from the airfields, under buildings, and from common areas where people work or congregate. WS commonly follows procedures recommended in the "Wildlife Hazard Management at Airports: a Manual for Airport Personnel" (Cleary et al 2005). Since 2005, more than 15 airports in Michigan have contacted WS for assistance in reducing deer threats to aviation safety. This may involve consultation and technical assistance (e.g., identification of hazards, recommendations for habitat management or exclusion) or operational (e.g., sharp shooting deer). Additional examples of wildlife damage management at airports include the removal of skunks from hangers and around buildings, coyotes that have crossed runways and taxiways while foraging for rodents, reduction in flooding caused by beaver, or removal of groundhogs that are digging around airfield equipment. Airports throughout Michigan have reported a total of 43 mammal strikes from 2002-2012, involving eight different species of mammals (FAA Wildlife Strike Database 2013). Of those 43 mammal strikes, seven of those involved coyotes and 16 involved white-tailed deer (FAA Wildlife Strike Database 2013). It is estimated that only 42% of all bird strikes are reported (Dolbeer et al. 2012), and it's likely that mammal strikes are also underreported. Consequently, the numbers of mammal strikes are most likely much higher than FAA records indicate.

Other Mammal Hazards to Public Health and Safety

In addition to threat from disease transmission, requests are received for assistance from perceived threat of physical harm from wildlife, especially from predatory wildlife (Conover 2002, Adams et al. 2006). WS may be requested to provide assistance with reduction of risk of bites and injuries from animals that appear to have lost their fear of humans and/or are behaving aggressively toward people.

Human encroachment into wildlife habitat increases the likelihood of human-wildlife interactions. Several predatory and omnivorous wildlife species thrive in urban habitat due to the availability of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in urban areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats (Adams et al. 2006). Often the only limiting factor of wildlife species in and around urban areas is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the seemingly unlimited amount of food, water, and shelter found within urban habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by humans toward many species of wildlife, especially around urban areas, has led to a decline in the fear wildlife have toward humans. When wildlife species begin to habituate to the presence of humans and human activity, a loss of apprehension occurs that can lead to threatening

behavior toward humans. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward humans, or abnormal behavior. Though wildlife attacking humans occurs rarely, the concern of wildlife attack or aggressive behavior of wildlife towards pets is a topic that is common in many areas of Michigan, both urban and rural. In many cases the perception that there is a danger of attack is simply because the public is seeing a species they are unfamiliar with.

Often, wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of humans is a direct result and indication of an animal inflicted with a disease. So, requests for assistance are caused by both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease. For example, increasing populations of raccoons have been implicated in the outbreak of distemper in certain areas (Majumdar et al. 2005). Distemper has not been identified as transmissible to humans. However, cooperators who feel threatened by the possibility of disease transmission often request assistance after observing sick raccoons on their property. Symptoms of distemper often lead to abnormal behavior in raccoons that are similar to symptoms associated with rabies. Raccoons with distemper often lose their fear of humans and can act aggressively which increases the risk that people, livestock, or companion animals may be bitten. Distemper is also known to occur in coyotes, red fox, and gray fox with symptoms that are similar to those exhibited by animals infected with the rabies virus.

Black bears occasionally threaten human health and safety. There have been no documented fatalities to humans caused by black bears in Michigan. However, in 2013 a 12 year-old female jogger was chased down and attacked by a black bear near Cadillac, Michigan. The injuries to this girl were non-life threatening. Situations could arise where WS is requested to assist with addressing bears that have posed a threat to human safety or could pose a threat in the state.

Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from being struck by vehicles and aircraft. Feral swine may act as reassortment vessels for such viruses as the highly pathogenic H5N1 influenza virus found throughout Europe, Asia, Africa and the Middle East (Hutton et al 2006). The reassortment of viruses could lead to new strains of influenza viruses that would become easily transferrable from mammals to humans (Brown 2004).

Emergency Response Efforts

Both large-scale natural disasters (e.g., hurricanes, tornadoes, and floods) and small-scale localized emergencies (e.g., release of exotic animals, oil spills, traffic accidents involving animal transport vehicles) may occur in which WS' personnel could be requested to assist federal, state, and local governments in charge of responding to those situations. Those requests for assistance would be on extremely short notice and rare emergencies that would be coordinated by federal, state, and local emergency management agencies. For example, WS' personnel may be requested to participate in the lethal removal of swine that were injured or were released from their transport vehicle at the scene of an accident to prevent those animals from endangering other drivers. In another example, WS' personnel may be requested to assist

local and state law enforcement in immobilization or lethal control of exotic animals that have escaped due to unforeseen circumstances.

WS responded to an oil spill that resulted from a pipeline rupture near Marshall, Michigan in which over 800,000 gallons of crude oil were released into a tributary of the Kalamazoo River. Enbridge Energy Partners LLP (Enbridge) reported the pipeline rupture July 26, 2010. The majority of wildlife impacted by the spill included waterfowl, aquatic rodents, and turtles. WS expertise in capturing wildlife played a major role in rescuing mobile wildlife affected by the oil spill.

1.2.2 Need for Mammal Damage Management to Protect Agricultural Resources

Michigan is an agricultural state with 52,194 farms and nearly 10 million acres in agricultural production (NASS 2014). Michigan cash receipts from farm marketing's totaled $8.68 billion in 2012. Crops (including nursery and greenhouse crops) and livestock (including meat animals, dairy products, poultry, and eggs) contribute substantially to the state's economy. Crop receipts and livestock receipts were valued at $5.51 billion and $3.17 billion respectively (NASS 2012). The state produces many agricultural commodities that are in the top ten ranking for production in the nation such as beans, blueberries, tart cherries, cucumbers for pickles, and grapes (NASS 2012).

The MDNR and WS receive requests for assistance from citizens experiencing agricultural damage caused by mammals, including, but not limited to the following: 1) predation on livestock by wolves[1] and coyotes; 2) threat and occurrence of damage to crops and stored feed due to mammals such as white-tailed deer, elk, and feral swine; and 3) risk of disease transmission, and 4) other problems. WS could conduct and assist in management efforts with various mammals, coordinated by or with the MDNR, Michigan Department of Agriculture and Rural Development (MDARD), USDA/APHIS/Veterinary Services (VS) and/or other federal, tribal and state agencies, to study, monitor and/or control the occurrence and spread of animal diseases to protect livestock and other agricultural resources. WS may also be asked to assist with management of animals housed at enclosed hunting facilities that pose a threat to agricultural resources. Feral swine are a common species found at facilities, and diseases identified in animals housed at the site may pose threats to other species within the enclosure or escaped animals may pose risks to livestock on adjacent lands or cause property damage.

Damage to Crops

Damage to crops by mammal species is a major concern to the agricultural community. Species such as feral swine, raccoons, rats, skunks, voles, white-tailed deer and woodchucks can cause significant damage to crops. WS provides technical assistance related to these damage events and refers landowners/managers to the MDNR for assistance in obtaining permits. At the request of landowners or cooperating agencies, WS may respond to requests for operational assistance if necessary. WS has worked cooperatively with the MDNR to help remove feral swine from

[1] Wolf damage and conflict management is addressed in a separate EA (USDA 2006).

agricultural landscapes.

Feral swine are responsible for destruction of crops, hay meadows, and pasture primarily by rooting and wallowing. Rooting is a common activity and is done year-round in search of food (Stevens 1996). The feral hog's rooting and wallowing activities damage pastures and hay meadows, spoil watering holes and can severely damage riparian habitats. Damage to crops results from direct consumption of crops and feeding related activities (i.e., trampling and rooting). WS has verified feral hog damage to crops in several counties, including one instance where the hogs caused an estimated $6,000 in damage to field corn.

Raccoons commonly feed on a variety of garden as well as agricultural crops. DeVault et al. (2007) reported 87% of the crop depredation in northern Indiana was attributed to raccoons. The majority of raccoon damage to corn crops occurs during the milk stage of maturity as the plants are pulled down and the ears are fed upon. Cornfields in Michigan are frequently interspersed among forests and waterways, which make them more susceptible to raccoon depredation. Fields adjacent to wooded and riparian areas often sustain higher rates of damage from raccoons (Beasley and Rhodes 2008). Damage also occurs to stored crops, such as corn silage and hay, when raccoons tear open silage bags and/or burrow into silos resulting in losses from spoilage, and contaminate crops with feces.

Rats (*Rattus spp*.) and mice cause damage to stored grain through feeding and contamination with droppings. They may damage crops in fields and containers and packaging materials in stored food. They cause structural damage to commodity storage structures and foundations, etc. by burrowing and gnawing. Voles and rabbits damage orchard trees by gnawing on bark and small branches. Trees are badly damaged or the bark is girdled and trees die when feeding is severe. Similar damage occurs in nurseries which grow landscape ornamentals and shrubs. Woodchucks (commonly referred to as groundhogs) are routinely reported to cause damage to field crops such as row and forage crops, orchards, nursery plants, and commercial gardens. Cottontail rabbits and voles damage orchard trees by gnawing at the base of the tree. Trees may be killed when feeding by rabbits and rodents is severe and the bark is girdled. Similar damage occurs in nurseries, which grow landscape ornamentals and shrubs.

White-tailed deer are most often cited as being the source of the wildlife damage (Conover and Decker 1991); 67% of all farmers reported problems with deer (Conover 1994). Conover et al. (1997) estimated that white-tailed deer caused an annual $100 million in damage to agricultural productivity. In Michigan, Campa et al. (1997) studied deer-agricultural crop damage and characterized significant economic loss as a harvest loss valued above $20 per acre. This study surveyed alfalfa (n=157), grain corn (n=246), soybean (n=106), and table bean (n=29) farmers in the Lower Peninsula and found that 20% of the alfalfa, 25% of the grain corn, 30% of the soybean, and 55% of the table bean farmers had substantial losses.

Risk of Disease Transmission

Most diseases of concern to domestic agricultural animals can also affect wildlife, and for many diseases, wildlife species are the natural disease reservoir. Monitoring for and containment or

eradication of these diseases to protect agricultural and natural resource interests could include wildlife damage management activities conducted by WS in cooperation with the VS program, MDNR, or other governmental agencies. As with WS' activities to protect human health and safety, WS could play an important role in the surveillance for diseases transmissible between livestock and wildlife including foreign animal diseases. Samples provided by WS can serve to establish important baseline data on the presence or absence of diseases in the state and can help identify areas where cooperators can focus disease management efforts.

Toxoplasmosis. The domestic cat has been found to transmit the protozoan parasite, *Toxoplasma gondii* to both domestic and wild animal species. Cats, including bobcats, have been found to be important reservoirs and the only species known to allow for the completion of the life cycle for *T. gondii* (Dubey 1973; Teutsch et al. 1979). Both feral and domesticated cats may be infected by this protozoan, but this infection is more common in stray cats. Fitzgerald et al. (1984) documented that feral and free-ranging cats transmitted *T. gondii* to sheep in New Zealand, resulting in abortion in ewes. Dubey et al. (1986) found cats to be a major reservoir of *T. gondii* on swine farms in Illinois. Toxoplasmosis can infect other mammals and WS has conducted surveillance in feral swine and white-tailed deer.

Disease Risks from Feral Swine. Feral swine are potential reservoirs for 30 viral and bacterial diseases, as well as 37 parasites that threaten the health of livestock and humans (Hutton et al 2006). Of greatest concern is infection of swine production facilities with diseases like swine brucellosis and pseudorabies. A study (Corn et al, 1986) conducted in Texas found that feral swine do represent a reservoir of diseases transmissible to livestock. Swine harvested in this study tested positive for pseudorabies, brucellosis, and leptospirosis. Other diseases carried by feral swine include hog cholera, tuberculosis, bubonic plague, and anthrax (Beach 1993). A study in Oklahoma (Saliki et al. 1998) found samples also positive for antibodies against porcine parvovirus, swine influenza and the recently emerged porcine reproductive and respiratory syndrome virus (PRRSV). PRRSV is highly infectious, requiring only a few viral particles to initiate infection (Henry 2003). Disease transmission is likely to occur where domestic livestock and feral swine have a common interface, such as a water source and livestock feeding areas. WS conducts disease surveillance in the feral swine population as part of the National Wildlife Disease Surveillance Program or other research surveillance projects.

Pseudorabies is a disease of swine that can also affect cattle, dogs, cats, sheep, and goats; and is often fatal in these other species. The disease is caused by the pseudorabies virus, an extremely contagious herpes virus that causes reproductive problems, including abortion, stillbirths, and even occasional death in breeding and finishing hogs. The United States is one of the world's largest producers of pork and is the second largest exporter of pork. U.S. pork production accounts for about 10 percent of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports more than 600,000 jobs. In 2004, domestic swine in all 50 states had attained Stage V pseudorabies free status. However, pseudorabies is still found in feral swine and these animals serve as a potential source of infection for domestic animals. In 2007, pseudorabies was detected in four swine herds in Michigan. At the request of MDARD, WS depopulated all swine at the properties and

swine in the surrounding area were tested and quarantined for several weeks until the end of the testing period.

Similar to pseudorabies, the USDA has been involved in a multi-year, multi-million dollar effort to eradicate brucellosis in swine and cattle and the presence of infected feral swine may complicate and delay the final success of that program (Hutton et al. 2006). Brucellosis is a bacterial disease that can also have negative effects on reproduction in swine. Witmer et al. (2003) summarized surveillance studies of feral swine populations in the United States and reported infection rates of 0-53% for swine brucellosis. Feral swine serve as a reservoir for disease reintroduction and pose a constant threat to the progress of disease eradication programs in domestic livestock.

Foreign Animal Diseases. International trade and travel and the popularity of exotic pets have resulted in an ongoing risk of foreign animal disease introduction. Introduction of a disease such as Classical Swine Fever, Foot and Mouth Disease, or other foreign animal diseases could have tremendous adverse impacts on the American livestock industry. State and federal agriculture and animal health agencies, and state wildlife agencies would have primary responsibility. However, these agencies may request WS assistance in conducting surveillance for the disease in wildlife populations, and/or capture and removal of animals in order to aid in management of the disease outbreak.

Predation and Livestock

In 2010, the NASS (2011) reported cattle and calf losses from animal predation totaled 219,900 head in the United States according to livestock producers. Animal predation represented 5.5% of the total cattle and calf losses reported by livestock producers in 2010 totaling $98.5 million in economic losses. In 2010, Michigan livestock producers lost 200 cattle and 600 calves due to predation. The economic loss was an estimated $355,000. Coyotes accounted for 59.5%, dogs 25%, and other predators 15.5% of cattle losses in Michigan in 2010 (NASS 2011). Coyotes accounted for 55.5%, dogs 5.6%, and unknown predators 38.9% of calf losses in Michigan in 2010 (NASS 2011). The primary non-lethal method employed by cattle and calf producers was the use of guard animals with a reported 38.6% of producers using guard animals to reduce predation. Michigan producers also reported using exclusion fencing, livestock carcass removal, culling, frequent checks, night penning, and fright tactics to reduce predation (NASS 2011).

1.2.3 Need for Mammal Damage Management to Protect Property

Browsing by free-ranging deer damages and destroys landscaping and ornamental trees, shrubs and flowers. As rural areas are developed, deer habitat may actually be enhanced because fertilized lawns, gardens, and landscape plants can serve as high quality food sources for deer (Swihart et al. 1995). Furthermore, deer are prolific and adaptable, characteristics which allow them to exploit and prosper in most suitable habitats near urban areas, including residential areas (Jones and Witham 1995). Free ranging deer have been using urban areas, nature preserves, and parks, causing damage to shrubs and trees in these areas more frequently. Although damage to landscaping and ornamental plants has not been quantified in and around parks, deer have caused severe and costly property damage to homeowner's properties and common areas. In addition to

browsing, male deer damage trees and shrubs by antler rubbing which results in broken limbs and bark removal. While large trees may survive antler rubbing, smaller saplings often die or become scarred to the point that they are not acceptable for landscaping.

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover et al. 1995, Romin and Bissonette 1996, Conover 1997). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer (Drake et al. 2005). The Insurance Information Institute (III) estimated in 2012 that 1.23 million deer-vehicle collisions occurred in the United States causing approximately $4 billion in property damage. In 1995, the damage to vehicles associated with vehicles striking deer was estimated at $1,500 per strike in damages (Conover et al. 1995). According to III damage costs associated with deer collisions in 2012 were estimated at $3,305 per incident, which was an increase of 4.4% over the 2011 estimate (III 2013). Often, deer-vehicle collisions in which a deer carcass was not recovered or little vehicle damage occurred go unreported. A Cornell University study estimated that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990).

Motor vehicle-deer crashes continue to be cause for concern in Michigan highway safety. Deer are the third most commonly reported struck object in the state (behind striking another vehicle and striking a fixed object). For 10 years (2002-2011), an average of 17% of all motor vehicle crashes in Michigan involved deer (MDOT 2013). In 2013, there were 49,205 motor vehicle-deer crashes: of these, there were 12 fatalities and an additional 1,212 people injured (MDOT 2013). In 2013, average repair costs reported by the Insurance Institute of Michigan were $2,100, while deer-vehicle collisions resulted in $130 million in total damage to property in Michigan in 2013.

Flooding caused by beaver dams can cause damage to roads and railroads, athletic fields, yards, croplands, and timberlands. Utility companies are negatively impacted by beaver pond flooding that has damaged infrastructure or limited access to sites. Beavers cause damage by cutting down trees for food and building dams. Beaver dams can cause large ecosystem changes, through erosion and flooding. This can also alter the spawning of native fish, when headwaters of streams are blocked.

Rooting by feral swine can cause damage to roadbeds, dikes and other earthen structures. Feral swine have broken through livestock and game fences to consume animal feed and mineral supplements. In some areas, foraging swine have damaged landscaping, golf courses and other ornamental plantings. In Michigan, damage by feral swine to crops, lawns, food plots, and natural areas has been documented (USDA unpublished data).

1.2.4 Need for Mammal Damage Management to Protect Natural Resources

Natural resources may be described as those assets belonging to the public which are usually managed and held in trust by government agencies for citizens. Such resources may be plants,

animals and their habitats, including threatened and endangered species and historic properties. Examples of natural resources in Michigan are historic structures and places; parks and recreation areas; natural areas, including unique habitats or topographic features; threatened and endangered plants or animals; and any plant or animal populations which have been identified by the public as a natural resource.

Scientists estimate that nationwide cats kill hundreds of millions of birds and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year. The American Bird Conservancy (ABC) states that "cats often kill common [bird] species such as cardinals, blue jays, and house wrens, as well as rare and endangered species such as piping plovers, Florida scrub-jays, and California least terns" (ABC 2011). Some feral and free-ranging cats kill more than 100 animals each year. For example, at a wildlife experiment station, a roaming, well-fed cat killed more than 1,600 animals over 18 months, primarily small mammals (ABC 2011). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin (Coleman et al. 1997). Based on information acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually. Most recently, Loss et al. (2013) estimated that free-ranging cats kill 1.4 to 3.7 billion birds and 6.9 to 20.7 billion mammals worldwide annually.

Muskrats and other burrowing rodents can damage natural resources by burrowing into earthen dams and dikes used to manage/retain ponds and riparian areas used by other wildlife species, by excessive foraging on riparian and wetland vegetation and cutting/girdling timber, seedlings, and other vegetation in natural areas, and parks, especially in riparian restoration sites.

Feral swine can compete with and prey upon native wildlife and severely damage wildlife habitats. Feral swine are omnivorous and feed on a wide variety of items, many of which are staples for native fauna. One of the more important seasonal food resources used by feral swine is wild fruit and nut crops, especially oak mast (Wood and Roark 1980). Oak mast is also an important food source for deer and wild turkey. When feral swine actively compete for mast, resident deer and wild turkey may enter the winter with inadequate fat reserves, thus threatening the viability of these native wildlife species (Beach 1993). Feral swine also prey on native wildlife, especially young animals and ground nesting birds, their nestlings and eggs (Beach 1993).

In Michigan, feral swine may also be adversely impacting hunting of native species of wildlife and wildlife watching opportunities. Landowners report shifts in white-tailed deer movement patterns and disturbance of wild turkey roosting and feeding sites which have negatively impacted hunter success. Feral swine have also damaged wildlife food plots intended for native species.

In addition to competition for food, feral swine foraging also causes problems for forest regeneration through consumption of hard mast (e.g., acorns and hickory nuts), uprooting and

consumption of seedlings (Campbell and Long 2009, West et al. 2009). Areas disturbed by feral swine rooting are also vulnerable to colonization by non-native invasive plant species. Rooting also accelerates plant decomposition and loss of soil nutrients (Campbell and Long 2009). The rooting and foraging behavior of feral swine can completely destroy the understory in forests and make trees less stable during windstorms.

Deer are considered a "keystone species", one that can have a profound impact on vegetation, altering species composition to the point that entire forests either fail to regenerate, or regenerate with tree species that are not beneficial for deer or other species of wildlife, or for lumber (Wallingford 2002). Deer overabundance can affect native vegetation and natural ecosystems in addition to ornamental landscape plantings. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus, can negatively affect certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse effects on other wildlife species that depend on those plants for food and/or shelter. Numerous studies have shown that over browsing by deer can decrease tree reproduction, understory vegetation cover, plant density, and diversity (Warren 1991). By one count, 98 species of threatened and endangered plants, many of them orchids and lilies, are disturbed by deer browsing (Ness 2003).

White-tailed deer overabundance and browsing can alter plant composition and regeneration in many northern hardwood/eastern deciduous forests. Reo and Karl (2010) studied the impact of deer densities on hardwood species regeneration in Michigan. Specifically, they compared northern red oak (*Quercus rubra L.*) regeneration on neighboring tribal and state forests with distinct hunting management practices. Reo and Karl (2010) observed that red oak seedling survival was greater on tribal lands where deer populations were maintained at lower densities.

Kraft et al. (2004) compared the effects of both forest management and deer browsing in western Upper Michigan on forest productivity and biodiversity. Kraft et al. noted that measurements of plant morphology and the frequency of flowering and fruiting were sensitive indicators of deer browse. Based on measurements of physical stature and reproductive potential, sugar maple (*Acer saccharum*), red-berried elder (*Sambucus racemosa*), bluebead-lily (*Clintonia borealis*), small Solomon-seal (*Polygonatum pubescens*), false Solomon-seal (*Smilacina racemosa*), rosy twisted stalk (*Streptopus roseus*), and trillium species (*Trillium grandiflorum* and *T. cernuum*) all experienced significant browse damage. Further, deer abundance may enhance dispersal and establishment of herbaceous plants into forest systems, including non-native and weedy species (Holmes et al. 2008).

The alteration and degradation of habitat from over-browsing by deer can have a detrimental effect on deer health and may displace other wildlife communities (*e.g.*, Neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat destroyed by deer browsing (VDGIF 1999). Similarly, DeCalesta (1997) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in some areas with higher deer densities (DeCalesta 1997). Intermediate canopy-nesting birds declined 37% in abundance

and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Casey and Hein (1983) found that three species of birds could no longer be found in a research preserve stocked with high densities of ungulates and that the densities of several other species of birds were lower than in an adjacent area with a lower deer density. Waller and Alverson (1997) hypothesized that by competing with squirrels and other fruit-eating animals for oak mast, deer may further affect many other species of animals and insects.

WS has been assisting the U.S. National Park Service (NPS), Apostle Islands National Lakeshore with white-tailed deer management efforts on Sand and York Islands since 2009 to protect rare Canada yew (*Taxus Canadensis*) from over-browsing. Deer management within the park is complex. The park's 21 islands have a diverse deer history. A few islands were not historically impacted by browsing and contain rare forest communities dominated by Canada yew a species nearly extirpated on the mainland. Hunting is permitted in the park and deer management is closely coordinated with both the state and local tribes. A Wildlife Management Plan and EA for Harvestable Species were completed in 2007 (USDI 2007). Consistent with the plan, the park has been implementing aggressive culling activity to reduce the number of deer on islands that are being heavily impacted by over browsing.

Chronic Wasting Disease (CWD) is a disease of the nervous system of cervids. The disease is similar to a group of diseases referred to as transmissible spongiform encephalopathy. This group of diseases includes scrapie of sheep, bovine spongiform encephalopathy (Mad Cow Disease), and Creutzfeld-Jakob Disease of humans. The agents that cause these infections are called prions, an abnormal form of a naturally occurring nervous system protein. The disease was first recognized in 1967 at a Colorado wildlife research facility. It has now been diagnosed in free-ranging deer and elk in Colorado, Illinois, Iowa, Kansas, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Mexico, New York, North Dakota, Pennsylvania, South Dakota, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming (CDC 2015).

In April 2015, MDNR identified a free-ranging white-tailed deer with CWD. Although, in 2008, a case of CWD was confirmed in a deer breeding facility, the 2015 case marks the first time CWD has been identified in the free-ranging deer population in Michigan. To date, a total of 5 cases of CWD in free-ranging white-tailed deer have been confirmed in Michigan (Michigan 2016).

WS has assisted in CWD management efforts with infected and potentially infected animals, coordinated by the MDNR and MDARD to control the occurrence and spread of CWD throughout the state. These efforts included depopulating local captive cervid facilities and assisting with surveillance.

1.2.5 Need to Protect T&E Species

Some of the species listed as threatened or endangered under the Endangered Species Act of 1973 and Michigan's Endangered and Threatened Species Laws, (Part 365 of PA 451 of 1994),

are preyed upon or otherwise adversely affected by certain mammal species. Piping plovers (*Charadrius melodus*, federally endangered, state endangered), Caspian terns (*Sterna caspia*, state threatened), Forster's terns (*Sterna forsteri*, state threatened), and Common terns (*Sterna hirundo*, state threatened) can be negatively affected by raccoons, opossums, striped skunks, coyotes, weasels, mink and other mammals that prey on birds, eat eggs, and cause disturbances at nesting sites. A WS predation management program to protect rare species can be one component of integrated programs that also include nest exclosures, management of public access and impacts, and educational efforts.

The USFWS recovery plan for the Great Lakes Piping Plover (*Charadrius melodus*) population identifies predation as an important limiting factor for the plover population. The establishment of predator control/removal protocols is identified as a priority one action for species recovery. Wemmer (2000) identified predation as the cause of failure for approximately 14% of Piping Plover nests in Michigan from 1981-1999. In Michigan, track identification, nest monitoring with cameras, experimentation with artificial nests and 24 hour nest monitoring have been used to identify predators posing the greatest threats to plovers including Herring gulls (*Larus argentatus*), Ring-billed Gulls (*L. delawarensis*), Merlins (*Falco columbarius*), Peregrine Falcons (*F. peregrinus*), Snowy Owls (*Nyctea scaniaca*), Great Horned Owls, (*Bubo virginianus*), American Crows (*Corvus brachyrhynchos*), Common Ravens (*C. corvax*), red fox, coyotes, raccoons, thirteen-lined ground squirrels, striped skunks, and domestic cats and dogs.

Wallowing and foraging by feral swine can significantly damage wetlands riparian areas, which may be important for threatened and endangered (T&E), and other sensitive species such as fish and mussels (Campbell and Long 2009, West et al. 2009). In Louisiana, feral swine have been implicated as the cause of elevated waterborne bacteria levels in streams, including levels which exceeded thresholds for the protection of human health (Kaller et al. 2007). Results from DNA fingerprinting indicated that feral swine were the primary source of the *Escherichia coli* bacteria in the stream. Freshwater mussel and insects declined in stream reaches with swine activity. There are four species of mussels federally-listed as endangered in Michigan (USFWS 2014). The snuffbox mussel is of particular concern as it occurs in small streams and could be impacted by feral swine if swine become established.

1.3 DECISION 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. The preparation of this EA was done in cooperation with the Bay Mills Indian Community, and Grand River Band of Odawa Indians. Grand Traverse Band of Ottawa and Chippewa Indians, Great Lakes Indian Fish & Wildlife Commission, Little Traverse Bay Band of Odawa Indians, Little River Band of Odawa Indians, Keweenaw Bay Indian Community, the Michigan Department of Community Health, the Michigan Department of Natural Resources, and the Pokagon Band of Potawatomi were consulting agencies in the preparation of this EA. As the authority for the state management of mammal populations in Michigan, the MDNR was involved in the development of the EA and provided input throughout the EA preparation process to ensure an

interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations.

WS also recognizes the Michigan Native American authorities to manage wildlife on tribal properties. The MI WS program is committed to working with all Tribes in the state and would not conduct any mammal damage activities on Tribal land without appropriate consultation and authorization.

Based on the scope of the EA, the lead, cooperating and consulting agencies worked together to address the following questions in the EA:

- How can WS best respond to the need to reduce mammal damage in Michigan?

- Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.4.1 Actions Analyzed

This EA evaluates mammal damage management by WS to protect property, agricultural resources, natural resources, and public health and safety in Michigan wherever such management is requested from the WS program. Protection of other resources or other program activities would be addressed in additional NEPA analysis, as appropriate.

1.4.2 Native American Lands and Tribes

WS would only conduct MDM activities on tribal lands with the consent of the affected tribe(s) and after appropriate authorizing documents were completed. Currently WS has no MOU's with any of the Michigan Native American tribes. If WS enters into an agreement with a tribe for MDM, this EA would be reviewed, and supplemented if needed, prior to initiating the project.

WS recognizes that wildlife is a key component of Native American culture and beliefs. The exact nature of this relationship and role varies among tribes and individuals within tribes.

1.4.3 Period for which this EA is Valid

If it is determined that an EIS is not needed, this EA would remain valid until the WS program in Michigan and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. WS activities conducted under the authorities of this EA would be monitored to ensure that the EA adequately addresses current and anticipated future program activities and impacts.

1.4.4 Site Specificity

As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. In addition, WS' activities that could involve the removal of mammals under the alternatives would only occur when authorized by the MDNR or Michigan Tribes.

This EA analyzes the potential impacts of mammal damage management based on previous activities conducted on private, public, and tribal lands in Michigan, where WS and the appropriate entities have entered into a MOU, cooperative service agreement, or other comparable document. Because the need for action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional mammal damage management efforts could occur. This EA anticipates the potential expansion and analyzes the impacts of such efforts as part of the alternatives.

Many of the mammal species addressed in this EA can be found statewide and are active throughout the year; therefore, damage or threats of damage can occur wherever those mammals occur. Planning for the management of mammal damage must be viewed as being conceptually similar to other federal or agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites 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 and police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where mammal damage could occur can be predicted, 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 associated with mammals is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever mammal damage and the resulting management actions occurs and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to mammal damage management in Michigan. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in 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 Michigan. 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 accomplish its mission.

1.4.5 Public Involvement

Issues related to mammal damage management as conducted by WS were initially developed by WS with assistance from the cooperating and consulting agencies and tribes. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document was made available for public review and input through legal notices published in the Lansing State Journal, the WS' stakeholder registry, on the APHIS website at http://www.aphis.usda.gov/wildlifedamage/nepa, the federal e-rulemaking portal at http://www.regulations.gov/#!docketDetail;D=APHIS-2016-0027, and through direct mailings to parties WS anticipated would be interested in the proposed action. This EA was available for review and comment from April 18 to June 1, 2016. New issues or alternatives raised after publication of public notices were fully considered prior to issuance of a final Decision. The public will be notified of the availability of the final EA and the Decision/FONSI using the same process that was used for the comment period on the EA.

1.5 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

Environmental Assessment: Integrated Wildlife Damage Management to Reduce White-tailed Deer Damage in Michigan. WS completed an EA that covered white-tailed deer damage management in the state of Michigan in 2002. This Mammal Damage Management EA will include white-tailed deer damage management and will replace the 2002 deer EA.

Environmental Assessment: Management of Wolf Conflicts and Depredating Wolves in Michigan. WS completed an EA that covered the potential impacts of wolf damage management

in the state of Michigan in 2006. Management of damage by and conflicts with gray wolves will not be addressed in this EA.

Final Environmental Impact Statement: Feral Swine Damage Management – A National Approach. WS issued a final EIS on feral swine damage management in June 2015 with a record of decision (ROD) anticipated in July 2015 (USDA 2015). Feral swine damage management is included in the scope of this EA on mammal damage management in Michigan. Once the ROD is issued, this EA will be checked for consistency with the final EIS and associated ROD and adjusted if needed consistent with CEQ NEPA implementing regulations and APHIS NEPA procedures.

1.6 AUTHORITY AND COMPLIANCE

WS is the lead agency in the preparation of this EA. Mammal damage management in Michigan requires the participation of other agencies that have management authority and expertise related to this project (consulting agencies). The MDNR and the Grand Traverse Band of Ottawa and Chippewa Indians are consulting agencies in the production of this EA.

1.6.1 Wildlife Services Legislative Authority

WS is the Federal program authorized by law to reduce damage caused by wildlife (the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended and the Act of December 1987 (101 Stat. 1329-331, 7 U.S.C. 426c).

Additionally, MOU's among WS and other governmental agencies also define WS responsibilities in wildlife damage management. For example, a MOU between the Federal Aviation Administration (FAA) and WS recognizes WS role and expertise in providing wildlife hazard management assistance to the aviation community. It states, that the "FAA or the certificated airport may request technical and operational assistance from WS to reduce wildlife hazards."

1.6.2 Michigan Department of Natural Resources Legislative Authority

The Michigan Department of Natural Resources is responsible for managing resident wildlife species in Michigan (Natural Resources and Environmental Protection Act, Public Act 451 of 1994. Part 401 of Public Act 451). WS and the MDNR currently have agreements that allow USDA-APHIS-WS to participate in a cooperative WDM program in Michigan. The agreements establish a cooperative relationship between WS, the MDNR, the Michigan Department of Agriculture and Rural Development, and Michigan State University Extension for planning, coordinating and implementing WDM policies to prevent or minimize damage caused by wild animal species (including T&E species) to agriculture, horticulture, aquaculture, animal husbandry, forestry, wildlife, public health/safety, property, natural resources, and to facilitate the exchange of information among the cooperating agencies.

1.6.3 Michigan Department of Agriculture and Rural Development

The Michigan Department of Agriculture and Rural Development (MDARD), is made up of six divisions providing consumer and business information, handling complaints, providing agricultural development and marketing services, and assisting agricultural production. The mission of the MDARD is to serve the citizens of Michigan by assuring food safety, agricultural, environmental, and economic interests of the people of the State of Michigan are met through service, partnership, and collaboration.

1.6.4 Great Lakes Indian Fish and Wildlife Commission (GLIFWC)

The Great Lakes Indian Fish and Wildlife Commission is an agency of eleven Ojibwe nations in Minnesota, Wisconsin, and Michigan, with off-reservation treaty rights to hunt, fish, and gather in treaty-ceded lands and waters. It exercises powers delegated by its member tribes. The GLIFWC assists its member tribes in the implementation of off-reservation treaty seasons and in the protection of treaty rights and natural resources. The GLIFWC provides natural resource management expertise, conservation enforcement, legal and policy analysis, and public information services. The GLIFWC's member tribes include: the Bay Mills Indian Community, Keweenaw Bay Indian Community and the Lac Vieux Desert Band in Michigan; the Bad River, Red Cliff, Lac du Flambeau, Lac Courte Oreilles, Sokaogon and St. Croix Bands in Wisconsin; and the Fond du Lac and Mille Lacs tribes in Minnesota. All member tribes retained hunting, fishing and gathering rights in one or more treaties with the U.S. government.

1.6.5 Federally Recognized Native American Tribes in Michigan

Michigan Native American tribes have authority for MDM on tribal lands. The federally recognized Native American tribes in Michigan at the time this EA was completed include the Bay Mills Chippewa Indian Community, Grand Traverse Bay Band of Ottawa & Chippewa Indians, Hannahville Indian Community, Keweenaw Bay Indian Community, Nottawaseppi Huron Band of Potawatomi Indians, Lac Vieux Desert Band of Lake Superior Chippewa Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, Match-E-Be-Nash-She-Wish Band of Potawatomi Indians of Michigan, Pokagon Band of Potawatomi Indians, Saginaw Chippewa Indian Tribe, and Sault Ste. Marie Tribe of Chippewa Indians.

In the 1836 Treaty of Washington (7 State. 491) between the U.S. government and the Bay Mills Indian Tribe, Sault Ste. Marie Tribe of Chippewa Indians, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians, and Little Traverse Bay Bands of Odawa Indians, the tribes retained the right to hunt, fish and gather and other usual privileges of occupancy on lands and waters within the bounds of the treaty (ceded territory). A 2007 consent decree between the State of Michigan and the tribes regarding implementation of treaty rights, states,

> *"the Parties recognize that the Tribes may desire to engage in activities designed to restore, reclaim, or enhance fish, wildlife or other natural resources within the*

inland portion of the 1836 Ceded Territory through stocking, rearing, habitat improvement, or other methods. The parties shall meet annually in order to minimize or avoid duplication of, or interference with, restoration, reclamation, and enhancement activities. With the exception of habitat projects on federal lands, which shall be subject to federal approval under applicable law, or on lands that are owned by the tribes or their members, the Tribes shall not undertake new restoration, reclamation or enhancement projects without state approval, provided that the State shall not withhold its approval without fully consulting with the Tribes and articulating a legitimate State interest for doing so…".

1.6.6 Compliance with Federal Laws

Several federal laws regulate WS' wildlife damage management actions. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act. All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS follows the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 et seq.), USDA NEPA implementing regulations (7 CFR 1b), and the APHIS Implementing Procedures (7 CFR 372) as a part of the decision-making process. NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts 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 CEQ through regulations in Title 40, Code of Federal Regulations, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to NEPA and CEQ regulations, this EA documents the analysis of a proposed federal action's impact, informs decision-makers and the public of reasonable alternatives, and serves as a decision-aiding mechanism to ensure that the policies and goals of NEPA are infused into Federal agency planning and decision making. An EA is prepared by integrating as many of the natural and social sciences as may be warranted based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

Endangered Species Act (ESA). It is federal policy, under the ESA, that all federal 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)). WS conducts Section 7 consultations with the USFWS, the agency with management authority for federally-listed threatened and endangered species, to ensure that any action authorized, funded or carried out by WS is not likely to jeopardize the continued existence of any endangered or threatened species. WS has consulted with the USFWS regarding potential risks from the proposed MDM program and will incorporate all USFWS provisions for the protection of threatened and endangered species from that consultation in program activities.

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. 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 United States Fish and Wildlife Service to issue permits for the take of bald eagles and golden eagles on a limited basis (see 74 FR 46836-46837, 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.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280).

This law 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, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and 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 varies, depending on whether the federal action involves a permit, license, financial assistance, or a federally authorized activity. WS has consulted with the Michigan Department of State regarding the consistency of the proposed MDM program with the state coastal management plan.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The U.S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the WS program are registered with and regulated by EPA and MDARD and used by WS in compliance with labeling procedures and other requirements.

Executive Order 13112 of February 3, 1999. This order directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. To comply with Executive Order 13112, WS may cooperate with other federal, tribal, state, or local government agencies,

or with industry or private individuals to reduce damage to the environment or threats to human health and safety.

Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected." This standard includes mammals that may cause safety and health concerns at workplaces.

The Native American Graves and Repatriation Act of 1990. The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

National Historic Preservation Act (NHPA) of 1966 as amended. The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the Tribes have control over any potential conflict with cultural resources on tribal properties.

Fish and Wildlife Act of 1956 (section 742j-1) Airborne Hunting. This Act, approved in 1971 was added to the Fish and Wildlife Act of 1956 and is commonly referred to as the Airborne Hunting Act or Shooting from Aircraft Act. The Act allows shooting animals from aircraft for certain reasons including protection of wildlife, livestock and human life under conditions in the Act. The USFWS is responsible for implementation of the Airborne Hunting Act but has delegated implementation of the Act to the states. If an alternative which includes aerial hunting is selected WS would obtain all necessary permits. (Shooting from aircraft is only being considered for feral swine removal and would not involve any other species.)

Federal Meat Inspection Act. The Federal Meat Inspection Act (FMIA) applies to all meat or products obtained from any cattle, sheep, swine, goat, horse, mule, or other equines intended for distribution in commerce. Animals falling under jurisdiction of the FMIA must be inspected pre- and post mortem. Animals that are killed before they reach a slaughter facility are classified as "adulterated meat", and cannot be used for human food per the FMIA. Feral swine fall under authority of the FMIA, and therefore could only be donated to charitable organizations for use as food by needy individuals if they are delivered alive to a USDA approved feral swine slaughter facility. Chapter 12, subchapter 1, section 623 of the FMIA provides an exemption for persons having animals of their own raising and game animals slaughtered for their own use without inspection. This provision allows landowners to utilize feral swine removed from their own

property, with the understanding that meat derived from these feral swine will be consumed only by the farmer, his/her immediate family and/or nonpaying guests.

Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations." 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. Environmental Justice is a priority within APHIS and WS. 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 minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, MDARD, by the Drug Enforcement Agency (DEA), by MOUs with land managing agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment. The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing mammal damage such as threats to public health and safety.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045). Children may suffer disproportionately from environmental health and safety risks for many reasons, including their developmental, physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed mammal damage management program would only occur by using legally available and approved methods 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.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360). This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.). This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife. 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 the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC 1999). WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues relevant to development and comparison of MDM alternatives, including issues analyzed in detail in Chapter 4 (Environmental Consequences) and included in the development of SOPs. This chapter also includes a discussion of issues which were considered but not analyzed in detail for each alternative. Discussions of the affected environment are included in this chapter, Chapter 1- Need for Action, and in the evaluation of potential environmental impacts of the alternatives in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Although the range and habitat used by individual species varies, at least some of the wild and feral mammals discussed in this analysis can be found in any location in the state where suitable habitat exists for foraging and shelter. Consequently, damage or threats of damage caused by the mammal species addressed in this EA can occur statewide wherever those mammals occur. However, mammal damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document has been signed between WS and a cooperating entity.
Upon receiving a request for assistance, MDM activities could be conducted on federal, state, tribal, municipal, and private properties in Michigan. Areas where damage or threats of damage could occur include, but are not limited to, agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, aquaculture facilities, railroad yards, waste handling facilities, industrial sites, natural resource areas, park lands, and historic sites; State, county, and interstate highways and roads; railroads and their right-of-ways; property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; property where burrowing mammals cause damage to structures, dikes, ditches, ponds, and levees; public and private properties in rural/urban/suburban areas where mammals cause damage to landscaping and natural resources, property, and pose risks to human safety. The area would also include airports and military airbases where mammals are a threat to human safety and to property; and public property where mammals are negatively impacting historic structures, and cultural landscapes.

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 action agency analyzes its potential impacts on the “human environment,” it is reasonable for that agency to compare not only the effects of the federal action, but also the potential impacts that occur or could occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

Most resident mammal species are managed under Michigan code and statute without any federal oversight or protection. There are some species, such as most non-native invasive species, that are not protected under state or federal law. In Michigan, the MDNR has the state authority to manage and authorize the taking of wild and feral mammals for damage management purposes. Other species such as escaped domestic species oversight belongs to MDARD. Feral cats and dogs, although often considered domestic animals, have no state agency oversight in Michigan and are managed at the local level by local municipalities. Free ranging feral swine are the management responsibility of MDARD, while swine associated with hunting facilities are the responsibility of the MDNR. Usually, when a non-federal entity (e.g., agricultural producers, municipalities, counties, private companies, individuals, or any other non-federal entity) takes a MDM action, the action is not subject to compliance with the NEPA due to the lack of federal involvement 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 proposed federal action.

Therefore, in those situations in which a non-federal entity has decided that a MDM action will occur and even the particular methods that will be used, WS' involvement in the action would not affect the environmental status quo because the requestor would have conducted the action in the absence of WS' involvement. Given that non-federal entities can receive authorization to use lethal MDM methods from the MDNR (depending on the species state classification), and since most methods for resolving damage are available to both WS and to non-federal entities, WS' decision-making ability is restricted to one of three alternatives: 1) WS can either take the action using the specific methods discussed in this EA upon request; 2) WS can assist with only some types of methods (e.g., provide non-lethal assistance only); 3) or WS can take no action, at which point the non-federal entity could take the action anyway, either without a permit, during the hunting or trapping season, or through the issuance of a permit by the MDNR. Under those circumstances, WS would have virtually no ability to affect the environmental status quo because the action would likely occur in the absence of WS' direct involvement.

2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

- Effects on target species and the regulated harvest of mammals
- Effects on other wildlife species, including Threatened and Endangered species
- Effects on human health and safety
- Impacts to Stakeholders, Including Aesthetics
- Humaneness and animal welfare concerns

2.2.1 Effects on Target Mammal Species

A common issue is whether damage management actions would adversely affect the populations of target mammal species. Methods that would be available under the alternatives to resolve damage or threats are considered either non-lethal methods or lethal methods. Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage, which reduces the presence of those species at the site, and potentially the immediate area around the site where non-lethal methods are employed. Lethal methods would be employed to remove a mammal or those mammals responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods or dispersed from an area using non-lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individual animals involved with the associated damage or threat, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods would be based on a measure of the number of animals killed in relation to their abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. Lethal removal would be monitored by comparing the number of animals killed with overall populations or trends in populations to assure the magnitude of removal was maintained below the level that would cause significant adverse effects to the viability of a native species population. Under the alternatives where lethal methods could be employed or recommended, the lethal removal (killing) of mammals would only occur at the request of a cooperator seeking assistance and only after the removal of those species identified as targets had been permitted by the MDNR, when required.

2.2.2 Effects on Other Wildlife Species, including T&E Species

There are concerns that the use of nonlethal and lethal MDM methods may have unintended adverse impacts on non-target species, including state and federally-listed threatened and endangered species. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife.

2.2.3 Effects of Damage Management Methods on Human Health and Safety

Review of the potential impacts on human health and safety from MDM actions has two primary components: 1) the potential risk to human health and safety from MDM methods; and 2) the potential benefits to human health and safety when MDM actions are conducted to reduce risks caused by wild and feral mammals. Some concerns exist regarding the safety of WS' methods despite their legality. In addition to the potential risks to the public associated with WS' methods, risks to employees are also an issue.

Safety of Proposed Chemical Methods

Safety concerns pertaining to the use of chemical MDM methods include the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed (e.g., animals used for food). Under the alternatives identified, the use of chemical methods would include immobilizing drugs, euthanasia drugs, and repellents (Appendix C). Chemicals proposed for use under the relevant alternatives are regulated by the EPA through FIFRA, by Michigan laws, by the DEA, by the FDA, and by WS' Directives.

Safety of Proposed Non-Chemical Methods

Non-chemical methods employed to reduce damage and threats to safety caused by mammals, could potentially be hazardous to human safety through misuse or accident. Non-chemical methods may include but are not limited to firearms, live-traps, exclusion, snares, cable restraints, body-gripping traps, foothold traps, pyrotechnics, and other scaring devices (Appendix C). Some people may be concerned that WS' use of firearms, traps, snares, cable restraints, and pyrotechnic scaring devices could cause injuries to people. There are also concerns regarding potential fire hazard to agricultural sites and private property from pyrotechnic use.

Impacts on human health and safety from mammals

The concern addressed here is that the absence of adequate MDM would result in adverse effects on human health and safety, because mammal damage would not be curtailed or reduced to the minimum levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries, illness, or loss of human lives.

2.2.4 Impacts to Stakeholders, Including Aesthetics

Aesthetics is a philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is subjective in nature and is dependent on what an observer regards as beautiful. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography; Decker and Goff 1987). In 2011, an estimated 90 million U.S. residents 16 years old or older participated in wildlife-related recreation including hunting (13.7 million people), fishing (33.1 million people) and/or wildlife watching (71.8 million people; USDI and USDC 2011). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from

experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Many people, directly affected by problems and threats to public health or safety associated with mammals may insist upon removal of the animal(s) from the property or public location when they cause damage. Some members of the public believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to public health or safety. Others, directly affected by the specific wildlife "problem", may not agree that there is a problem. They may perceive that the issue at hand is normal animal behavior and a consequence of living in proximity to nature and should be tolerated. Similarly, individuals not directly affected by the harm or damage caused by wildlife may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Individuals totally opposed to mammal damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. These people would strongly oppose removal of mammals regardless of the amount and type of damage. Some members of the public who oppose removal of wildlife do so because of human-affectionate bonds with individual animals. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment. Advocates of the Animal Rights philosophy believe that animals are entitled to the same rights and protections as humans and that if an action is unacceptable treatment for a human it is unacceptable treatment for an animal.

Some individuals are concerned about the presence of mammal species that may be considered by them to be overabundant, such as deer, coyotes, feral cats or introduced wild pigs, which they feel proliferate in such numbers that they cause ecosystem damage or human safety concerns. To such people those species represent pests which are nuisances, upset the natural order in ecosystems, damage crops and/or property and potentially carry diseases transmissible to humans or other wildlife or pose other threats to human safety. Their overall enjoyment of other animals is diminished by what they view as the destructive presence of such species.

2.2.5 Humaneness and Animal Welfare Concerns of Methods Used

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest 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 is described as a " . . . highly unpleasant emotional response usually associated with pain and distress." However, suffering " . . . can occur without pain . . . ," and" . . . pain can occur without suffering . . . "(AVMA 1987). Because suffering

carries with it the implication of a time frame, a case could be made for " . . . little or no suffering where death comes immediately . . . "(CDFG 1991), such as shooting.

Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2007, CDFG 1991). The American Veterinary Medical Association (AVMA) defines pain as being, "that sensation (perception) that results from nerve impulses reaching the cerebral cortex via ascending neural pathways" (AVMA 2007). The key component of this definition is the perception of pain. The AVMA (2007) notes that "pain" should not be used for stimuli, receptors, reflexes, or pathways because these factors may be active without pain perception. For pain to be experienced, the cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of hypoxia, depression by drugs, electric shock, or concussion, pain is not experienced.

Stress has been defined as the effect of physical, physiologic, or emotional factors (stressors) that induce an alteration in an animal's base or adaptive state. Responses to stimuli vary among animals based on the animals' experiences, age, species and current condition. Not all forms of stress result in adverse consequences for the animal and some forms of stress serve a positive, adaptive function for the animal. Eustress describes the response of animals to harmless stimuli which initiate responses that are beneficial to the animal. Neutral stress is the term for response to stimuli which have neither harmful nor beneficial effects to the animal. Distress results when an animal's response to stimuli interferes with its well-being and comfort (AVMA 2007).

Analysis of this issue must consider not only the welfare of the animals captured, but also the welfare of humans, livestock and some T&E species if damage management methods are not used. For example, some individuals may perceive techniques used to remove a predator that is killing or injuring pets or livestock as inhumane, while others may believe it is equally or more inhumane to permit pets and livestock that depend upon humans for protection to be injured or killed by predators.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 No Wildlife Damage Management at Taxpayer Expense; Wildlife Damage Management should be Fee Based

An issue identified through the scoping process is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. In Michigan, funds to implement wildlife damage management activities and programs are derived from a number of sources, including, but not limited to federal, state, county and municipal governments/agencies, private organizations, corporations and individuals, homeowner/property owner associations, and others, under Cooperative Service Agreements and/or other contract documents and processes. A minimal federal appropriation is allotted for the maintenance of a WS program. The remainder of the WS program is mostly fee-based. Technical assistance is provided to requesters as part of the federally-funded activities, but the majority of direct assistance in which WS' employees perform damage management activities is funded through

cooperative service agreements between the requester and WS.

Federal, state, and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the United States. Wildlife damage management is an appropriate sphere of activity for government programs because aspects of wildlife damage management are a government responsibility and authorized by law.

2.3.2 Mammal Damage should be Managed by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce mammal damage for property owners or property owners could attempt to reduce their own damage problems. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to contract with a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues and reduced administrative burden. The relationship between WS and private industry is addressed in WS directive 3.101.

2.3.3 Appropriateness of Preparing an EA (Instead of an EIS) for Such a Large Area

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). This EA addresses impacts for managing damage and threats to human safety associated with mammals in Michigan to analyze individual, direct, indirect and cumulative impacts, provide a thorough analysis of other issues relevant to MDM, and provides the public an opportunity to review and comment on the analysis and alternatives.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State of Michigan will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. Most mammals are managed by the state agencies, so the best available data for analysis is often based on statewide population dynamics. For example, an EA on county level may not have sufficient data for that area and have to rely on extrapolations from statewide analyses anyway. Additionally, most mammal populations require an area larger than a county for a healthy, sustainable population. 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.

2.3.4 Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with NEPA. Consideration of this issue may not be the driving factor when developing site-specific management strategy. The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. However, the cost effectiveness of methods and the effectiveness of methods are linked. Methods determined to be most effective to reduce damage and threats to human safety caused by mammals and that prove to be the most cost effective would generally receive the greatest application.

2.3.5 A Loss Threshold Should Be Established Before Allowing Lethal Methods

WS has received comments indicating that a threshold of loss should be established before employing lethal methods to resolve damage, and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of damage which may be tolerated before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

2.3.6 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 to lethally remove mammals. As described in Appendix C, the lethal removal of mammals with firearms by WS to alleviate damage or threats would occur using a rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996).

The removal of mammals by WS in Michigan using firearms occurs primarily from the use of rifles. However, the use of shotguns could be employed to lethally remove some species. Mammals that are removed using rifles would occur within areas where retrieval of all mammal carcasses for proper disposal is highly likely (e.g., at an airport). With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal of mammal carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass. In rare instances, feral swine may be left on site if aerial shooting is used to remove feral swine from remote locations which cannot be safely accessed or for which access by ground vehicles would cause substantial adverse impact to soils and vegetation. However, the feral swine program has committed to using lead-free ammunition for aerial shooting unless adequate supplies of ammunition cannot be obtained, so risks to scavengers from this type of action would be very low (USDA 2015).

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal 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 occur that lead from bullets deposited in soil from shooting activities could lead to contamination of water, either ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "transport" readily in surface water when soils were neutral or slightly alkaline in pH (i.e., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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 EPA (i.e., requiring action to treat the water to remove lead). The study found that the dissolution (i.e., capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot form crusty lead oxide deposits on their surfaces, which serves to naturally further reduce the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities to reduce mammal damage using firearms, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

Removal of mammals can occur during regulated hunting seasons through the issuance of depredation permits by the MDNR without the need to obtain a permit for species that are classified as an "unprotected species," and through other authorizations granted to landowners/managers for some species by regulations outlined by the MDNR. Consequently, WS' assistance with removing mammals would not be additive to the environmental status quo because animals removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. Based on current information, the risks associated with lead bullets that are deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from mammal carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

2.3.7 Effects on Human Health from Consumption of Meat Donated by WS

The potential for lead and other contaminants to be present in meat that has been processed for human consumption is a concern. The potential for the spreading of zoonotic diseases in animals processed and donated for human consumption is also a concern. Under the proposed action alternative, meat from wildlife lethally taken during damage management activities could be donated to charitable organization for human consumption. WS could recommend the donation or consumption of meat under the technical assistance only alternative, but would not be directly involved with damage management activities under that alternative.

If WS donates wild meat for human consumption, WS' policies pertaining to the testing or labeling would be followed in order to address potential health concerns. Wild game donated for human consumption may be tested for exposure to substances such as organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. The entity selecting the capture/euthanize and donation for charitable consumption program would be responsible for all costs associated with legal and appropriate donation for human consumption.

Stewart and Veverka (2011) documented that white-tailed deer that were shot with lead ammunition in the head or extreme upper neck in sharpshooting situations showed no deposition of lead fragments in the meat of the animals that would have been processed for human consumption. Lower neck shots do frequently experience lead fragmentation in the loin muscle and the authors recommend removing the loins prior to processing to ensure that these fragments were not ingested. WS' personnel would be trained to shoot and target the head and upper neck of white-tailed deer.

Animals immobilized using immobilizing drugs or euthanasia chemicals would not be donated for human consumption with disposal of carcasses occurring by deep burial or incineration. Black bear, deer, elk, feral swine and moose taken by any method for disease sampling or in an area where zoonotic diseases of concern are known to be prevalent and of concern to human health after consuming processed meat would not be donated for consumption and would be disposed of by deep burial or incineration.

The Federal Meat Inspection Act (FMIA) applies to all meat or products obtained from any cattle, sheep, swine, goat, horse, mule, or other equines intended for distribution in commerce. Animals falling under jurisdiction of the FMIA must be inspected pre- and post mortem. Feral swine fall under authority of the FMIA, and therefore could only be donated to charitable organizations for use as food by needy individuals if they are delivered alive to a USDA approved feral swine slaughter facility which is not a logistically viable solution for the Michigan WS program. However, the FMIA provides an exemption for persons having animals of their own raising and game animals slaughtered for their own use without inspection. This provision allows landowners to utilize feral swine removed from their own property, with the understanding that meat derived from these feral swine will be consumed only by the farmer, his/her immediate family and/or nonpaying guests. The WS program may offer feral swine to

the landowner/manager. Issues pertaining to the safety of the meat are similar to those addressed above for deer and bear.

2.3.9 Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

Another issue commonly identified is a concern that mammal damage management activities conducted by WS would affect the ability of persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of mammals or by reducing the number of mammals present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted or trapped during regulated seasons in Michigan include: black bear, cottontail rabbit, coyote, fox squirrel, gray fox, gray squirrel, ground squirrel, least weasel, long-tailed weasel, mink, muskrat, raccoon, red fox, red squirrel, river otter, striped skunk, white-tailed deer, and Virginia opossums.

Raccoons, coyotes, and bats (except for threatened or endangered species) may be taken all year on private property without a permit or license when they are doing or about to do damage, or there is reason to believe they were involved in a human or pet exposure to rabies (MI Wildlife Conservation Order). Unprotected species which may be considered target species in this EA include all other wild mammals not specifically mentioned in the Michigan game species list[2] or Michigan's threatened and endangered species list.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to reduce or alleviate damage reduce mammal densities by dispersing animals from areas where damage or the threat of damage is occurring. Similarly, lethal methods used to reduce damage could locally lower target species densities in areas where damage is occurring, resulting in a reduction in the availability of those species during the regulated harvest season. WS' MDM activities would primarily be conducted in areas where hunting access is restricted (e.g., airports, urban areas) or has been ineffective in resolving the damage problem. The use of non-lethal methods (such as black bear relocation) or lethal methods often disperses mammals from areas where damage is occurring to areas outside the damage area which could serve to move those mammal species from those less accessible areas to places more accessible to hunters. In addition, in appropriate situations, WS recommends recreational hunting and trapping as a damage management alternative for several of the species listed in this EA.

[2] "Game" means any animal designated as game under the authority of section 40110 of 1994 PA 451, as amended, MCL 324.40110, and any of the following animals: badger, bear, beaver, bobcat, brant, coot, coyote, crow, deer, duck, elk, fisher, Florida gallinule, fox, geese, hare, Hungarian partridge, marten, mink, moose, muskrat, opossum, otter, pheasant, quail, rabbit, raccoon, ruffed grouse, sharptailed grouse, skunk, snipe, sora rail, squirrel, Virginia rail, weasel, wild turkey, wolf, woodchuck, and woodcock. "Game" does not include privately owned cervidae species located on a cervidae livestock facility registered under 2000 PA 190, MCL 287.951 to 287.969.

2.3.10 Global Climate Change/Greenhouse Gas Emissions

The CEQ has advised federal agencies to consider whether analysis of the direct and indirect greenhouse gas (GHG) emissions from their proposed actions may provide meaningful information to decision makers and the public (CEQ 2014). Based on their review of the available science, CEQ advised agencies that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO2-equivalent GHG emissions on an annual basis, significant impacts on the environment from the action were possible and the agencies should consider that a quantitative and qualitative assessment may be meaningful to decision makers and the public. WS has assessed the potential GHG impacts from nationwide program actions including MDM activities currently conducted by the MI WS program in context of this guidance.

Combining vehicle, aircraft, office, and ATV use for FY13 and potential new vehicle purchases, total CDEs for the entire nationwide WS program are estimated to be less than is likely to be 10,350 – 12,254 MT or less per year, which is below the CEQ's suggested reference point of 25,000 MT/year for detailed analysis (USDA 2015). Nonetheless, WS understands that greenhouse GHG emissions are a significant environmental concerns and will continue to conduct all program actions in accordance with applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

2.3.11 Impacts on Historic and Cultural Resources

The MDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve 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 are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. WS has requested consultation with the State Historic Preservation Office for concurrence with this determination. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as propane exploders, pyrotechnics, firearms, or other noise-making methods are used at or in close proximity to such sites for purposes of hazing or removing animals. 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 or nuisance problem, which means such use, would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of 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 Section 106 of the NHPA would be conducted as necessary in those types of situations.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

Chapter 3 contains a discussion of the alternatives which were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. The alternatives which receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences) are described, as are alternatives considered but not analyzed in detail. This chapter also includes SOPs for mammal damage management in Michigan.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1: Continue the Current Adaptive Integrated Mammal Damage Management Program (Proposed Action/No Action)

The Proposed Action/No Action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques (Appendix C), identified through use of the WS Decision Model, to reduce damage and threats caused by mammals. Under this alternative, WS, in consultation with the MDNR, would continue to respond to requests for assistance by: 1) taking no action if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. WS would also continue to work with the MDNR, Michigan State University Extension Service, tribes and other entities to produce and distribute materials and provide educational programs on methods for preventing damage. Funding could occur through federal appropriations or from cooperative funding.

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), and is a viable and reasonable alternative that could be selected. In the case of ongoing activities, the No Action alternative, may be defined as the continuation of the current program (CEQ 1981). This alternative serves as a baseline for comparison with the other alternatives.

When a request for direct operational assistance is received to resolve or prevent damage caused by mammals, WS conducts site visits to assess damage or threats and identifies the cause of the damage. WS applies the decision model described by Slate et al. (1992) to develop an effective site specific management strategy which minimizes risk of adverse environmental impacts and risks to human health and safety from MDM methods and is consistent with landowner/manager management objectives (Appendix C). The use of the Decision model by WS' employees under the proposed action is further discussed below in Section 3.2.3. Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or could include instances where application of lethal methods alone

would be the most appropriate strategy. Property owners or managers may choose to implement WS' recommendations on their own (i.e., use WS technical assistance), use contractual services of private businesses, use volunteer services of private organizations, or use the services of WS (i.e., direct operational assistance). Property owners may also take management action themselves without consulting another private or governmental agency, or take no action.

3.1.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

Under this alternative, WS would be restricted to only using or recommending non-lethal methods to resolve damage caused by mammals (Appendix C). Lethal methods could continue to be used under this alternative by those persons experiencing damage by mammals without involvement by WS. In situations where non-lethal methods were impractical or ineffective to alleviate damage, WS could refer requests for information regarding lethal methods to the MDNR, local animal control agencies, or private businesses or organizations. Property owners or managers might choose to implement WS' non-lethal recommendations on their own or with the assistance of WS, implement lethal methods on their own, or request assistance (nonlethal or lethal) from a private or public entity other than WS. Property owners/managers frustrated by lack of WS' assistance with the full range of mammal damage management techniques may try methods not recommended by WS or use illegal methods (e.g., poisons). In some cases, in the absence of readily available technical assistance from WS on use of lethal methods, property owners or managers may misuse some methods or use some methods in excess of what is necessary.

3.1.3 Alternative 3: No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be involved with any aspect of mammal damage management. Information on MDM methods would still be available to producers and property owners through other sources such as MDNR, MSU Extension Service offices, or pest control organizations and private businesses. Requests for information would be referred to these entities. Currently, MDNR does not provide direct MDM assistance, but does provide technical assistance and issues permits for MDM activities as appropriate.

Persons experiencing damage caused by mammals could continue to resolve damage by employing those methods legally available. All methods described in Appendix C would be available for use by persons experiencing damage or threats of damage except for the use of immobilizing drugs, euthanasia chemicals, culvert traps, and foot snares for bears. Immobilizing drugs and euthanasia chemicals can only be used by WS, licensed veterinarians, or those that are trained and working under the supervision of an appropriate DEA license holder.

3.2 MAMMAL DAMAGE MANAGEMENT STRATEGIES USED BY WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1 and 2 described above. Alternative 3 would terminate both technical assistance and operational MDM by WS, but these methods would still be legally available to other entities. Appendix C is a more thorough description of the methods that could be used or recommended by WS.

3.2.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), 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., feral hogs) or any combination of these, depending on the circumstances of the specific damage problem.

3.2.2 The IWDM Strategies Employed by WS

Technical Assistance Recommendations
"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods and approaches. The implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for use by non-WS entities. Site-specific technical assistance may be provided through a telephone consultation, or during an on-site visit with the requester. In some instances, wildlife-related information provided to the requestor by WS results in tolerance/acceptance of the situation. In other instances, management options are discussed and recommended. 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.

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 mammal damage problems.

From FY 2007 through FY 2012, WS has conducted more than 72 technical assistance projects to reduce conflicts and damage to agricultural resources, property, natural resources, and threats to human safety associated. A summary of the types of damage situations WS helped to address through technical assistance is provided in Table 1.1.

Direct Damage Management Assistance (Direct Damage Management)
Direct damage management assistance includes damage management activities that are directly conducted or supervised by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when a *Work Initiation Document for Wildlife Damage Management* or other comparable instruments provide 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. The professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use pesticides are necessary or if the problems are complex.

Educational Efforts
Education is an important element of WS program activities because wildlife damage management is about finding balance and compromise 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 routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures, courses, and demonstrations are provided to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development
The National Wildlife Research Center functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. National Wildlife Research Center scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. National Wildlife Research Center scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

Examples of WS Technical Assistance and Direct MDM in Michigan
The Wayne County Airport Authority has entered into a Cooperative Service Agreement with WS for the purpose of assessing, managing, and monitoring wildlife-related public safety and aviation hazards at Detroit Metropolitan Airport (DTW) and Willow Run Airport (YIP). Aircraft strikes and other interactions involving coyotes, woodchucks, skunk, and other mammals have created safety hazards at the airports. WS has implemented an IWDM approach consisting of technical assistance and direct damage management components including: WS reviews airport development and landscaping plans, makes habitat management recommendations, provides training to DTW and YIP personnel, hazardous mammal species management, and exclusion. WS involvement at DTW and YIP has considerably reduced or prevented strikes with hazardous mammal species at the airport.

WS has entered into a Cooperative Service Agreement at the request of the Mt. Pleasant Police Department to reduce white-tailed deer numbers from a residential area within the City of Mt. Pleasant. The City of Mt. Pleasant experienced damage to shrubs, landscaping, gardens, and increased collisions with motor vehicles. Many residents were concerned about Lyme disease. These concerns were on the increase and the non-lethal strategies applied were not alleviating the problems. WS was able to provide lethal removal services and reduce the number of complaints with deer.

WS, in cooperation with MDARD, has worked in the north eastern Lower Peninsula, where bovine TB is endemic in the deer, to provide wildlife risk assessments to cattle farmers. These assessments provide farmers with ways to reduce their risk of contracting bovine TB from wildlife. Examples of recommendations include protecting feed, hay and water sources from exposure to deer. This project has shown the use of tools such as fencing, hay storage units, and the use of guard dogs lowered the risk of disease transmission.

3.2.3 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 3.1). 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. Wildlife Services personnel assess the problem then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, the effectiveness of the strategy continues to be monitored and evaluated. If the strategy is effective, the need for further management is ended. 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.

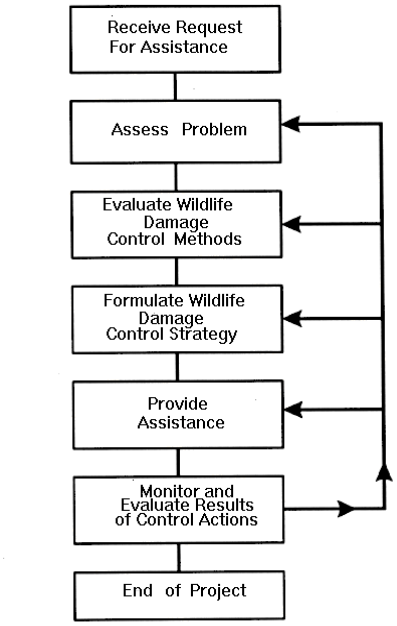

Figure 3.1 WS Decision Model as presented by Slate et al. (1992) for developing site specific strategies to resolve human-wildlife conflicts.

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 would provide technical assistance regarding the biology and ecology of mammals 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 mammals 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 mammal damage management activities. This process allows decisions on mammal 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.

Community Decision-Makers
The decision-maker for the local community would be elected officials or representatives of the community. The elected officials or representatives are popularly elected residents of the local community or appointees who oversee the interests and business of the local community. This person or persons would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision-making. Identifying the decision-maker for local business communities is more complex because building owners may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS could provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Direct control could be provided by WS only if requested by the local community decision-maker, funding is provided, and if the requested direct control was compatible with WS' recommendations.

Private Property Decision-Makers
In the case of private property owners, 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. Due to privacy issues, WS cannot disclose cooperator information to others. Therefore, individual property owner or managers make the determinations regarding involvement of others in the decision-making process for the site. Direct control could be provided by WS if requested, funding is provided, and the requested management is in accordance with WS' recommendations.

Public Property Decision-Makers
The decision-maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS could provide technical assistance to this person and recommendations to reduce damage.

Direct control could be provided by WS if requested, funding provided, and the requested actions were within the recommendations made by WS. Public involvement would be conducted by the agency responsible for managing the site in accordance with agency procedures.

Tribal Decision-Makers

The decision-makers for tribal property and ceded territories would be the officials responsible for or authorized to manage the Tribal lands and the lands and/or resources identified under treaty rights, to meet interests, goals, and legal mandates for the property. WS could provide technical assistance and recommendations to reduce damage. Direct control could be provided by WS if requested, funding provided, and the requested actions were within the recommendations made by WS. Involvement of tribal members or members of the surrounding community would be conducted in accordance with the established regulations and procedures for the affected tribe(s).

3.3 MAMMAL DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE (See Appendix C for a more detailed description of each method or approach.)

3.3.1 Non-lethal Methods

Non-lethal methods are often used by the cooperators before and/or after requesting assistance from WS. It is not unusual for cooperators to have already tried non-lethal methods prior to requesting assistance from WS. For example, in a 2010 NASS Nationwide survey of cattle producers, Michigan cattle producers reported using frequent checking (14.5%), livestock guarding animals (38.6%), night penning (2.8%), exclusion fencing (23.3%), livestock carcass removal (15.4%), culling of sick or injured animals (24.7%), fright tactics (0.8%), and other methods (11.2%) to prevent predation losses (NASS 2011). In a similar 2004 survey, Michigan sheep producers, reported using fencing (85%), shed lambing (57.8%), culling of sick/injured animals (4.7%), night penning (10.2%), frequent checks (8.4), changing bedding (3.2%), carcass removal (1.5%), guard dogs (5.2%), guard llamas (3.4%), guard donkeys (3.5%), herding (1.9%), and frightening devices (0.4%), other (1.6) to prevent predation losses (NASS 2005).

Exclusion (tree wraps, fencing, electrical barriers, etc.) involves physical exclusion of wildlife from protected resources and/or prevention of girdling, gnawing, and general damage.

Cultural methods and habitat modifications are typically implemented by agricultural producers or property owners. They consist primarily of non-lethal preventive methods which minimize exposure and/or reduce the amount or attractiveness of the protected resource to wildlife that would cause damage or pose a threat. A few examples of these types of techniques are: planting lure crops, providing alternate foods, changing animal husbandry practices, switching to short variety crops, picking less palatable varieties of landscape plants, picking up and containing rubbish in mammal resistant containers, not leaving pet food out at night, and keeping the vegetation around the protected resource short.

Animal behavior modification refers to tactics that alter the behavior of animals to reduce damage. Some of these tactics include:

- Propane exploders
- Pyrotechnics
- Distress calls and sound producing devices
- Visual repellents and other scaring tactics
- Livestock guarding animals

Repellents are usually naturally occurring substances that are chemically formulated to be distasteful or to elicit pain or discomfort to target animals when they are encountered. In Michigan, repellents must be registered with the Michigan Department of Agriculture and Rural Development (MDARD).

Non-lethal Capture Devices, including foot-hold traps, culvert traps, catch poles, cable restraints, nets, and box/cage/corral traps are used to capture wildlife. These devices hold the animal until the Specialist arrives and relocates the animal. Alternatively, when monitoring for diseases in wildlife, samples may be collected and then the animal is released at the capture site. WS could also use these capture methods for animals to be outfitted with transmitters used for wildlife research. These same devices can be used as lethal methods if the specialist euthanizes the captured animals via gunshot or euthanasia chemicals discussed below.

Medications for Animal Handling such as anesthetics (Ketamine, Telazol), sedatives (analgesics; Xylazine), and accessory drugs (Yohimbine, antibiotics, etc.) are used to capture, sedate, and handle animals involved in wildlife damage or disease situations. They may also be used to capture animals to receive transmitters for research purposes. These and other drugs are available for WS use, pursuant to State and Federal regulations, and are identified as approved drugs by the WS program through its Immobilization and Euthanasia Committee.

3.3.2 Lethal Methods

Lethal Capture Devices, including body-gripping traps (Conibear), snap traps and some snares designed to kill the captured animal.

Non-lethal Capture Devices: Non-lethal capture devices as discussed above can also be used as lethal methods when the captured animal is killed via shooting or euthanasia chemicals discussed below.

Shooting is helpful in some situations to supplement and reinforce other dispersal techniques and to kill mammals that are caught in nonlethal capture devices. It is selective for target species and may be used in conjunction with the use of spotlights, calling, and other techniques such as elevated positions, stands, etc. Shooting with firearms is sometimes used to manage mammal damage problems when lethal methods are determined to be appropriate. The animals are killed as quickly and humanely as possible.

Aerial Surveillance and Sharpshooting
Surveillance and sharpshooting from helicopters to remove feral swine has proven to be very affective across the U.S. Aerial surveillance could be conducted throughout the year by low level helicopter flights to determining presence of feral hogs prior to initiating other control methods. Aerial sharpshooting would be conducted during the winter (approximately January through March) after leaves have fallen from trees and snow is present on the ground. Wildlife Services would not conduct aerial sharpshooting on a property without the consent of the landowner/manager. All aerial activities would be conducted in accordance with the policies established in WS Directive 2.62 – Aviation Safety and Operations and the WS Aviation Safety and Operations manuals. Aerial sharpshooting has been identified as a viable tool for feral swine management in the U.S. (Campbell et al. 2010, West et al. 2009). Reported removal rates for aerial removal of feral swine range from 9-39 swine per hour (Campbell et al. 2010, Saunders and Bryant 1988, Hone 1983). Differences in swine density, climate, terrain and plant cover account for most of the variation in capture rates. Sometimes individual feral swine may be live captured, fitted with radio transmitters, and released to be used to identify groups ("Judas pigs") which are subsequently removed using the aerial methods listed. Although aerial sharpshooting is an expensive method, WS' experience with feral swine removals indicates that the staff time, travel time and labor required to achieve similar results using ground-based methods will likely make aerial sharpshooting a cost-effective option.

Sport harvest through hunting and trapping is often an important part of MDM strategies and is recommended by WS to enhance the effectiveness of other damage management techniques and to accomplish population management objectives developed by the WDNR.

Gas Cartridges are incendiary devices designed to give off carbon monoxide and other poisonous gases and smoke when ignited. They are used to fumigate burrows of certain rodents and other mammals.

Zinc Phosphide is a toxicant mixed on baits to reduce damage by rodents. Anticoagulant rodent baits could be used in bait stations in and around airport structures. Zinc phosphide and anticoagulant rodenticides could be used by WS to reduce hazards associated with rodents at airports.
Carbon dioxide (CO_2) gas is an AVMA-approved euthanasia method (AVMA 2013) which is sometimes used to euthanize small mammals that have been chemically immobilized or captured in live traps. Live animals are placed in an enclosed space into which CO_2 gas is released. The animals quickly expire after inhaling the CO_2.

Euthanasia agents (Sodium Pentobarbital and its derivatives, Potassium Chloride) are used to euthanize animals involved in wildlife damage or disease situations. These and other drugs are available for WS use, pursuant to State and Federal regulations, and are identified as approved drugs by the WS program through its Immobilization and Euthanasia Committee.

Carcass disposition. Animals killed to reduce damage or health and safety risks are disposed of in accordance with applicable state, tribal and local regulations. Animals that are used for disease monitoring are usually given to the MDNR, and are incinerated after samples are collected. In some cases, samples for disease monitoring and research may be collected in the field in which case the animal is disposed of using the normal process for that species. Most animals taken during damage management are disposed of in a landfill. Deer may be donated for human consumption. Feral swine fall under authority of the FMIA (Section 1.6.6), and therefore could only be donated to charitable organizations for use as food by needy individuals if they are delivered alive to a USDA approved feral swine slaughter facility which is not currently a logistically viable solution for the Michigan WS program. In rare instances, feral swine may be left on site if aerial shooting is used to remove feral swine from remote locations which cannot be safely accessed or for which access by ground vehicles would cause substantial adverse impact to soils and vegetation.

3.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

3.4.1 Lethal Mammal Damage Management Only By WS

Under this alternative, WS would not use or recommend any non-lethal MDM methods, but would only conduct lethal MDM. This alternative was eliminated from further analysis because some mammal damage problems can be resolved effectively through non-lethal means. Additionally, this alternative directly contradicts WS Directive 2.101.

3.4.2 Exhaust All Feasible Non-lethal Methods before Using Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix C be applied in response to every request for assistance to reduce damage and threats to safety from mammals. If the use of all non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. 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 request. This alternative would not prevent the use of lethal methods by those persons experiencing mammal damage but would only prevent the use of those methods by WS until all non-lethal methods had been employed.

People experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. 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) is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered and given preference where practical and effective (WS Directive 2.101). This alternative would have environmental impacts intermediate to Alternatives 1 (Integrated MDM with preference given to practical and effective nonlethal methods) and Alternative 2 (only nonlethal methods). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

3.4.3 Compensation Only for Mammal Damage Losses

Reimbursement provides producers monetary compensation for losses, it does not remove the problem nor does it assist with reducing future losses. The compensation only alternative would require the establishment of a system to reimburse persons impacted by mammal damage. Under such an alternative, WS would not provide any technical assistance or direct damage management. Aside from lack of legal authority, analysis of this alternative indicates that the concept has many drawbacks (Wagner et al. 1997):

- It would require larger expenditures of money and labor to investigate and validate all damage claims to determine and administer appropriate compensation.
- Compensation would most likely be less than full market value.
- In the case of predation on livestock or pets, compensation may not be a satisfactory solution for individuals who feel responsible for the well-being of their livestock or in situations where there is an emotional attachment to the animal.
- Compensation would give little incentive to resource owners to limit damage through improved cultural, husbandry, or other practices and management strategies.
- Not all resource owners would rely completely on a compensation program and unregulated lethal control would most likely continue as permitted by state law.
- Compensation would not be practical for reducing threats to human health and safety.

This alternative was eliminated from further analysis because it is not financially feasible or practical to provide compensation for all mammal damage.

3.4.4 Reproductive Control

Reproductive control is often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Population dynamic characteristics (*e.g.*, longevity, age at onset or reproduction,

population size, and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target populations, cover types, and access to target individuals), socioeconomic, and other factors often limit the use and effectiveness of reproductive control as a tool for wildlife population management.

Reproductive control for wildlife could occur through sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

There remain several limitations to the use of reproductive control for wildlife population stabilization. Currently, chemical reproductive inhibitors are not available for use to manage most mammal populations. The only reproductive inhibitor that is registered with the EPA is GonaCon™, which is registered for use on white-tailed deer only. GonaCon™ is intended for use in combination with other forms of deer population management (EPA Reg. No. 56228-40). Recent studies have examined the practicality of administering GonaCon™ to free-ranging white-tailed deer as well as the efficacy, toxicity, and safety of the vaccine (Gionfriddo et al. 2009, 2011). In a Maryland study, an overpopulated deer herd on a completely fenced site was initially reduced in density by WS sharpshooters at the request of the property owner. Once the population size was reduced to a level that could be supported by the available habitat, GonaCon™ was applied to adult females. Forty–three does were captured, marked, and released at their capture sites during July 2004. Of those does, 28 were injected with GonaCon™ vaccine, and 15 were maintained as unvaccinated control animals. Data show the vaccine to be 88 percent effective the first year and 47 percent effective the second year in treated deer (Gionfriddo et. al. 2009). GonaCon™ still has limitations, however, especially the need to capture and inject each animal. This product is currently registered by the EPA as a "Restricted Use" product for use by state or federal wildlife or natural resource management personnel or persons working under their authority. In Michigan, however, the product is not currently registered for use. Reproductive inhibitors for the other mammal species addressed in this EA do not currently exist.

A second deer immunocontraceptive method using porcine zona pellucida (PZP; e.g., SpayVac) has been effective in field trials (Rutberg et al. 2013, Locke et al. 2007), but is not currently approved by EPA or the State for general use. It is being used in research studies. Although the product does appear to suppress reproduction for multiple years in many treated animals, it also has the undesirable side effect of causing multiple estrus periods in does (Fagerstone et al. 2010).

Surgical sterilization, in general, can be an expensive method for deer population control because of the time required to capture and handle the deer and the expertise of the personnel required for the procedure (Boulanger et al. 2012). However, in some cases, communities may be willing to undertake the costs associated with this method. For example, a community in Fairfax, New

Jersey, has received private donations for a two-year trial program of surgical sterilization costing an estimated $1,000 per doe (Jackman 2013). A similar pilot study was started in Clifton, Ohio, in 2015 and is also being paid for through donations (Data on cost per deer are not available; Clifton Deer Sterilization Working Group 2014). The primary advantage of surgical sterilization is that the impact is permanent and deer need only be handled once in their lifetime, instead of the repeat treatments required for the immunocontraceptive vaccines discussed above. Data are not yet available on the long-term results of these programs.

It is difficult, time-consuming, and expensive to effectively trap, chemically capture, or remotely treat the number of deer necessary to effect an eventual decline in the population. As noted above, some communities may be willing to undertake this cost. Nonetheless, in general, this method is unsuitable for large-scale population reductions. Additionally, reproductive control will not be beneficial in addressing disease management problems in Michigan (e.g., CWD, and TB) in which prompt removal of infected animals and/or prompt population reduction is required.

When used exclusively, in areas where deer populations are already excessively high, population modeling continues to indicate it would take a number of years of implementation before deer populations would decline and, therefore, damage would continue at the present unacceptable level for a number of years (Fagerstone et al. 2010). However, in localized areas with excessive deer populations, particularly closed populations, reproductive control may have great utility in maintaining a lower population after it has first been reduced by other methods.

While MDNR does not have an "official" policy on sterilization or contraceptive drugs, it currently does not consider these methods an option for managing free-ranging white-tailed deer in the State (Chad Stewart, MDNR pers. comm. 2015). Given the cost and logistical difficulties with implementation, and the fact that reproductive control will not change the health (TB, CWD) status of the deer, this method continues to be unsuitable for addressing all deer conflicts in the State and will not suffice as a stand-alone alternative. However, if approved by MDNR, WS could include this as one of the methods available in the integrated Deer Damage Management Alternative (current program) as a pilot study or research project.

Trap-Neuter-Release Program for Feral and Free Ranging Cats

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. The debate focuses on whether controlling feral, free-ranging, or invasive animal populations through Trap-Neuter-Release (TNR) programs are effective and alleviate problems (*i.e.*, diseases, predation, agricultural damage, and human safety).

Theoretically, TNR would work if all animals of one sex or both were sterilized. However, the probability of controlling invasive species in the wild with this technique is not currently reasonable, especially with the animals being self-sufficient and not relying on humans to survive. Additionally, some individuals within a population can be trap-shy. Capturing or removing trap shy individuals often requires implementing other methods.

Many veterinarians and public health officials oppose TNR programs based on health concerns and disease threats. The potential for disease and parasite transmission to humans either from direct contact during sterilization or the risk of exposure after the animal is released is a concern. Once live-captured, performing sterilization procedures during field operations on anesthetized feral cats would be difficult. Sanitary conditions are difficult to maintain when performing surgical procedures in field conditions. To perform operations under appropriate conditions, live-captured feral cats would need to be transported from the capture site to an appropriate facility which increases the threat from handling and transporting. A mobile facility could be used but would still require additional handling and transporting of the live-captured feral cats to the facility. Once the surgical procedure was completed, the feral cat would have to be held to ensure recovery and transported back to the area capture occurred.

Trap-Neuter-Release programs are often not as successful as desired to reduce immediate threats to humans and long term threats posed to wildlife (AVMA 2003, Barrows 2004, Levy and Crawford 2004, Jessup 2004, Winter 2004). Feral cats subjected to TNR would continue to cause the same problems[3] they caused before the TNR program was initiated because of slow attrition. Trap-Neuter-Release programs can take a decade or longer to reduce target species populations (Barrows 2004, Winter 2004) especially when acute issues need rapid solutions (Levy and Crawford 2004, Stoskopf and Nutter 2004). Several studies report that target species populations often remain stable or increase following TNR programs due to immigration and reproduction from other members of the groups (Castillo and Clarke 2003, Levy and Crawford 2004, Winter 2004) with little to no resolution of threats to human safety or damages (Barrows 2004, Slater 2004, Winter 2004).

Other concerns arise when considering the legality of TNR programs given the documented damage caused by target species, especially to native wildlife (Barrows 2004, Levy and Crawford 2004, Jessup 2004). Some people have questioned whether TNR programs are violating the Migratory Bird Treaty Act and the ESA because released animals may continue to kill migratory birds and/or endangered species (Barrows 2004, Levy and Crawford 2004, Jessup 2004). As a result of the continued threat to human safety created by TNR programs and the continued threat to T&E wildlife and native wildlife in general, this alternative will not be considered further.

3.4.5 Bounties

Payment of funds (bounties) for killing some mammals suspected of causing economic losses have not been supported by the MNDR[4] , as well as most wildlife professionals for many years (Latham 1960). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective

[3] Brickner (2003), Levy et al. (2003), Barrows (2004), and Jessup (2004) reported that sterilized cats that do not spend any time on courting and mating are left with more time to hunt than non-sterilized cats and therefore, continue to remain as potential reservoirs of animal and human disease, a social nuisance, and continue to hunt and kill protected species.

[2]http://www.michigan.gov/documents/dnr/NRC_4104_471574_7.pdf

at controlling damage over a wide area, such as the entire state of Michigan. The circumstances surrounding the removal of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring. In addition, WS does not have the authority to establish a bounty program.

3.4.6 Trap and Translocate Mammals Only

Under this alternative, all requests for assistance where removal of the problem animal(s) is identified as the preferred management strategy would be addressed using live-capture and relocation or the recommendation of live-capture and relocation. Mammals would be live-captured using immobilizing drugs, live-traps, or nets (*e.g.*, cannon nets, rocket nets, or drop nets) described in Appendix C and relocated. Translocation sites would be identified and have to be approved by the MDNR and/or the property owner where the translocated mammals would be placed prior to live-capture and translocation. Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. However, all translocation of mammals by WS could only occur with the authorization of the MDNR.

The translocation of mammals that have caused damage to other areas following live-capture may not be effective or cost-effective for all situations. Translocation may be ineffective because some problem mammal species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and/or translocation would most likely result in mammal damage problems at the new location. Sometimes, hundreds of mammals would need to be captured and translocated to solve damage problems (*e.g.*, deer confined within a perimeter fence); therefore, translocation would be logistically unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). In some instances, there also may be a concern of spreading wildlife diseases by moving wildlife from one location to another. Given the limitations on translocation of wildlife, the exclusive use of translocation in situations where removal of problem mammals is warranted will not be addressed in detail.

3.4.7 Supplemental Feeding

Supplemental feeding would involve providing acceptable foods (e.g. corn or a balanced ration diet) either during certain annual periods when deer browsing on ornamental plants and flowers is most severe, or on a year-round basis. This alternative was not considered in detail because deer numbers would most likely continue to grow, perhaps to a level even higher than what would occur without such feeding, requiring increased costs for supplemental feed, and increasing the occurrence of damage to property, agricultural and natural resources, and threats to human health and safety. Additionally, supplemental feeding is banned in Deer Management Unit (DMU) 487 in Michigan and has strict regulations elsewhere in the state due to the potential to spread diseases such as bovine tuberculosis.

3.4.8 Technical Assistance Only

This alternative would restrict WS to only providing technical assistance (advice) on MDM. Producers, property owners, agency personnel, or others could obtain permits from the MDNR as needed and could conduct mammal damage management using any of the legally available nonlethal and lethal techniques. Technical assistance information is also readily available from entities other than WS such as the USFWS, universities, extension agents, FAA, and private individuals and organizations. Consequently, environmental impacts of this alternative are likely to be similar to Alternative 3 – No WS Mammal Damage Management Program. Consequently, the agencies have determined that detailed analysis of this alternative would not contribute substantive new information to the understanding of environmental impacts of damage management alternatives and have chosen to not analyze this alternative in detail.

3.5 STANDARD OPERATING PROCEDURES (SOPs) FOR MAMMAL DAMAGE MANAGEMENT

The WS program has developed SOPs for its activities that reduce the potential impacts of these actions on the environment. Some key standard operating procedures pertinent to the proposed action and alternatives of this EA include:

- The WS Decision Model thought process is used to identify effective wildlife damage management strategies and their effects.

<u>Target, Non-target, and Threatened and Endangered Species</u>

- WS personnel are trained and experienced to select the most appropriate method for taking problem animals and excluding non-target species.

- WS has consulted with the USFWS and MDNR regarding potential impacts of the proposed alternatives on state and federally-listed T&E species. Reasonable and prudent measures or other provisions identified through consultation with the USFWS and MDNR will be implemented to avoid adverse effects on T&E species.

- WS would initiate informal consultation with the USFWS following any incidental take of T&E species.

- Research is being conducted to improve MDM methods and strategies so as to increase selectivity for target species, to develop effective non-lethal control methods, and to evaluate and minimize non-target hazards and environmental effects of MDM techniques.

- In the event that WS recommends habitat modification (e.g., modifying a wetland) as a damage management practice for the landowner/manager, WS will advise the

landowner/manager that they are responsible for checking with state and federal authorities regarding regulations and endangered species protections that may be applicable to the proposed project.

- WS uses chemical methods for MDM that have undergone rigorous research to prove their safety and lack of serious effects on non-target animals and the environment.

- EPA approved label directions are followed for all pesticide use. The registration process for chemical pesticides is intended to assure minimal adverse effects to the environment when chemicals are used in accordance with label directions.

- Live-traps would be placed so that captured animals would not be readily visible from any road or public area.

- Traps and snares will not be set within 30 feet of exposed animal carcasses to prevent the capture of scavenging birds.

- Foothold trap pan tension devices will be used to reduce hazards to non-target species that weigh less than the target species.

- Captured non-target animals would be released unless it is determined by WS personnel that the animal would not survive.

- Where applicable, annual WS removal will be considered with the statewide "total harvest" (e.g., WS removal and other licensed harvest) when estimating the impact on wildlife species.

- Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.

Health and Safety

- All WS personnel in Michigan using restricted chemicals and controlled substances (immobilization and euthanizing drugs) are trained and certified by, or operate under the direct supervision of, program personnel or others who are trained in the safe and effective use of chemical MDM materials.

- WS uses MDM devices and conducts activities for which the risks of hazards to public safety and to the environment have been determined to be low according to a formal risk assessment. Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.

- Appropriate warning signs are posted on main entrances or commonly used access points to areas where foothold traps, cable restraints, snares or rotating jaw (conibear-type) traps are in use.

- All WS actions are conducted in accordance with applicable state, tribal, federal and local laws, including regulations mandating that land traps set for mammals be checked at least once each calendar day.

- Damage management projects conducted on public lands would be coordinated with the management agency.

- Pesticide use, storage, and disposal conform to label instructions and other applicable laws and regulations, and Executive Order 12898.

- Material Safety Data Sheets for pesticides would be provided to all WS personnel involved with specific damage management activities.

Humaneness and Animal Welfare Concerns of Methods Used

- All WS actions are conducted in accordance with applicable state, federal and local laws, including regulations mandating that land traps set for mammals are checked at least once each calendar day.

- Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.

- Management controls are in place within WS and its Immobilization and Euthanasia Committee to maintain personnel training and certification.

- Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used.

- Use of newly-developed, proven, non-lethal methods would be encouraged when appropriate.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed when selecting an appropriate alternative to meet the need for action established in Chapter 1. The environmental consequences of each alternative are analyzed in relation to the issues identified for detailed analysis in Chapter 2 to determine the extent of actual or potential impacts. The environmental consequences of each alternative are analyzed in comparison with the no action alternative (Alternative 1) to determine if the real or potential effects would be greater, lesser, or the same. In addition to considering applicable state, federal and local regulations, the analysis also takes into consideration applicable mandates, directives, and the procedures of WS and the MDNR.

The following resource values within the state are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, visual resources, air quality, prime and unique farmlands, timber, and range. These resources will not be analyzed further.

Indirect and Cumulative Effects: Indirect effects are impacts caused by an action that are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative Effects, defined by CEQ (40 CFR 1508.7), 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. Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

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.

4.1 EFFECTS ON TARGET MAMMAL SPECIES POPULATIONS

4.1.2 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

A common concern is whether damage management actions would adversely affect the populations of target mammal species, especially when lethal methods are employed. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods can disperse, exclude or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where non-lethal methods are employed. 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 or recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance has already tried applicable non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use has already been proven ineffective in adequately resolving the damage or threat.

Many non-lethal methods exclude, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, these types of non-lethal methods result in a reduction in the presence of the target mammals at the site where the methods were employed. However, mammals responsible for causing damage or threats are moved to other areas with minimal impact on those species' populations. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (e.g., food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife because individuals of the target species are unharmed. The use of non-lethal methods would not have adverse impacts on mammal populations in the state under any of the alternatives.

The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since mammals would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove specific mammals that have been identified as causing damage or posing a threat to human safety. The use of lethal methods would result in short-term local reductions of mammals in the immediate area where damage or threats were occurring. The number of mammals removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed. The analysis of potential impacts of WS actions on target mammals is based on estimations of anticipated maximum annual levels of take developed using information on prior requests for WS assistance; discussions with cooperating and consulting agencies and tribes; and experience of Michigan WS field staff and supervisors.

Where appropriate, WS may recommend mammals be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage. Hunting and trapping may be recommended in situations where the damage problem is associated with high target animal densities in the project area (e.g., overbrowsing by high densities of deer) and not the actions of one or a small group of animals. However, WS involvement in these types of actions is limited to recommendations. Establishing hunting and trapping seasons and the allowed take during those seasons, and issuance of harvest permits to address damage problems, is the responsibility of the MDNR. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those mammals with hunting and/or trapping seasons would be occurring in addition to any take that could occur by WS under the alternatives or recommended by WS.

Generally, WS only conducts damage management on species whose population densities are high or concentrated and usually only after they have caused damage. Table 4.1 identifies average annual lethal removal of animals by WS, proposed maximum annual WS removal, and estimated annual harvest by hunters and trappers within Michigan for calendar years (CY) 2009 to 2013. No indirect effects were identified for this issue**.**

Table 4.1a Average annual Michigan WS lethal removal and public harvest of native mammals addressed in this EA. See species accounts below for source of information on harvest.

Species	Average Annual WS Removal 2009-2013 5-year Average[a]	Maximum Proposed WS Annual Removal [a]	MI Statewide Average Annual Estimated Season Harvest[b]	% WS Proposed Annual Removal Compared to Average Annual MI Harvest
Badger	0	5	215	2.33%
Beaver	6	500	15,578	3.21%
Black Bear	0	5	2,193	0.23%
Bobcat	0	5	712	0.70%
Coyote	11	150	46,745	0.32%
Eastern Chipmunk	0	100	NA	NA
Eastern Cottontail	0	100	233,540[c]	> 0.04%
Elk	0	5	173	2.89%
Fisher	0	5	265	1.89%
Gray Fox	0	30	3,063	0.98%
Marten	0	5	303	1.65%
Mink	0	20	13,211	0.15%
Misc. mice, shrews, moles & voles	8	1,000 combined	NA	NA
Muskrat	8	200	181,354	0.11%
Norway Rat	0	500	NA	NA
Porcupine	0	20	NA	NA
Raccoon	73	500	156,303	0.32%
Red Fox	0	30	6,448	0.47%
River Otter	0	20	1,070	1.87%
Snowshoe Hare	0	15	35,900[c]	0.04%
Fox Squirrel	0	20	NA	NA
Gray Squirrel	0	20	NA	NA
Red Squirrel	0	20	NA	NA

Species	Average Annual WS Removal 2009-2013 5-year Average[a]	Maximum Proposed WS Annual Removal [a]	MI Statewide Average Annual Estimated Season Harvest[b]	% WS Proposed Annual Removal Compared to Average Annual MI Harvest
Northern & Southern Flying Squirrel	0	5	NA	NA
Thirteen-Lined Ground Squirrel	0	20	NA	NA
Other Ground Squirrel	2	5	NA	NA
Squirrels, all species	2	90	436,918[c]	0.02%
Striped Skunk	8	100	5,847	1.71%
Virginia Opossum	26	200	25,495	0.78%
Weasels	0	20	3,266	0.61%
White-Tailed Deer (Wild)	129	5,000	438,419	0.11%
Woodchuck	57	200	NA	NA

[a]Only includes lethal removal

[b] Data is averaged over interval of 2009-2013 unless otherwise noted.

[c]Harvest data is only available through 2011 season. Data is average of harvest from 2009-2011.

Table 4.1b Average annual Michigan WS lethal removal of introduced, feral and domestic mammals addressed in this EA for the period for 2009 to 2013.

Species	Average Annual WS Take 2009-2013 5-year Average[a]	Maximum Proposed WS Annual Take[a]	MI Statewide Average Annual Estimated Season Harvest 2008-2012	% WS Proposed Annual Take Compared to Average Annual MI Harvest
Feral Cat	0	200	NA	NA
Feral Dog	0	30	NA	NA
Feral Swine	0	500	NA	NA
Feral Rabbit	0	15	NA	NA
White-Tailed Deer (Captive)	2	500	NA	NA

[a]Only includes lethal take

NATIVE SPECIES

Beaver

Beaver are found statewide in Michigan where suitable habitat exists. Most requests for assistance with beaver damage management in Michigan involve conflicts with flooding of roads and railroad rights of way associated with beaver ponds; weakening of roadways and railbeds resulting from impounded water or burrowing for beaver dens; and felling trees on roads and train tracks. However, there is a potential for WS to receive a request for assistance where beaver are causing timber damage on public or private property. In addition to property damage, these types of activities may also pose risks to human safety.

The beaver population in Michigan is currently unknown. However, beaver populations are sufficient to allow beaver to be harvested during an annual trapping season. During the regulated season, the MDNR allows trappers to harvest an unlimited number of beaver during the length of the season. According to the MDNR Otter and Beaver Harvest Surveys from 2009-2013, furtakers who had obtained an otter tag reported taking an average of 15,578 beaver during the yearly trapping season (Frawley 2015a, 2013, 2012a). This estimate is an underestimate of the total number of beaver removed annually because it does not include legal take of animals outside the harvest season (e.g., take for damage management by WS, private property owners, or private pest control businesses). WS' proposed annual removal of up to 500 beaver would represent 3.21% of the known average beaver taken during the trapping season.

The unlimited harvest levels allowed by the MDNR during the length of the trapping season provides an indication that the MDNR does not believe cumulative removal, including removal for damage management, would reach a level where overharvest of the beaver population would occur and cause an undesired population decline. Reports of beaver taken per hunter/trapper

during this period show a decreasing trend and may indicate a decline in the population. However, catch per trapper can be impacted by a variety of factors that do not relate to species abundance (Frawley 2015a). For example, the data do not include information on effort per hunter/trapper and may reflect decreasing interest/effort in capturing beaver and not a declining population trend. Survey of otter trappers that were also trapping for beaver indicate that 75% of trappers felt that beaver populations in their area were stable (54%) or increasing (21%; Frawley 2015b). The MDNR has regulatory authority over the management of wildlife, including beaver, and all removal by WS has occurred and would continue to occur only after being authorized by the MDNR and only at the levels authorized. Given the limited removal of beaver proposed by WS relative to estimated levels of fur harvest, and the MDNR'S oversight of WS, annual trapping seasons, and private pest control operator removal, the lethal removal of up to 500 beaver would not have an adverse individual or cumulative effect on the Michigan beaver population.

Black bear

Black bear are predominantly found in the Upper Peninsula and northern Lower Peninsula of Michigan, although, sightings have been as far south as the Michigan – Indiana border. On average bears have 2 cubs every other year (Kurta 1995). However, sows in the northern Lower Peninsula typically breed earlier (two to three years of age) and have above-average litter sizes (2.6 cubs per sow) than black bears in other Midwestern states (MDNR 2009). Black bear populations in the Northern and Lower Peninsula are believed to be stable to increasing. At the time the Michigan black bear management plan was prepared in 2009, the state black bear population in both Peninsulas was believed to be stable to increasing (MDNR 2009). Bear hunting is limited by a quota system, which restricts the number of licenses issued and the areas that can be hunted. The season is limited to a five week period starting in September and ending in October. In 2013 and 2014, 1,561 and 1,471 black bears, respectively, were harvested by hunters in Michigan (MDNR 2015).

WS' current policy is to refer all nuisance black bear calls and complaints to the MDNR. However, in rare instances at the request of MDNR, WS could be called to euthanize a bear struck by a vehicle in situations where WS personnel are able to respond more quickly than MDNR personnel. This type of incident is not anticipated to involve more than 5 black bears per year**.** WS involvement in these situations would be to rapidly and humanely assist an animal that would die due to injuries, and would not increase overall mortality rates for the population. WS involvement in euthanizing injured bears would have no impact on the environmental status quo for black bears in Michigan.

Coyote

Coyotes are found throughout the state of Michigan including in some urban and suburban areas. On average, coyotes have six pups in a litter (Kurta 1995). The MDNR has established hunting and trapping seasons for coyotes from July through April with no bag limits. Also, coyotes may be taken without a license if the animal is doing or about do damage on private land.

The coyote is probably the most extensively studied carnivore, and considerable research has

been conducted on population dynamics (Bekoff and Gese 2003). Coyote densities have been estimated at .32-.37/km^2 in the Upper Peninsula of Michigan (Petroelje et al. 2014). Coyote densities vary based on local habitat quality and prey availability.

Based on previous requests for assistance received by WS and anticipated future requests, the removal of coyotes by WS would not exceed 150 coyotes annually. Compared to the average annual harvest of 46,745 coyotes, WS' removal would represent 0.32% in direct impacts. Coyotes are highly prolific and able to rebound rapidly from harvest pressure. Coyote removal sites are usually relatively small relative to coyote mobility and territory size, so immigration of coyotes from the surrounding area quickly replaces the animals removed (Stoddart 1984). Compensatory reproduction and mortality factors also contribute to rapid population recovery after removals and the ability of coyote populations to sustain relatively high levels of removals over time. A population model by Pitt et al. (2001, 2003) assesses the impact of removing a set proportion of a coyote population during one year and then allowing the population to recover. In the model, all populations recovered within 1 year when <60% of the population was removed. Recovery occurred within 5 years when 60-90% of the population was removed. Pitt et al. (2001, 2003) also evaluated the impact of removing a set proportion of the population every year for 50 years. When the removal rate was <60% of the population, the population size was the same as for an unexploited population. These findings are consistent with an earlier model developed by Connolly and Longhurst (1975), and revisited by Connolly (1995) which indicated that coyote populations could withstand an annual removal of up to 70% of their numbers and still maintain a viable population.

Therefore, no significant cumulative impacts are expected when WS' removal is added to the average annual sportsman harvest. Based on the limited proposed removal by WS and the fact that the MDNR allows for unlimited harvest of coyotes, WS' activities will have no significant effects on statewide coyote populations. The unlimited harvest levels allowed by the MDNR during the length of the trapping season provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the coyote population would occur resulting in an undesired population decline. The MDNR'S oversight of WS, annual trapping seasons, and private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall coyote population.

Eastern Cottontail

The cottontail is the most abundant and widespread of the rabbits in the U.S, and is found statewide. Population densities for cottontail rabbits vary with habitat quality, but one rabbit per 0.4 hectares (one acre) is a reasonable average (Craven 1994). Cottontail rabbits generally live only 12-15 months, but they can raise as many as six litters per year of one to nine young (usually four to six); (National Audubon Society 2000). Cottontails are a regulated game species in Michigan and the MDNR has established seasons and bag limits for this species. No statewide population estimates are available for cottontail rabbits, however the MDNR does estimate harvest via hunter surveys. The estimated annual average take of cottontails from 2009-2011 was 233,540 rabbits (Table 4.1a; Frawley 2015b).

WS estimates that no more than 100 cottontail rabbits may be taken per year for MDM. This maximum estimated take by WS is 0.04% of the estimated annual take by hunters in the state. Almost all of rabbits would be removed from urban, airport, commercial, or industrial habitats where hunting is not likely to occur. Cottontail rabbit damage management activities would target single rabbits or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Given the high productivity of cottontail rabbits and that WS actions will be confined to very small, scattered portions of the state that are usually not subjected to hunting, WS' limited lethal take of cottontail rabbits would have no adverse impacts on overall rabbit populations in the state.

Elk

This native species was reintroduced into Michigan in 1918 and steadily increased in population size until hunting was authorized in 1964. Hunting has been used in recent years to maintain a balance between a healthy elk herd and minimizing damage. The MDNR maintains the herd size between 800-1,400 animals (MDNR 2012). Elk are currently located in the northern Lower Peninsula of Michigan. The MDNR authorizes limited hunting during August, September, and December with a restricted harvest of 100 - 275 elk annually. The MDNR adjusts harvest levels annually to maintain population goals (MDNR 2014).

WS MI may be requested by the MDNR to lethally take elk due to a disease threat such as bTB, CWD, or etc. WS MI may also humanely kill elk when an animal has been mortally injured or wounded and MDNR cannot respond in a timely manner. WS proposed annual removal of five elk would represent less than 1.0% of the minimum goal population. When combined with the average annual hunter harvest, WS' proposed removal would only increase the cumulative take from 35.0% to 35.6%. The MDNR's oversight of WS, hunting seasons, and other forms of mortality would ensure that the cumulative impacts on the elk population including potential removals by WS for MDM would not have a significant negative impact on the overall elk population.

Red Fox

Red fox can be found in every county in Michigan and are common in areas with fallow and cultivated fields, meadows, bushy fence lines, woody stream borders, and low shrub cover along woods and beaches. They can also be found in suburban and, less commonly, urban areas where food is readily available (MDNR 2015b). Red fox produce an average of 5 kits per litter (range 1-13 kits) (Fox 2007).

Red fox are classified as a furbearer in Michigan with regulated annual hunting and trapping seasons during which there is no limit on the number of red fox that can be harvested (MDNR 2015c(?). The estimated average annual take by sportsmen from 2009 through 2013 for red fox was 6,448 (Table 4.1a).

Red fox densities are difficult to determine because of the species' secretive and elusive nature. However, researchers have documented that the red fox has high reproductive and dispersal rates

and thus, can withstand high mortality (Allen and Sargeant 1993, Viogt 1987). Annual harvests in localized areas in one or more years will likely have little impact on the overall population in subsequent years, but may reduce localized populations (Allen and Sargeant 1993). Philips (1970) stated that fox populations are resilient and for fox control (by trapping) to be successful, pressure on the population must be almost continuous. Philips (1970) and Voigt (1987) also concurred that habitat destruction affects fox populations to a greater extent than short-term over-harvest.

The MDNR does not collect data on the size of the red fox population in the state, but does monitor population trends through hunter and trapper surveys. Population estimates for red fox are not maintained by the MDNR. The mean harvest of red fox by both hunters and trappers has declined since the mid-1980s which suggests red fox numbers may have been declining over this period (Frawley 2015a). Coyotes can exclude red fox from their territories and reduced densities of red fox have been recorded in areas where higher numbers of coyotes are found (Sovada et al. 1995).

WS receives few formal requests for assistance with red fox, however depredation to poultry from fox is the most frequent call received from WS. This tends to be associated more often with red fox then gray. The second most frequent reason individuals call is related to rabies. WS tests sick or strange acting mammals (that have not been involved in human or animal exposure) for rabies. Fox make up one third of the rabies positive animals tested by WS. Based on previous and anticipated requests for assistance, take of red fox by WS for MDM would not exceed 30 red fox annually. This maximum estimated take by WS is less than 1% of the estimated annual take by hunters and trappers. This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population. Unlimited regulated harvest allowed by MDNR provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the red fox population would occur resulting in an undesired population decline. WS' coordination with MDNR ensures that the removal by WS and other entities occurs within allowable harvest limits.

Gray Fox

The gray fox is common in many parts of the United States where deciduous woodlands provide habitat. The grey fox is somewhat smaller in stature than the red fox, having shorter legs and extremities. The striking pelage has grizzled upper parts resulting from individual guard hairs being banded with white, grey, and black (Fritzell 1987).

Gray fox are found in woody, brushy, and rocky habitats from the extreme southern Canada to northern Venezuela and Columbia (Fritzell 1987). In Michigan, gray fox are typically found in woodlands and are present in all counties. As with red fox, information on population estimates and densities in Michigan are not available; however, gray fox numbers may be locally abundant, but down in some areas, perhaps because of increasing coyote populations (http://www.michigan.gov/dnr/0,4570,7-153-10366_46403_63473-286169--,00.html). People can harvest gray fox during the annual hunting and trapping seasons in Michigan without a limit on the number of gray fox that may be taken during the open season (MDNR 2015c). Table 4.1a

shows the number of gray fox that have been harvest annually during the hunting and trapping seasons. Between 2009 and 2013, sportsmen harvested an annual average of 3,063 gray fox per year in Michigan.

WS receives few requests for assistance with gray fox, however in anticipation of future requests for assistance WS expects to take 30 or fewer gray fox annually. This represents less than 1% of the average annual sportsmen's harvest. Since Michigan's state-wide population of gray fox is likely much higher than the number of gray fox taken annually by sportsmen, WS' take would be of a much lower magnitude. Unlimited regulated harvest allowed by MDNR provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the gray fox population would occur resulting in an undesired population decline. WS' coordination with MDNR ensures that the removal by WS and other entities occurs within allowable harvest limits

Small Native Rodents & Insectivores

Rodents (eastern chipmunk, mice, voles, pocket gophers, etc.) and insectivores (shrews and moles) are taken by WS during wildlife hazard management, assessment, and monitoring at airports and airbases because these species serve as attractants to birds such as raptors and mammalian carnivores, which create direct hazards to aircraft. Additionally, these species may be taken in orchards and other cultivated areas to reduce damage to agricultural resources, such as apple trees and in or near parks, and other structures to protect human health and safety, or natural resources.

Native rodents which may be the target of WS monitoring and operational activities at airports and other locations include the eastern chipmunk, meadow vole, prairie vole, deer mouse, white-footed mouse, and pocket gopher. Insectivores which may be the target of WS activities at airports and other locations include Eastern mole, short-tailed shrew, and masked shrew. Many of these species are very prolific: eastern chipmunk (up to 2 litters annually, typically 3 to 5 young per litter), meadow vole (up to 17 litters annually, typically 4-5 young per litter), white-footed mouse (multiple litters, five young each), deer mice (3-4 litters, 4-6 young each), and short-tailed shrews (two to three litters with 5-7 young each) (Godin 1977). Eastern moles and pocket gophers have one or two litters per year: Eastern mole (two to five young each), pocket gopher (usually one litter per year, with an average of three to four young) (Godin 1977, Burt and Grossenheider 1980, National Audubon Society 2000). Large population fluctuations are characteristic of many small rodent populations.

The primary method of lethal removal for these species by WS would be trapping. Removal of these species by WS would be done at specific isolated sites (e.g., airports, orchards, etc.). Impacts of the levels of removal listed in table 4.1 to rodent and insectivore populations would be minimal due to the species' relatively high reproductive rates and because rodent/insectivore damage management recommended and conducted by WS would be at a limited number of specific local sites within the range of these species. Based upon the above information, WS limited lethal annual removal of 1,000 small rodents may cause temporary reductions at the specific local sites where WS works, but would have no adverse direct or cumulative impacts on

overall populations of the species in Michigan.

Muskrat

Muskrats can be found utilizing wetlands and streams throughout Michigan. Muskrats are prolific breeders, producing two litters of young each year. Litter size varies from one to 14, with six to seven being the average number of young. However, their short life span and numerous mortality factors cause severe short-term population fluctuations (Godin 1977).

Muskrats are managed by the MDNR as a furbearer species with a trapping season that occurs from October 25 to March 1 with no daily or season harvest limit. In damage situations, property owners, dwelling occupants, farmers, and their agents, may remove muskrats via lawful procedures to alleviate damage to property and other resources under a nuisance animal control permit. Sportsmen have harvested an average of 181,354 muskrats annually from 2009-2012 (Table 4.1).

This species is considered widespread and very common throughout most of the state. WS has removed an average of eight muskrats per year to respond to damage complaints. Based on previous requests for assistance received by WS, the removal of muskrats by WS would not exceed 200 muskrats annually. Using the average annual hunter harvest data to assess WS' impacts to the muskrat population, WS' removal of 200 muskrats would represent 0.11% of the harvest (Table 4.1). This level of removal is considered to be a very low magnitude and no significant direct impact. Given that the actual population is much higher than the annual harvest, WS' removal is an even lower magnitude of the statewide population.

The unlimited harvest levels allowed by the MDNR during the length of the trapping season provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the muskrat population would occur resulting in an undesired population decline. The MDNR'S oversight of WS, annual trapping seasons, and private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall muskrat population.

Raccoons

The raccoon is found throughout Michigan. Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing the percentage of the population that has already been counted or estimated and the additional difficulty of knowing how large an area the raccoons are using (Sanderson 1987). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Raccoon densities range from 0.9 to as high as 250 per km^2 (2 to 650 per mi^2) with most reported densities ranging from 4 to 30 per km^2 (10 to 80 per mi^2) in rural areas (Riley et al. 1998). The WS' National Rabies Management Program (NRMP) has conducted over 290 raccoon densities study in the eastern U.S. since 1997. These studies indicate that density indices, ranging from 0-70 raccoons/km^2 (average of 12 raccoons/km^2), are well within the documented range of estimates reported from other studies (USDA 2014). Additionally, in similar NRMP density studies conducted in Michigan, WS estimated 51.7 raccoons/km^2 at Kennsington Metro Park (2005 unpublished data) and 18.3

raccoons/km^2 at Crosswinds Marsh (2006 unpublished data).

There are no true population estimates available for raccoons in Michigan. However, using the lowest estimate mean density of 1.5 – 8 raccoons/km., as derived from the above mentioned ORV density studies, the lowest estimated raccoon population in Michigan is between 219,653 and 1,171,480 raccoons. Raccoons are managed by the MDNR as a furbearer game species and may be harvested from October 1 to January 31 with no daily or season bag limit. In damage situations, property owners, dwelling occupants, farmers, and their agents, may remove raccoons with no permit if the animal is causing or about to cause damage. The average annual hunter harvest of raccoons was 156,303 from 2009-2012. WS has removed an average of 73 raccoon per year to resolve damage issues.

In future programs, WS may be requested to address damage being caused by raccoons anywhere in Michigan to protect resources or human health and safety. Activities would target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health, natural resources, or property. Some local populations may be temporarily reduced if raccoons are lethally removed. Based upon an anticipated increase for requests for WS' assistance, up to 500 raccoons could be lethally removed by WS annually to alleviate damage.

Using the lowest estimated population densities for Michigan to assess WS' impacts to the raccoon population, WS' removal of 500 raccoons would represent 0.04 – 0.23% of the estimated population. This level of removal is considered to be a very low magnitude. The unlimited harvest levels allowed by the MDNR during the length of the hunting and trapping seasons provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the raccoon population would occur resulting in an undesired population decline. The MDNR's oversight of WS, hunting/trapping seasons, and private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall raccoon population.

Striped Skunk

The striped skunk is found throughout Michigan in a variety of rural, suburban, and urban habitat types. No population estimates are available for striped skunks in Michigan. Densities have been reported to range from 1 skunk per 77 acres to one per 10 acres (Rosatte 1987). There are approximately 33 million acres of rural land in Michigan. If only 50% of the rural lands throughout the State have sufficient habitat to support striped skunks, skunks are only found in rural habitat, and skunk densities average one skunk per 77 acres, a statewide skunk population could be estimated at nearly 214,285 skunks. Skunks can be found in a variety of habitats, including urban areas, throughout the State; therefore, skunks likely occupy more than 50% of the rural land in Michigan. The striped skunk is managed by the MDNR as a furbearer species with year round hunting and trapping seasons. There is no daily or season bag limit for either trapping or hunting of striped skunks. Property owners, their spouse or children may harvest skunks on their private property year round without a license. Sportsmen have harvested an average of 5,847 skunks annually from 2009-2013 (Table 4.1).

WS has removed an average of eight striped skunks per year to respond to damage complaints and disease issues, including work at landfills, airports, and rabies related projects. WS continues to receive an increasing number of requests for assistance with skunks. Therefore, the number of skunks taken annually by WS to address the increasing number of requests for assistance is also likely to increase. Based on recent requests for assistance and in anticipation of receiving additional requests for assistance, WS could annually remove up to 100 skunks to alleviate damage or threats of damage associated with those requests. This represents 0.04 of the lowest estimate population and 1.71% of the average state harvest.

The unlimited harvest allowed by the MDNR during the annual hunting and trapping seasons provides some indication the population of skunks is not subject to overharvest during the annual harvest seasons and from damage management activities. WS' removal combined with hunter harvest and all other forms of mortality would not result in negative cumulative impacts to the statewide skunk population.

Virginia Opossum

Virginia Opossums have historically been found in southern Michigan. However, their range has slowly expanded into the northern Lower Peninsula and parts of the Upper Peninsula. On average, opossums have 7-9 joeys in a liter, but can have as many as 17-21 joeys in a liter (Kurta 1995). The opossum is managed by the MDNR as a furbearer species with a year round hunting and trapping. There is no daily or season bag limit for either trapping or hunting of opossum. Property owners, their spouse or children may harvest opossums on their private property year round without a license. Sportsmen have harvested an average of 25,495 opossums annually from 2009-2012 (Table 4.1).

Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year in a Virginia study conducted by Seidensticker et al. (1987). In that five-year study, it was also observed that there was a wide variation in opossum densities, in what was considered excellent habitat for the species. However, the mean density during the study was 10.1 opossum per mi^2 with a range of 1.3 opossum per mi^2 to 20.2 opossum per mi^2 (Seidensticker et al. 1987). Verts (1963) found a density estimate of 10.1 opossum per mi^2 in farmland areas of Illinois while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per mi^2 in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per mi^2. No population estimates are available for Michigan.

WS has removed an average of 26 opossums per year to respond to damage complaints. Based on previous requests for assistance received by WS, the removal of opossum by WS would not exceed 200 opossum annually. Using the average annual hunter harvest data to assess WS' impacts to the opossum population, WS' removal of 200 opossum would represent 0.78% of the harvest (Table 4.1). This level of removal is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' removal is an even lower magnitude of the statewide population.

The unlimited harvest levels allowed by the MDNR during the length of the hunting and trapping seasons provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the opossum population would occur resulting in an undesired population decline. The MDNR's oversight of WS, hunting/trapping seasons, and private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall opossum population.

White–Tailed Deer

The MDNR manages free-ranging white-tailed deer as a protected game species with many restrictions on their management and harvest (Natural Resources and Environmental Protection Act, Public Act 451 of 1994). Part 401 of Public Act 451 gives authority to the Natural Resources Commission (NRC) and the MDNR Director to issue orders specific to wildlife management and hunting. The MDNR collects and compiles information on white-tailed deer population trends, sport harvest, and other known mortality, and uses this information to manage for sustainability and healthy deer populations. Free-ranging white-tailed deer populations have remained healthy and viable in Michigan and population monitoring continues to insure harvestable and viable populations. The MDNR uses a number of strategies to manage for a healthy deer herd, as outlined in the Michigan Deer Management Plan, (MDNR 2010) and this information has been considered in the analysis of potential impacts of WS' activities on Michigan's free-ranging deer herd.

White-tailed deer are found in every county in Michigan and have flourished because of their ability to adapt to disturbed areas, alteration of forested habitat, and mixed land use practices. In 1914, it was estimated that only 45,000 deer remained in Michigan. Due to revised management strategies the deer population increased to over 1 million by 1937. This increase in the deer population coincided with the first discussions of deer-vehicle accidents. Additionally, there was a significant amount of winter starvation and over-browsing in cedar swamps. In the following years, largely due to changes in available habitat, primarily the forest regrowth of formally logged lands, the deer population saw a decline. Once again, deer management strategies were revised and the deer population increased to 2.2 million by 1995 (MDNR 2010).

Methods used to resolve damage or threats to human safety can involve altering the behavior of the target species and may require the use of lethal methods when appropriate. Under the proposed action, WS would incorporate non-lethal and lethal methods in an integrated approach in which all or a combination of methods may be employed to resolve a request for assistance. WS would recommend both non-lethal and lethal methods (to include regulated hunting) to interested individuals, as governed by federal, state, and local laws and regulations. Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage thereby, reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. 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

appropriate by WS' personnel. WS refers the public to the MDNR for assistance with hunting programs and deer damage permits.

The use of lethal methods would result in local population reductions in the area where damage or threats were occurring. The number of target animals removed from the population using lethal methods under this alternative would be dependent on the number of requests for assistance received, the number of deer involved with the associated damage or threat, the efficacy of methods employed, and the permitting of the removal by the MDNR. In the event of a disease outbreak (e.g., TB or CWD) lethal removal of deer may be conducted to manage deer herd health. In the event of such an outbreak, the MDNR may decide to remove deer for disease surveillance or to reduce the likelihood of disease transmission to livestock and the rest of the state deer herd. At the request of MDNR, WS could assist in this effort which is not anticipated in WS removing more than 5,000 deer per year.

MDNR collects data via deer check stations and mail surveys to determine a statewide deer population estimate. The population of free-ranging deer in Michigan is continually fluctuating. From 1995-2008, it was conservatively estimated that there was between 1.8 to 2.2 million deer in Michigan (MDNR 2010). Heavy snowfall in winters 2012-2014 resulted in declines in the deer herd in the Upper Peninsula and declines in deer harvested (MDNR 2015b, c). WS did not take any deer in the Upper Peninsula of Michigan during 2014 or 2015, so program activities did not contribute to cumulative impacts in the Upper Peninsula deer herd. Deer population numbers in the Lower Peninsula were generally stable to increasing in 2015.

Between 2010 through 2015, WS removed an average of 300 deer annually (Table 4.2a and 4.2b). However, after review of previous activities conducted by WS and in anticipation of future damage management requests, WS could remove up to 5000 deer annually as permitted by the MDNR. In most years, average annual removal is expected to be well below the maximum of 5000 deer. Higher levels would be most likely to occur in situations where there is a disease outbreak such as the detection of bovine TB or CWD in deer, or where there is a need to remove/reduce high concentrations of deer from an island or fenced area.

WS proposed removal of 5000 deer, as analyzed in this EA, would represent 1.27% of the five year Michigan annual deer harvest average and 0.28% of the lowest recorded deer population since 1995. WS' removal, combined with the average annual hunter harvest and take by other permits, would represent 22% of the lowest recorded population. Deer populations have shown to be sustainable through this harvest level, and WS expects no significant adverse cumulative impacts. The MDNR's oversight of WS, hunting seasons, and private pest control operator take removal would ensure that the cumulative removal would not have a negative impact on the overall deer population.

Table 4.2a Michigan white-tailed deer harvest and WS' removal 2010 - 2015

Year	Harvest[‡]	Other removal[a]	WS' Removal[b,c]	Total	WS % of Total
2010	412,299	5,551	95	417,850	0.02%
2011	416,721	5293	104	422,014	0.02%
2012	414,003	6,213	97	420,216	0.02%
2013	378,794	6,508	313	385,302	0.08%
2014	322,367	6,673	309	329,040	0.09%
2015			879		0.27%[d]

[‡]Harvest data obtained from based on Michigan Deer Harvest Survey Reports
[a]Other removal includes deer taken under special permits including Deer Management Assistance (DMA) permits (crop damage and disease control permits) issued by MDNR.
[b]WS' removal reported by Calendar Year.
[d]Percent of Total for 2015 was calculated using 2014 data. Data for 2015 was not available at the time of reporting.

Table 4.2b Free ranging White-tailed deer removed by Wildlife Services in Michigan to protect natural resources, and risks to human health and safety (airports), 2004-2015.

Calendar Year	Natural Resource Protection	Human Health & Safety (Airports)	Human Health & Safety (Disease)	Total
2004	0	0	12	**12**
2005	0	5	51	**56**
2006	0	0	64	**64**
2007	18	0	31	**49**
2008	15	19	108	**142**
2009	82	30	9	**121**
2010	26	35	34	**95**
2011	28	26	50	**104**
2012	9	11	77	**97**
2013	46	11	256	**313**
2014	5	17	287	**309**
2015	2	10	867	**879**
Total	**231**	**164**	**1846**	**2241**

The potential lethal removal of up to 5,000 deer annually by WS (in the case of a disease outbreak), the possibility of WS damage management activities adversely affecting the overall Michigan deer population (1.8 to 2.2 million) is considered low. The cumulative take (0.23% - 0.28% of the overall population and 1.52% of the total lethal take) is far below the level that

would begin to cause a continuous decline in the regional deer population. WS' limited removal of no more than 5,000 white-tailed deer annually would have no significant direct or cumulative effects on deer populations in Michigan.

Woodchucks

Woodchucks (also known as groundhogs) are found throughout much of the eastern and midwestern U.S., with distribution across Michigan. They use a variety of open habitat types including agricultural areas, old fields, forest edges, fencerows, urban, and suburban settings. One limiting factor in the occurrence of woodchucks is soil types which allow for burrowing activities. Woodchucks have one litter a year and average five kits (Armitage 2003). Woodchucks breed at age one and live four to five years. The MDNR is responsible for the management of the woodchuck population but does not conduct population census for woodchucks. Woodchucks may be taken year round with a small game hunting license.

Woodchuck densities vary from area to area, depending on food availability, soil type, hunting pressure, and predation. Populations with up to six or seven individuals per acre have been documented. However a population of four per acre is considered abundant and the average is probably closer to one per acre of farmland (Fergus 2001).

To analyze the potential impacts of WS' activities on woodchuck populations in Michigan, the best available information will be used to estimate a state-wide population. There are over 9,948,564 acres of currently active farmland in Michigan (NASS 2014). Based on Fergus, there may be an average of one woodchuck per acre of farmland. Using a modest estimate of one woodchuck for every acre of farmland, a conservative state-wide woodchuck population could be estimated at approximately 9.9 million individuals.

Gas cartridges could be employed to fumigate woodchuck burrows in areas where damages are occurring. Gas cartridges act as a fumigant by producing carbon monoxide when ignited. The cartridges contain sodium nitrate, which when burnt, produces carbon monoxide gas. The cartridges would be placed inside active burrows at the entrance, the cartridge would be ignited, and the entrance to the burrow would be sealed with dirt, which allows the burrow to fill with carbon monoxide. Carbon monoxide is a method of euthanasia considered conditionally acceptable by the AVMA for free-ranging mammal species (AVMA 2007).

The removal of woodchucks would also occur using other methods, such as shooting, live traps, and body-gripping traps. However, the number of woodchucks lethally taken using gas cartridges and by other methods is not expected to exceed 1,000 woodchucks. Based on a population estimated at 9.9 million woodchucks, take of up to 1000 woodchucks annually by WS would represent 0.01% of the estimated population. The MDNR's oversight of WS, hunting/trapping seasons, and private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall woodchuck population.

Other Target Species (Native)

Target species, in addition to the mammals analyzed above, have been lethally taken in small

numbers by WS or could be lethally taken when requested to resolve damage or threats of damage. WS could lethally remove the following species not to annually exceed the number associated with each species: badger (5), bobcat (5), elk (5), fisher (5), marten (5), mink (20), porcupine (20), river otter (20), snowshoe hare (15), squirrels (fox, gray, red and thirteen-lined ground, 20 each), Northern and Southern flying squirrel (5 each), and weasels (all species, 20 total). Due to the limited number of animals likely to be removed relative to their total population range, none of these mammal species are expected to be taken by WS at any level that would individually or cumulatively adversely affect overall statewide mammal populations. Damage management activities would target single animals or local populations at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced as a result of removal activities to reduce damage at a local site. The estimated WS removal would be of low magnitude when compared to the number of those game species harvested each year, and would be of extremely low magnitude when compared to the statewide population of those species. Those species are not considered to be of low densities in the state.

INTRODUCED FERAL AND DOMESTIC SPECIES

Difference between Management of Damage by Native species and Introduced, Feral and Domestic Species

WS addresses damage management of native species and introduced, feral and domestic species, differently. While the techniques used may be the same, the goals are different. In managing the damage caused by native wildlife species the goal is to resolve human and wildlife conflicts with minimal negative impact on the overall population. The species discussed in this section are not native to the U.S. or they are maintained in captive populations isolated from contact with native species (e.g., captive deer). Non-native species are generally considered to be detrimental to healthy native ecosystems, and removal of exotic species is generally considered to have beneficial environmental impacts. Consequently, in contrast to management of native species, management objectives for damage management actions involving non-native invasive species may include efforts to substantially reduce or eliminate non-native species.

Executive Order 13112 defines "invasive species" as an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Amongst other things, the EO directs federal agencies whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) prevent the introduction of invasive species, 2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, 3) monitor invasive species populations accurately and reliably, 4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded, 5) conduct research on invasive species and develop technologies to prevent introduction, and provide for environmentally sound control of invasive species, and 6) promote public education on invasive species and the means to address them.

Captive Cervids

The MDNR or MDARD periodically contacts WS to request assistance in humanely killing captive cervids for disease monitoring and management, law enforcement purposes, or human health and safety reasons. The detection of disease at a captive facility often raises concerns for the potential spread of diseases to free-ranging herds. Diseases can spread rapidly among deer inside these facilities due to the close contact between the confined animals. Often, once a disease occurs in a confined deer herd, the MDNR and/or the MDARD requires the removal of the entire herd to ensure the containment of the disease. Any involvement with the depopulation of deer confined inside a perimeter fence by WS would be at the request of the MDNR and/or the MDARD. As proposed in this alternative, in those cases where the MDNR and/or the MDARD has requested WS' assistance with the removal of a captive deer herd in Michigan, the removal would not exceed 500 deer for purposes of disease monitoring or surveillance. Captive cervids that have been removed from seven farms since 1999 include elk and white-tailed deer. Captive cervid damage management would only be conducted with written authorization from the resource owner and MDNR or MDARD. WS anticipates that up to 500 captive cervids could be removed annually based on prior requests. These animals are in closed populations that typically do not interact with free-ranging cervids. Complete removal of a captive deer herd would not impact the statewide population of wild, free-ranging deer as captive herds are typically isolated. WS' assistance with removal of deer from captive cervid farms is not included in the deer population impact analysis because captive cervids do not contribute to and are not included in counts of the free-ranging deer population. Projects conducted to minimize disease in captive cervids are likely to have beneficial impacts because it minimizes the risk of disease transmission to the free-ranging deer population.

Table 4.2b Captive cervids removed by Wildlife Services in Michigan related to disease 2004-2015.

Calendar Year	Captive Cervids
2004	0
2005	0
2006	312
2007	9
2008	100
2009	4
2010	0
2011	8
2012	0
2013	0
2014	0
2015	0
Total	**433**

Feral Cats

Feral cats produce two to 10 kittens during any month of the year. An adult female may produce three litters per year where food and habitat are sufficient. Cats are opportunistic predators and scavengers that feed on rodents, rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and leftover pet food (Fitzwater 1994). Lethal control will not be used on cats bearing obvious identification (e.g., collars). Preference will be given to live-capture methods in all other feral cat management projects, but in some cases it may not be possible to resolve the problem with nonlethal methods. Michigan WS does not anticipate removing more than 200 feral cats in any given year and has not removed any feral cats in the last 5 years (Table 4.1b). AVMA approved euthanasia measures for lethal removal of cats is WS preferred method. However, under some circumstances this may not be an option and humanely killing via firearm would be the only other accepted method. Most non-lethal or lethal removal of cats would be conducted for projects protecting human health and safety, valuable wildlife, or captive birds and other animals.

In 2011, Petsmart Charities was quoted as estimating that there were 657,000 feral cats just in the Detroit metropolitan area (Associated Press 2011). A 2013 Michigan Animal Shelter Activity Report showed shelters received 91,044 cats, of which 38% (34,977) were euthanized (Michigan Department of Agriculture 2014). Nationwide, the Humane Society of the United States estimates that between three and four million cats are euthanized in shelters each year. Given the low number of animals removed by WS relative to the estimated size of the state feral cat population, the reproductive capacity of feral cats and that any WS lethal removal of feral cats would be restricted to isolated individual sites, the proposed removal of cats will have little direct or cumulative impacts on overall feral cat populations.

Feral Dogs

Feral dogs may kill native wildlife, livestock and pets and may also pose a health and safety risk to humans. Feral dogs in Michigan have been responsible for the death of a pet dog in 2014 and pose significant health and safety concerns to humans.

WS proposes to use foot-hold traps and cage traps to live capture and remove the dogs. AVMA approved euthanasia measures for lethal removal of dogs is WS preferred method. However, under some circumstances this may not be an option and humanely killing via firearm would be the only other accepted method. In the event that the animals pose an imminent threat to human health, firearms could be used to humanely kill the animal(s) involved in the threat. WS has consulted with natural resource managers, law enforcement and animal control officers, and all parties have agreed these animals present a significant threat to human safety and support a coordinated effort to eliminate feral dog populations. WS purposed annual removal of 30 dogs is in agreement with executive order 13112. Any MDM involving lethal control actions by WS would be restricted to isolated individual sites, and would have little direct or cumulative impacts on overall feral dog populations.

Feral Swine

In July 2015, APHIS completed an Environmental Impact Statement on a national strategy to

reduce damage by feral swine (USDA 2015). The management alternative selected in the EIS involves implementing and leading a nationally-coordinated, integrated feral swine damage management program in partnership with federal, state, territorial, and tribal agencies. APHIS allocates resources to APHIS-Wildlife Services programs serving states and territories with feral swine populations to improve baseline operational capacity for feral swine damage management and provide cost-share opportunities. Additional resources are strategically allocated to meet the national objective of reducing the range and size of the feral swine population in the United States and for strategic local projects (e.g., threatened and endangered species). The new program also includes a national component to emphasize research, monitoring, education, and other coordinated support actions. All actions are conducted in accordance with state, territorial and tribal management objectives for feral swine.

In Michigan, feral swine are primarily found in isolated areas. The MDNR considers feral swine an invasive species and is seeking to eradicate feral swine from the state. While WS and the MDNR record known harvest of swine, reporting is voluntary and the true harvest and population size is unknown. The MDNR and WS monitor citizen observations and have received reports of feral swine scattered throughout Michigan. Feral swine are an unprotected species that the MDNR has deemed a threat to natural as well as agricultural resources. There is a continuous open hunting season and no harvest limits; however, hunters are required to possess a valid game license and landowners may shoot feral swine on their own property without a license. The MDNR promotes the removal of feral swine wherever they may be encountered.

Currently, WS assists the MDNR, MDARD, and USDA APHIS Veterinary Services with feral swine disease surveillance through the USDA APHIS Comprehensive Feral Swine Disease Surveillance Program. Samples are collected opportunistically from animals killed by hunters or limited agency trapping efforts. WS could be requested to assist with the removal of feral swine either for the reduction of damage caused by feral swine to agricultural and natural resources, for reduction of risks to human health and safety, or for the purpose of disease surveillance and management. Based upon current and anticipated increases in future work, it is anticipated that no more than 500 feral swine would be killed annually by WS in Michigan. Feral swine often have negative impacts on the environment. Therefore, these animals are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Any reduction in feral swine populations, including eradication, could be considered a beneficial impact to the environment and is in accordance with the provisions of the APHIS EIS on feral swine damage management (USDA 2015).

Miscellaneous Rodents & Insectivores

Non-native Species: Norway rats, black (roof) rats, and house mice are not native to North America and were accidentally released into this country. In the wild, the impact of these species is seen by many as entirely detrimental (Burt and Grossenheider, 1980). These species eat anything digestible and may prey on eggs or offspring of native species and compete with native species for resources. Executive Order 13112 Invasive Species directs federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Although

removal of this species up to and including extirpation could be seen as desirable, because of the productivity and distribution of the species and the limited nature of WS work, WS is unlikely to ever do more than limit populations at specific local sites. In addition, WS working under the Rural Development, Agriculture Act of 1988, (Public Law 100 – 202, 7 USC 426c) states, " On and after December 22,1987, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreement….". Therefore, WS would not conduct any urban rodent control associated with private residences or businesses. "Urban" in this case is defined as various municipalities that are greater than 50,000 in population (78 FR 49445-49446). Based on the above information and WS limited lethal removal of rodents and insectivores in Michigan, WS should have minimal effects on statewide non-native rodent populations.

Other Target Species (Feral/Domestic)

Target species, in addition to the mammals analyzed above, could be live trapped and returned to facility where it escaped or lethally taken when requested to resolve damage or threats of damage.

Summary

Evaluation of WS' activities relative to wildlife populations indicated that program activities will likely have no cumulative adverse effects on populations in Michigan. WS' actions would be occurring simultaneously, over time, with other natural processes and human-generated changes that are currently taking place. Those activities include, but are not limited to:

- Natural mortality of wildlife
- Human-induced mortality through private damage management activities
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in population densities

All those factors play a role in the dynamics of wildlife populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. WS' actions taken to minimize or eliminate damage are constrained as to scope, duration and intensity, for the purpose of minimizing or avoiding impacts to the environment. WS evaluates damage occurring, including other affected elements and the dynamics of the damaging species; determines appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

4.1.3 Alternative 2: Non-lethal Mammal Damage Management Only by WS

Under this alternative, WS would not intentionally remove any target mammal species because no lethal methods would be used. Although, the methods employed by WS would not be

intended to result in the death of an animal, some methods, such as live-capture and anesthesia, can result in injury or death of target animals despite the training and best efforts of management personnel. This type of removal is likely to be limited to a few individuals and would not adversely impact populations of any species.

Although WS lethal removal of mammals would not occur, it is likely that without WS conducting some level of lethal MDM activities for these species, private MDM efforts would increase. Cumulative impacts on target species populations would be variable depending upon actions taken by affected landowners/resource managers and the level of training and experience of the individuals conducting the MDM. Some individuals experiencing damage may take illegal or unsafe action against the problem species either unintentionally due to lack of training, or deliberately out of frustration of continued damage. In these instances, more target species may be taken than with a professional MDM program (Alternatives 1). Overall impacts on target species populations would be similar to or slightly more significant than Alternative 1 depending upon the extent to which resource managers use the assistance provided by WS. However, for the reasons presented in the population effects analysis in section 4.1.1, it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative.

4.1.4 Alternative 3: No Federal WS Mammal Damage Management

Under this alternative, WS would have no impact on target mammal populations. Private efforts to reduce or prevent depredations would likely increase. As with Alternative 2, cumulative impacts on target species populations would be variable, depending upon actions taken by affected landowners/resource managers, and the level of training and experience of the individuals conducting the MDM. Impacts on target species are likely to be similar to or slightly more significant than Alternative 1. Because resource owners/managers would not have access to WS direct MDM assistance or, at least, technical assistance, impacts may be more significant than Alternatives 2. However, for the same reasons shown in the population effects analysis in section 4.1.1, it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative

4.2 Effects on Other Wildlife Species, including T&E Species

4.2.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Effects on Non-target (non-T&E) Species: WS activities proposed under this alternative would not involve the direct destruction or alteration of wildlife habitat and will not impact critical habitat for any species. In the event that WS recommends habitat modification (e.g., modifying a wetland, removing trees attracting birds to an airport) as a damage management practice for the landowner/manager, WS will advise the landowner/manager that they are responsible for checking with state and federal authorities regarding regulations and endangered species protections that may be applicable to the proposed project.

Direct impacts on non-target species could occur if WS program personnel were to inadvertently kill, injure, or harass animals that are not target species. In general, these impacts result from the use of methods that are not completely selective for target species. Non-target species are usually not affected by WS's non-lethal management methods, except for the occasional scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action.

WS personnel are experienced and trained in wildlife identification, and to select the most appropriate methods for taking targeted animals and excluding non-target species. Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. WS personnel use animal lures and set traps and snares in locations that are conducive to capturing target animals while minimizing potential impacts to non-target species. Any non-target species captured would be subsequently released on site unless it is determined by the WS Specialist that the animal will not survive.

WS' SOPs would require compliance with pesticide label directions and use restrictions, and establish training requirements for all employees applying pesticides as built-in measures to assure that use of registered chemical products do not result in significant adverse effects on non-target species populations. The lethal chemicals proposed for use or recommendation under this are zinc phosphide, gas cartridges, and anticoagulant rodent baits. Appendix C contains detailed descriptions of these chemicals. These products have undergone considerable environmental review through EPA and state registration processes, which means they have been found to present no unreasonable risk to the environment or human health and safety when used according to label directions. Standard operating procedures designed and implemented to avoid adverse direct and indirect effects on non-target species are described in Chapter 3.

A small number of non-target animals have been captured and killed by Michigan WS annually (Table 4.4). This level of removal is unlikely to adversely impact populations of these species. As stated above in the section on target species removal, muskrat, mink, beaver, raccoon, fox, weasels, skunks, Virginia opossum, coyote, fisher and bobcat can be taken by licensed hunters and trappers (Table 4.1), and WS' removal is low relative to the estimated licensed harvest of these species. WS does not expect the rate of non-target species removal to substantially increase above current or past program levels under the proposed action. WS has concluded that the level of non-target animals killed by the WS program would have no adverse cumulative effects on any native wildlife species population.

Under this alternative, WS would use helicopters to identify where feral swine exist and remove feral swine. There have been concerns that the use of aircraft might disturb other wildlife species populations to the point that their survival and reproduction might be adversely affected. White-tailed deer, wild turkey, and other wildlife may be seen during aerial surveillance. When used for surveillance, helicopters are likely to make a single pass through an area on a given day. In areas with swine, aircraft would be in the area longer to remove feral swine than for surveillance but the time spent on any given property will be minimal and limited to several hours per year. Overall duration and frequency of flights in an area is not expected to be

sufficient to constitute a "chronic" disturbance as discussed below. WS would not conduct aerial sharpshooting in the vicinity of active bald eagle nests or eagle roosting and feeding congregations. WS Specialists must have a clear view of the animal before shooting, so the risk of shooting a non-target animal is negligible.

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. The report summarized a number of studies have documented responses by certain wildlife species that suggest adverse impacts might occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts on populations, although the report stated it is possible to draw the conclusion that impacts to wildlife populations are occurring. It appears that some species will frequently or at least occasionally show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent such as hourly and over long periods of time which represents "chronic exposure." Chronic exposure situations generally involve areas near commercial airports and military flight training facilities.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards and from behind occupied cliff nests. Eagle courtship, nesting and fledging were not adversely affected, indicating that no special management restrictions were required in the study location.

It was reported that low level overflights of 2-3 minutes in duration by a fixed-wing airplane and a helicopter produced no "drastic" disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level flying military aircraft in North Carolina and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the time-activity budgets of the species.

Andersen et al. (1989) conducted low-level helicopter overflights directly over 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period. Their results also showed similar nesting success between hawks subjected to such overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but showed that ferruginous hawks (*B. regalis*) are sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, and neither were they alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on

foot. Ellis (1981) reported that five species of hawks, two falcons, and golden eagles were "incredibly tolerant" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and never limiting to productivity. Further reassuring, the considerable analyses of the Air National Guard (1997a, 1997b) show that, despite considerable research on numerous wildlife species, no scientific evidence exists that indicates any substantive adverse effects on wildlife populations will occur as a result of any of the types of low-level or other overflights that do or may occur.

Table 4.4 Michigan WS average non-target mammal capture and removal for FY2009-2013 from all project areas.

Species	Average Killed Annually	Average Annual Freed, Relocated, Transferred Custody
Badgers	0	0.6
Black Bears	0	1.4
Bobcats	0	0.6
Feral Cats	0.2	0
Porcupines	1.2	0
Raccoons	0.2	0
Norway Rats	0.2	0
Striped Skunks	0.6	0.4

Effects on T&E species:

Large Mammals: Canada lynx (*Lynx Canadensis*) and cougar (*Felis concolor*) are listed as state and/or federally threatened or endangered in Michigan. Methods utilized by WS which could result in incidental capture, injury or even death of lynx or cougar include foothold traps, foot snares, cable restraints, and body gripping traps (Conibears). Each of these methods has varying degrees of selectivity and each carries a differing likelihood of risk to non-target animals. The low likelihood of occurrence of the species in the action area, the fact that wildlife damage control activities are not generally conducted in habitats utilized by lynx and cougar, and the targeted control methods utilized by WS, makes the likelihood of an incidental capture extremely low.

Bats: The evening bat (*Nycticeius humeralis*) and Indiana bat (*Myotis sodalis*) are listed as state and/or federally threatened or endangered in Michigan. Additionally, the Northern long-eared bat (*Myotis septentrionalis*) has been proposed as endangered. WS has not taken part in any MDM related to bats. It is the practice of Michigan WS to refer any bat related damage calls to nuisance wildlife control operators (NWCO). MDM methods utilized by WS are highly unlikely to result in any incidental captures or take related to threatened/endangered bats.

Rodents: The least shrew (*Cryptotis parva*), prairie vole (*Microtus ochrogaster*), and smoky shrew (*Sorex fumeus*) are listed as state threatened or endangered in Michigan. The proposed methods which may pose risks to state listed rodents include use of the rodenticide, ZP, snap traps, and gas cartridges. These methods would primarily be used at airports to reduce wildlife hazards to aircraft and human safety. These methods could also be used in and around barns and industrial facilities, at landfills and in orchards, but due to the lack of suitable available habitat at these types of sites, WS use of rodenticides, gas cartridges or snap traps from this alternative would pose little risk to state-listed rodents, and risks to these species from the proposed methods are likely very low. To reduce risks to state-listed rodents from MDM actions conducted in orchards, WS will consult with the MDNR prior to using these methods in counties where these rodents are known to occur. WS will implement any recommendations for the protection of state-listed rodents which are provided by the MDNR. Given that WS' rodent damage management activities are restricted to a limited number of sites and a small area of the state and the protective measures listed above, this alternative will not have an adverse impact on state listed rodents.

Birds:
Piping plovers (*Charadrius melodus*) are an endangered species in Michigan. Michigan WS has previously been requested to provide assistance with predator removal to protect nesting plovers. These types of activities have the potential to disturb nesting birds. WS consults with the USFWS prior to initiating work and implementing all recommendations for the protection of plovers. Consequently, the proposed MDM program may affect but is unlikely to adversely affect piping plovers.

The primary risks to T&E birds from the proposed action are the risk of primary toxicity to birds from the consumption of ZP treated grain. None of the T&E species in Michigan readily consume grains. There is minimal risk to species that consume rodents as 90% of ZP ingested by rodents is detoxified in the digestive tract (Matschke unpubl. as cited in Hegdal et al. 1980). Based on the above analysis, WS concludes that the proposed action will have no effect on T&E bird species.

Reptiles: WS activities with the potential to impact T&E reptiles include removal of beaver dams in areas where wetland communities have developed, accidental capture in body gripping traps (e.g. conibear traps) set to capture aquatic rodents, or live traps adjacent to aquatic habitats. As noted elsewhere in this section, instances where WS would remove dams from areas where wetland characteristics have been established are relatively rare. WS will consult with the MDNR and USFWS prior to conducting beaver dam removal at sites with established wetlands and will implement any recommendations from these agencies for the protection of state and federally-listed species.

As noted in Table 4.4, WS has captured no non-target reptiles during MDM activities. There has been no incidental take of any state or federal T&E reptile species. Given the low rate of occurrence for state-listed species and that most reptiles can be released from the capture device,

this alternative will have no effect on T&E reptile populations.

Fish, Amphibians, Aquatic/Wetland Invertebrates and Aquatic Plants: The only risk to species in these groups from the proposed action is potential disturbance and/or loss of habitat associated with beaver dam removal. Almost all of WS' beaver dam removal work in Michigan involves removing recently built dams (usually one year old or less) to restore water movement in irrigation canals, under roadways, and in streams where dams result in undesirable property flooding. Recently flooded sites do not possess wetland characteristics, and wildlife habitat values are not the same as in established wetlands. Dam removal in these situations will be restoring the environmental status quo for the sites and will likely be beneficial to resident plants and animals. In the relatively rare instances when WS removes dams from an area where wetland community has developed in response to the presence of a beaver dam/pond (usually for trout stream restoration projects), WS will consult with the USFWS and MDNR, as appropriate, to determine if T&E species are present at the site and the measures needed to protect T&E species. WS will implement any recommendations for protective measures from these agencies. Many fish and aquatic invertebrates prefer clear gravel/sand bottoms and free-flowing water conditions. Beaver dam removals are likely to be beneficial to these species. Based on this analysis and the proposed protective measures, this alternative will have no effect on state or federally-listed fish, amphibians, aquatic/wetland organisms or plants.

Plants**:** WS does not anticipate conducting habitat management in areas where state or federally-listed plants may occur. Risks of WS personnel trampling on or otherwise crushing state-listed plants are low. Where possible, WS personnel utilize available trails and roads to minimize impacts on vegetation. Feral swine can cause substantial damage to native plants and ecosystems (Campbell and Long 2009, West et al. 2009). Removal of feral swine can have beneficial impacts on threatened and endangered plants. Given the above information, the proposed action may affect, but is unlikely to adversely affect state and federally listed plants.

Summary

T&E species that are federally and state-listed (or proposed for listing) in Michigan are listed in the Appendix E. WS has determined that the proposed action would not adversely affect populations of state or federally-listed T&E species. The MDNR has concurred that the likelihood of adverse impacts to state endangered or threatened species as a result of methods outlined by WS are very low or not likely to occur utilizing the integrated management approach presented in WS proposed plan. Additionally, WS conducted a section 7 consultation with the USFWS for federally listed species. The USFWS concurred with WS' determinations of "may affect, but not adversely affect" relevant T&E species (Appendix D).

WS Impact on Biodiversity:

WS' MDM program is not conducted to eradicate native wildlife populations. WS operates according to international, federal, and appropriate state laws and regulations enacted to ensure species viability.

Trophic cascades occur when predators limit the density and/or behavior of their prey and thereby enhance survival of the next lower trophic level (Silliman and Angelini 2012). A tropic cascade is the culmination of both direct and indirect interactions. The direct interaction consists of two forms of predation. The first is between predator and herbivore, causing a reduction in herbivore abundance. The second is between herbivores and vegetation. This may be seen in the reduction of vegetative species through consumption by herbivores (Floyd 2014).

In a recent study, Waser et al. (2014) noted that activity of coyotes, which eat mule deer fawns, decreased with proximity to a remote biological field station. In contrast, activity of mule deer does and intensity of herbivory on palatable plant species both increased with proximity to the station and were positively correlated with each other. Judging from two palatable wildflower species whose seed crop and seedling recruitment were greatly reduced near the field station, the coyote-deer-wildflower trophic cascade has the potential to influence plant community composition.

However, Allen (2014) concluded that contemporary predator control of dingoes to protect livestock in Australia does not actually reduce dingo populations to levels low enough or long enough in order for other mesopredators to exploit the situation and increase predation pressure on native wildlife. Rather, these control programs are somewhat of an ecological non-event for wildlife, mesopredators, and dingoes. Similarly, WS MDM activities are expected to result in negligible effects with regard to trophic cascade systems. Any reduction of a local group of mammals is frequently temporary because immigration from adjacent area or reproduction replaces removed animals.

WS operates on a relatively small percentage of land area of the state, and WS' take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population. Reductions in non-native-species like feral hogs are likely to be beneficial because non-native species disrupt ecosystems and compete for resources with native wildlife.

4.2.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

WS efforts to protect rare, threatened or endangered species would not be as effective as the preferred alternative because WS would be unable to access lethal techniques if non-lethal techniques are ineffective. Lethal efforts to protect these species would have to be conducted by other natural resource management entities. Under this alternative, WS' removal of non-target animals would be less than that of the proposed action because no lethal control actions would be taken by WS. Non-target species are usually not affected by WS's non-lethal management methods, except for the occasional scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action. Capture and release (e.g., for disease monitoring) and capture and relocate would be allowed under this alternative. There is the extremely remote chance that the capture devices could result in the death of a non-target animal. However, given

that these devices would be applied with provisions to keep the target animal alive, the risks to non-target species are very low and would not result in adverse impacts on non-target species populations.

If mammal damage problems were not effectively resolved by non-lethal control methods, members of the public may resort to other means of lethal control such as the use of shooting or the use of pesticides. This could result in less experienced persons implementing control methods and could lead to greater risks to non-target wildlife than the proposed action. For example, shooting by persons not proficient at mammal identification could lead to killing of non-target mammals. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could lead to unknown effects on local non-target species populations, including T&E species. Hazards to raptors, including bald eagles and peregrine falcons, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

Effects on T&E species: WS will not have any direct negative impact on T&E species. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the MDM. As stated above, frustrated individuals may resort to use of unsafe or illegal methods like poisons which may increase risks to species like the bald eagle and peregrine falcon. Risks to T&E species may be lower with this alternative than with Alternative 3 because people would have ready access to assistance with non-lethal MDM techniques. WS could advise individuals as to the potential presence of state and federally listed species in their area.

4.2.3 Alternative 3: No Federal WS Mammal Damage Management

Alternative 3 would not allow any WS MDM in the state; therefore WS would not remove any non-target species under this alternative. The MDNR or other natural resource management entities may have to allocate staff time and resources for projects to protect threatened, endangered and rare birds because WS could no longer assist with these programs. Private efforts to reduce or prevent depredations could increase which could result in less experienced persons implementing control methods and could lead to greater removal of non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could impact local non-target species populations, including some T&E species. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

Effects on T&E species: WS will not have any direct impact on T&E species. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the MDM. As stated above, frustrated individuals may resort to use of unsafe or illegal methods like poisons

which may increase risks to species like the state-listed peregrine falcon. Risks to T&E species may be higher with this alternative than with the other alternatives because WS would not have any opportunity to provide advice or assistance with the safe and effective use of MDM techniques or have the opportunity to advise individuals regarding the presence of T&E species.

4.3 Effects on Human Health and Safety

4.3.1 Impacts on Human Safety from Chemical MDM Methods

4.3.1.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

The only pesticides that might be used or recommended by WS would be non-lethal repellents such as Hinder, Deer Away and others that are registered with MDARD. Such chemicals must undergo rigorous testing and research to prove safety, and low environmental risks before they would be registered by the EPA or FDA. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in SOP that would assure that use of registered chemical products would avoid significant adverse effects on human health. Additionally, WS would adhere to the disposal requirements per label instructions to prevent indirect effects on the environment.

Drugs used in capturing, sedating, handling, and euthanizing wildlife for wildlife management purposes include ketamine hydrochloride, a mixture of tiletamine and zolazepam (Telazol), xylazine (Rompun), potassium chloride, antibiotics, and others. WS would adhere to all applicable requirements of the AMDUCA to prevent any significant adverse impacts on human health with regard to this issue. Standard operating procedures for the use of drugs would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS. As determined on a state-level basis by these veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Animals that have been drugged and released would be ear tagged or otherwise marked to alert hunters and trappers that they should contact state officials before consuming the animal.

- Most drug administration would be scheduled to occur well before state-controlled hunting/trapping seasons which would give the drug time to completely metabolize out of

the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

- Activities involving the handling and administering drugs, drugs selected for use, animal marking systems, and the fate of any animals that must receive drugs at times during or close to scheduled hunting seasons would be coordinated with the MDNR.

By following these procedures, the proposed action would avoid any significant direct, indirect, and cumulative impacts on human health with regard to this issue.

4.3.1.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

Alternative 2 would not allow for any lethal mammal damage management by WS in Michigan. WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include use and recommendation of repellents and could use capture and handling drugs for capture and release projects. Impacts from WS use of these chemicals would be similar to those described under the proposed action.

Excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS's assistance and resorting to other means of MDM. Risks associated with non-WS use of toxicants will vary depending upon the training and experience of the individuals conducting the MDM. Such means could include illegal pesticide uses. Hazards to humans could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the proposed alternative. Overall risks to human health and safety from this alternative are likely to be equal to or greater than Alternative 1.

4.3.1.3 Alternative 3: No Federal WS Mammal Damage Management

Alternative 3 would not allow any WS MDM in Michigan. Concerns about human health risks from WS's use of chemical MDM methods would be alleviated because no such use would occur. Private efforts to reduce or prevent damage would be expected to increase. Risks to human health and safety from chemical MDM methods will be variable depending upon the training and experience of the individual conducting the MDM. Hazards to humans and pets could be greater under this alternative if other chemicals that are less selective or that cause secondary poisoning are used or if chemicals are used improperly by inexperienced personnel. It is hypothetically possible that frustration caused by the inability to alleviate mammal damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards to pets. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the current program alternative.

4.3.2 Impacts on Human Safety from Non-chemical MDM Methods

4.3.2.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

An Integrated MDM strategy has the greatest potential of successfully reducing human health and safety risks associated with the mammals addressed in this EA. Efficacy of any given MDM method will vary depending on site specific conditions. Access to the full range of MDM methods results in the greatest possibility of alleviating risks to human health and safety by allowing WS specialists to pick the methods best suited to the particular situation.

Non-chemical MDM methods that might raise safety concerns include shooting with firearms, use of traps and snares, and harassment with pyrotechnics. All WS personnel are trained in the safe and effective use of MDM techniques. The Michigan WS program has had no accidents involving the use of pyrotechnics, traps, snares, or explosives in which any person was harmed. Standard operating procedures designed and implemented to avoid adverse effects on public and pet health and safety are described in Chapter 3.

Shooting and trapping are methods used by WS which pose minimal or no threat to pets and/or public health and safety. All firearm safety precautions are followed by WS when conducting MDM and WS complies with all laws and regulations governing the lawful use of firearms. Shooting is virtually 100% selective for target species and may be used in conjunction with spotlights. WS may use firearms to humanely euthanize animals caught in live traps. WS traps are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of trap presence. Body grip (e.g., conibear type) traps used for beaver are restricted to water sets which further reduce threats to public and pet health and safety.

Firearms and firearm misuse are a cause of concern because of issues relating to public safety and accidental injury or death. To ensure safe use of firearms, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within three months of their appointment and a refresher course annually in accordance with WS Directive 2.615. WS employees who use firearms as a condition of employment must comply with all applicable federal, state, and local regulations including the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. Therefore, no adverse effects on human safety from WS' use of these methods are expected.

In most cases, it is difficult to conclusively prove that mammals were responsible for transmission of individual human cases or outbreaks of mammal-borne diseases. However, the limited records of disease occurrence in Michigan do not necessarily mean absence of risk, but may indicate a lack of reliable research in this area. There are limited studies available on the occurrence and transmission of zoonotic diseases in wild mammals. Study of this issue is

complicated by the fact that some disease-causing agents associated with wildlife, may also be contracted from other sources. WS works with cooperators on a case-by-case basis to assess the nature and magnitude of the wildlife conflict including providing information on the limitations about what we know regarding health risks associated with wild mammals. In most cases, the risk of contracting a disease from wild mammals is relatively low. It is the choice of the individual cooperator to tolerate the potential health risks or to seek to reduce those risks. Certain requesters of MDM service may consider even a low level of risk to be unacceptable. Many property owners/managers wish to eliminate risks before someone actually gets sick because of conditions at their site. In such cases, MDM, either by lethal or non-lethal means, would reduce the risk of mammal-borne disease transmission at the site for which MDM is requested.

In some situations the implementation of non-lethal controls such as netting barriers and harassment could actually increase the risk of human health problems at other sites by causing the mammals to move to other sites not previously affected. In such cases, lethal removal of the mammals may actually be the best alternative from the standpoint of overall human health concerns in the local area. If WS is providing direct damage management assistance in relocating mammals, coordination with local authorities would be conducted to assure they do not reestablish in other undesirable locations.

Aerial wildlife operations, like any other flying, could result in an accident. WS' pilots and crewmembers are trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The National Wildlife Services Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a Wildlife Services Flight Training Center and annual recurring training for all pilots.

The National Transportation Safety Board (NTSB) has stated that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (USDA 2005). Helicopters used for aerial wildlife operations carry less fuel than fixed-wing aircraft with 30 gallons the maximum for most helicopters. In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from un-ignited fuel spills.

For these reasons, the risk of ground fires or fuel/oil pollution from aviation accidents could be considered low. In addition, based on the history and experience of the program in aircraft accidents, it appears the risk of significant environmental damage from such accidents is exceedingly low.

4.3.2.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include use and recommendation of repellents and could use capture and handling drugs for capture and release projects. Impacts from WS use of these chemicals would be similar to those described under the proposed action.

Excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS' assistance and resorting to other means of MDM. Risks associated with non-WS use of toxicants will vary depending upon the training and experience of the individuals conducting the MDM. Such means could include illegal pesticide uses. Hazards to humans could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the proposed alternative. Overall risks to human health and safety from this alternative are likely to be equal to or more significant than Alternative 1.

Under this alternative, non-chemical MDM methods that might raise safety concerns include shooting with firearms when used as a harassment technique, cage traps, and harassment with pyrotechnics. Risks to human health and safety from use of firearms as a harassment technique under this alternative are similar to risks discussed for firearms use (harassment and lethal removal of target animals) under Alternative 1. As with Alternative 1, WS personnel would receive safety training on a periodic basis to keep them aware of safety concerns. Therefore, no adverse effects on human safety from WS' use of these methods are expected.

Some resource owners/managers may not feel that non-lethal techniques are adequate to resolve their wildlife conflict and may use lethal MDM methods without WS assistance. Risks to human safety from these actions will depend on the method selected and the experience and training of the individual using the technique.

Non-lethal methods may not be effective at or suitable for all situations. The efficacy of some techniques may be limited by habituation (the ability of an animal to become accustomed to and not respond to an otherwise frightening sight or sound). Other techniques like fencing may not be suitable because of zoning, visual impacts on the site or because they may adversely impact other non-injurious species. In some situations the implementation of non-lethal controls such as netting barriers and harassment could actually increase the risk of human health problems at other sites by causing the mammals to move to other sites not previously affected. However, when WS is providing direct damage management assistance in relocating mammals, coordination with local authorities would be conducted to minimize the risk of problem animals relocating to other undesirable areas.

4.3.2.3 Alternative 3: No Federal WS Mammal Damage Management

Private efforts to reduce or prevent damage would be expected to increase. Risks to human health and safety from chemical MDM methods will be variable depending upon the training and experience of the individual conducting the MDM. Hazards to humans and pets could be more significant under this alternative if other chemicals that are less selective or that cause secondary poisoning are used or if chemicals are used improperly by inexperienced personnel. It is hypothetically possible that frustration caused by the inability to alleviate mammal damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards to pets. Some

chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the current program alternative.

Non-WS personnel would be able to use pyrotechnics, traps, snares or firearms in MDM programs and this activity would likely occur to a greater extent in the absence of WS assistance. Hazards to humans and property could be greater under this alternative if personnel conducting MDM activities using non-chemical methods are poorly or improperly trained.

With no WS assistance, cooperators would be responsible for developing and implementing their own MDM program. Success of cooperator efforts to reduce or prevent risks to human health and safety from wildlife will depend on the training and experience of the individual conducting the MDM. If less experienced persons attempt to implement control methods, risks of not reducing mammal hazards could be greater than under the proposed action.

4.4 Impacts on Stakeholders, including Aesthetics

4.4.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Those who routinely view or feed individual animals would likely be disturbed by removal of such mammals under the current program. WS is aware of such concerns and takes these concerns into consideration when developing site-specific management plans. WS may be able to mitigate such concerns by leaving certain animals that have been identified by interested individuals.

Some members of the public have expressed opposition to the killing of any mammals during MDM activities. Under this Proposed Action Alternative, some lethal control of mammals would occur and these persons would be opposed. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular mammals that would be killed by WS' lethal control activities. Lethal control actions would generally be restricted to local sites and to small, unsubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would, therefore, continue to remain available for viewing by persons with that interest. WS does not anticipate any significant indirect or cumulative adverse impacts as wildlife are a renewable resource.

Damage to property would be expected to decrease under this alternative since all available damage management methods and strategies would be available for WS use and consideration. Relocation or dispersal of mammals by harassment can sometimes result in the mammals causing the same or similar problems at the new location. If WS is providing direct damage management assistance in relocating such mammals, coordination with local authorities would be conducted to assure they do not re-establish in other undesirable locations.

4.4.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

Under this alternative, WS would not conduct any lethal MDM, but may conduct harassment of mammals that are causing damage. Some people who oppose lethal control of wildlife by the government, but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild mammals would not be affected by the death of individual mammals under this alternative, but might oppose dispersal or translocation of certain mammals. WS may be able to mitigate such concerns by leaving certain animals that have been identified by interested individuals. Individuals opposed to any type of management of wildlife for human purposes (i.e., animal rights philosophy) will continue to be opposed to WS actions. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would be similar to the Proposed Action Alternative.

4.4.3 Alternative 3: No Federal WS Mammal Damage Management

Under this alternative, WS would not conduct any lethal removal of mammals nor would the program conduct any harassment of mammals. Those in opposition of any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild mammals would not be affected by WS's activities under this alternative. However, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would then be similar to the Proposed Action Alternative.

4.5 Humaneness and Animal Welfare Concerns of Methods Used

4.5.1 Alternative 1: Implement an Integrated Mammal Damage Management Program (Proposed Action/No Action)

MDM methods viewed by some persons as inhumane would be employed by WS under this alternative. These methods would include shooting, trapping, toxicants/chemicals, and snares. Despite SOPs and state trapping regulations designed to maximize humaneness, the perceived stress and trauma associated with being held in a trap or snare until the WS employee arrives at the capture site to dispatch or release the animal, is unacceptable to some persons. Other MDM methods used to remove target animals including shooting and body-gripping traps (i.e., Conibear) result in a relatively humane death because the animals die instantly or within seconds to a few minutes. These methods however, are also considered inhumane by some individuals. WS may use EPA registered and approved chemicals to manage damage caused by some mammals in Michigan. Some individuals consider the use of such chemicals to be inhumane. WS personnel are experienced, professional and humane in their use of management methods. Under this alternative, mammals would be killed by experienced WS personnel using the best and most appropriate method(s) available.

The AVMA states "... euthanasia is the act of inducing humane death in an animal" and that "...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 terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible" (AVMA 2001).

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."

The challenge in coping with this issue is how to achieve the least amount of animal suffering

with the constraints imposed by current technology. WS and the National Wildlife Research Center are striving to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective.

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 MDM methods are used in situations where non-lethal damage management methods are not practical or effective. No indirect or cumulative adverse impacts were identified for this issue.

4.5.2 Alternative 2: Non-lethal Mammal Damage Management Only by WS

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the Proposed Action Alternative.

4.5.3 Alternative 3: No Federal WS Mammal Damage Management

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the Proposed Action Alternative.

SUMMARY

No significant cumulative environmental impacts are expected from any of the three Alternatives. Under the Proposed Action, the lethal removal of mammals by WS would not have significant impacts on overall native mammal populations in Michigan, but some short-term local reductions may occur. Some efforts to reduce damage cause by non-native species could result in elimination of the species from local areas or the state (e.g. feral swine). No risk to public safety is expected when WS' programs are provided and accepted by requesting individuals in Alternative 1 since only trained and experienced wildlife biologists/specialists would conduct and recommend MDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1 and 2 conduct their own MDM activities, and when no WS assistance is provided in Alternative 3. In all three Alternatives, however, the increase in risk would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS's participation in MDM activities on public and private lands within Michigan, the analysis in this EA indicates that WS Integrated MDM program will not result in significant cumulative adverse impacts on the quality

of the human environment. Table 4.5 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4.5 Summary of Potential Impacts

Issue	Alternative 1 Integrated Mammal Damage Management Program (Proposed Action/No Action)	Alternative 2 Non-lethal MDM Only by WS	Alternative 3 No Federal WS MDM Program
1. Target Mammal Species Effects	1) Low effect - reductions in local target mammal numbers; would not significantly affect local or state native populations.	1) No effect by WS. 2) Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.	1) No effect by WS. 2) Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.
2. Effects on Other Wildlife Species, Including T&E Species	1) Low effect - methods used by WS would be highly selective with very little risk to non-target species. 2) WS would provide operational assistance with T&E species protection.	1) Low effect - methods used by WS would be highly selective with very little risk to non-target species. 2) WS only able to provide limited operational assistance with T&E species protection.	1) No effect by WS. 2) Impacts by non-WS personnel would be variable. 3) WS would not provide operational assistance with T&E species protection.
3. Human Health and Safety Effects	1) The proposed action has the greatest potential of successfully reducing this risk. 2) Low risk from methods used by WS.	1) Low risk of injuries from methods used by WS. WS less likely to resolve risks associated with animals than with Alt 1. 2) Efforts by non-WS personnel to use lethal MDM techniques could result in less experienced persons implementing control methods, a greater risk of injuries and greater potential of not reducing mammal	1) Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.

Issue	Alternative 1 Integrated Mammal Damage Management Program (Proposed Action/No Action)	Alternative 2 Non-lethal MDM Only by WS	Alternative 3 No Federal WS MDM Program
		damage than under the proposed action.	
4a. Aesthetic Values of Wild Mammal Species and Human Affectionate Bonds	1) Low to moderate effect at local levels; Some local populations may be reduced; WS mammal damage management activities do not adversely affect overall state target native mammal populations.	1) Low to moderate effect. Local mammal numbers in damage situations would remain high or possibly increase when non-lethal methods are ineffective unless non-WS personnel successfully implement lethal methods; no adverse effect on state target mammal populations.	1) Low to moderate effect. Local mammal numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse effect on overall state target mammal populations.
4b. Aesthetic Values of Property Damaged by Mammals	1) Low effect - mammal damage problems most likely to be resolved without creating or moving problems elsewhere.	1) Mammal damage may not be reduced to acceptable levels; mammals may move to other sites which can create aesthetic damage problems at new sites.	1) High effect - mammal problems less likely to be resolved without WS involvement. Mammals may move to other sites which can create aesthetic damage problems at new sites.

Issue	Alternative 1 Integrated Mammal Damage Management Program (Proposed Action/No Action)	Alternative 2 Non-lethal MDM Only by WS	Alternative 3 No Federal WS MDM Program
5. Humaneness and Animal Welfare Concerns of Methods Used	1) Impact by WS low to moderate effect - methods viewed by some people as inhumane would be used by WS.	1) Impact by WS Lower effect than Alt. 2 since only non-lethal methods would be used by WS. 2) Impacts by non-WS personnel would be variable.	1) No effect by WS. 2) Impacts by non-WS personnel would be variable.

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APPENDIX B: LITERATURE CITED

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APPENDIX C: MAMMAL DAMAGE MANAGEMENT METHODS

Resource owners and government agencies use a variety of techniques as part of integrated mammal damage management programs. All lethal and non-lethal methods have limitations based on costs, logistics, practicality, or effectiveness. There are also regulatory constraints on the availability and use of some MDM techniques. Mammal damage management methods currently available to the Michigan WS program are described here. If other methods are proven effective and legal to use in Michigan, they could be incorporated into the Michigan WS program, pursuant to permits, other authorizations, agreements with landowners, NEPA compliance, and applicable laws, regulations, and policies.

WS MDM efforts are not intended to reduce overall native mammal populations in the state or region although in some instances, reduction of local population densities may be conducted to address site specific damage problems. However, projects to address problems with non-native species such as feral hogs may be intended to reduce or eliminate the local, regional (within state), or state populations of these species. Depending upon the alternative selected, the specific control methods and techniques that could be used are as follows:

NON-LETHAL METHODS (NON-CHEMICAL)

Wildlife Exclusion (physical exclusion) pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals which cannot climb from entering areas of protected resources. Fencing of culverts, drain pipes, and other water control structures like that used with a Beaver Deceiver™ can sometimes prevent beavers from building dams which plug these devices. In those applications, however, consideration must be given for water flow so that the fence does not act to catch and hold water-borne debris. Fencing, especially if it is installed with an underground skirt, can prevent access to areas for many mammal species which dig, including coyotes, foxes, woodchucks, beaver, and muskrat. Areas such as airports, yards or hay meadows may be fenced. Hardware cloth or other metal barriers can sometimes be used to prevent girdling and gnawing of valuable trees and to prevent the entry of mammals into buildings through existing holes or gaps. Construction of concrete spillways may reduce or prevent damage to dams by burrowing aquatic rodent species. Riprap can also be used on dams or levies at times, especially to deter muskrat, woodchucks, and other burrowing rodents. Electrical water barriers have proven effective in limited situations for beaver; an electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at keeping beaver out. The effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted because beaver will avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997). Similarly, electric fences of various constructions have been used effectively to reduce damage to various crops by raccoons, bears and other species (Boggess 1994).

Cultural Methods and Habitat Management includes the application of practices which seek to minimize exposure of the protected resource to damaging animals through processes other

than exclusion. They may include animal husbandry practices such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where damaging mammals might hide, manipulating the surrounding environment to deter animals from entering a protected area, removal of trees from around buildings to reduce access by squirrels and raccoons, or planting lure crops on fringes of protected crops. Some mammals which cause damage in urban environments are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals. Making trash, bird food, and garbage unavailable and removing all pet food from outside during nighttime hours can reduce the presence of bears, raccoons, and opossums when they become a problem. If tree squirrels are damaging property or causing a nuisance, care in preventing them from obtaining bird seed left in bird feeders can often greatly reduce their presence. This may mean hanging bird feeders by thin wire from tree limbs, or constructing mounting poles which cannot be climbed by these animals.

Other habitat management strategies may include physical manipulation of the natural environment. As an example, continual destruction of beaver dams and removal of dam construction materials on a daily basis will sometimes cause beavers to move to other locations, although this strategy can be far more expensive than removing beavers in conjunction with dam removal. Water control devices such as the 3 log drain (Roblee 1983), the T culvert guard (Roblee 1987), wire mesh culvert (Roblee 1983), and the Clemson beaver pond leveler (Miller and Yarrow 1994) can sometimes be used to control the water in beaver ponds to desirable levels that do not cause damage. Use of these devices is very limited among private landowners. Such methods have variable results and rarely provide acceptable levels of control unless used in an integrated program with other strategies.

In general, WS involvement in cultural methods and habitat management is limited to technical assistance (advice). Implementation of the methods and associated legal requirements are the responsibility of the landowner/manager. When WS makes habitat management recommendations, WS advises landowners/managers that they are responsible for compliance with all applicable state federal and local regulations including the ESA.

Animal Behavior Modification. This refers to tactics that deter or repel damaging mammals and thus, reduce damage to the protected resource. These techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ extreme noise or visual stimuli (e.g., flashing lights). Unfortunately many of these techniques are only effective for a short time before animals habituate (i.e., learn there is not a real threat; Conover 1982). The position of such frightening devices should be changed frequently because over a period of time, animals usually become used to scare devices (Pfiefer and Goos 1982). Using motion activated systems instead of systems which are activated on regular intervals may also extend the effective period for a frightening devices. Some devices used to modify behavior in mammals may include:

- Electronic guards (siren/strobe-light devices)
- Propane exploders
- Pyrotechnics

- Laser lights
- Human effigies

Electric Fencing and Maintenance

Electric fencing has proven effective in deterring bears from landfills, trash dumpsters, apiaries, cabins, and other high-value properties. Fencing, however, can be an expensive abatement measure. When developing a damage prevention program, consideration is given to the extent, duration, and expense of damage in relation to the expense of using fencing. Numerous fence designs have been used with varying degrees of success. Electric fence chargers increase effectiveness. For example, depending on the amount of bear pressure, use of an electric polytape portable fence or a welded-wire permanent fence (Figure C-1) can be very effective.

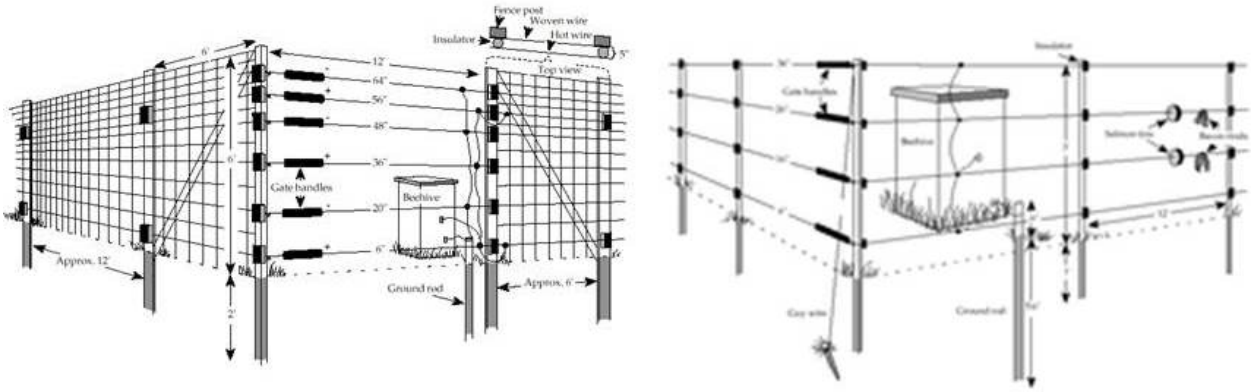

Figure C-1. Polytape portable fence (left) and welded-wire permanent fence (right)

To energize the fences, a 110-volt outlet or 12-volt deep cell (marine) battery is connected to a high-output fence charger. The fence charger and battery should be protected against weather and theft. Warning signs should be used to protect human safety. Electric fences must deliver an effective shock to repel bears. Bears can be lured into licking or sniffing the wire by attaching attractants to the fence, such as peanut butter, in accordance with state regulations pertaining to bear baiting.

Fence voltage should be checked each week at a distance from the fence charger; it should yield at least 3,000 volts. To protect against voltage loss, the battery and fence charger should be kept dry and their connections free of corrosion. Make certain all connections are secure and check for faulty insulators (arcing between wire and post). Also clip vegetation beneath the fence. Each month, check the fence tension and replace baits or lures as necessary. Always recharge the batteries during the day so the fence is energized at night.

Animal Capture Devices. WS specialists can use a variety of devices to capture mammals. For reasons discussed above under "Relocation", small to medium sized mammals captured are usually killed via gunshot, cervical dislocation, or one of the chemical euthanasia methods listed

below. However there are occasions where captured animals are relocated, or, in the case of some disease surveillance projects, may be released on site.

Bow nets are small circular net traps used for small mammals. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is often set over a food source and it is triggered by an observer using a pull cord or remote controlled electronic switch.

Cable restraints are traps made of light cable with a locking device, and are used to catch small and medium sized mammals. The cable is placed in the path of an animal in the form of a loop. When the target species walks into the cable restraint, the loop becomes smaller in size, holding the animal as if it were on a leash. When used as a live capture device, cable restraints are equipped with integrated stops that permit tightening, but do not choke the animal.

Cage traps are live capture devices used to catch a variety of small to medium sized mammals. Cage traps come in a variety of sizes and are generally made of galvanized wire mesh, and consist of a treadle inside the cage that triggers the door to close behind the animal being captured. Cage traps can range from the extremely small, intended for the capture of rodents and other small mammals to the large corral/panel traps fitted with a routing or saloon style repeating door, used to live-capture feral hogs.

> **Beaver live traps include the Hancock traps** (suitcase/basket type cage traps) and commercially produced traps designed to live-capture beaver. The Hancock trap is constructed of a metal frame covered in chain-link fence that is hinged with springs. Trap appearance is similar to a large suitcase when closed. Other traps are constructed of steel and placed in running water or on the edge where a beaver may swim into it. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal.

Catch poles consist of a long pole with a cable noose at one end. The noose end is typically encased in plastic tubing. Catch poles can be used to safely catch and restrain animals such as small bears (cubs) and raccoons.

Colony traps are multi-catch traps used to either live-capture or drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak et al. 1987). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes.

Culvert traps have been used by wildlife managers to safely capture wild bears at least since the 1950's (Erickson 1957, Black 1958). The trap itself rarely injures the animal and trap mortality is rare (Erickson 1957). Occasionally, non-target animals are caught in culvert traps, such as raccoons (*Procyon lotor*), fisher (*Martes pennanti*), and domestic dogs (*Canis familiaris*). Non-target animals would be released unharmed.

Foothold traps are devices that come in a variety of sizes that allows the traps to be species specific to some degree. Depending on the circumstances, pan-tension devices, trap placement

and lure selection can also be used to reduce risks to nontarget species. These traps can be set on land or in water. They are made of steel with springs that close the jaws of the trap around the foot (and sometimes the leg) of the target species. These traps may have offset steel or padded jaws, which hold the animal.

Foot snares are spring activated (i.e., Aldrich-type) foot snares (Figure C-2) that would be used in situations that preclude the use of culvert traps. Foot snares are a safe and effective capture device when properly set and inspected (Miller et al 1973, Johnson and Pelton 1980). Bears captured in this manner can be tranquilized, released, relocated, or destroyed. WS uses bait as described previously to attract bears to foot snare sets.

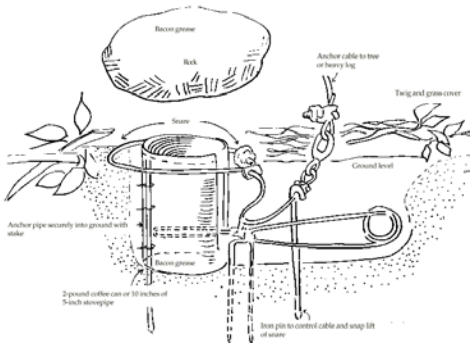

Figure C-2. Example of a foot snare.

Hand nets are used to catch small mammals in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles.

Net guns are devices that project a net over a target animal using a specialized gun.

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. Rocket netting is normally used for birds and larger mammal species such as deer but can be used to capture other mammal species.

Sherman box traps are small live traps used to capture small mammals such as rodents. These traps are often made of galvanized steel or aluminum and fold up for easy transport. Sherman box traps also consist of a treadle towards the back of the trap that triggers the door to close behind the animal being captured.

NON-LETHAL METHODS (CHEMICAL)

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension,

resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for these wild species (Fowler and Miller 1999).

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel are even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Repellents are usually naturally occurring substances or chemicals formulated to be distasteful or to elicit pain or discomfort for target animals when they are smelled, tasted, or contacted. Many repellents are commercially available for mammals, and are registered primarily for herbivores such as rodents and deer. Repellents are not available for many species which may present damage problems, such as some predators or furbearing species. Repellents are variably effective and depend to a great extent on the resource to be protected, time and length of application, and sensitivity of the species causing damage. Acceptable levels of damage control are usually not realized unless repellents are used in conjunction with other techniques, as part of an integrated damage management program. In Michigan, repellents must be registered with the Michigan Department of Agriculture and Rural Development (MDARD).

LETHAL METHODS (NON-CHEMICAL)

For reasons discussed above under “Relocation”, animals captured using the non-lethal capture methods are usually killed via gunshot, cervical dislocation, or one of the chemical euthanasia methods listed in the Lethal Methods (chemical) section. Lethal mechanical methods are:

Shooting is selective for target species and may involve the use of spotlights, night vision, or thermal imagery. A handgun, shotgun or rifle may be utilized. Shooting is an effective method to remove a target number of mammals in damage situations. Removal of specific animals in the problem area can oftentimes provide immediate relief from a problem. Shooting is sometimes utilized as one of the first lethal damage management options because it offers the potential of resolving a problem more efficiently and selectively than some other methods. Shooting may sometimes be one of the only damage management options available if other factors preclude setting of damage management equipment. Firearm use may be a public concern because of

issues relating to safety and misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course annually thereafter (WS Directive 2.615). WS employees, who carry firearms as a condition of employment, are required to meet criteria contained in the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. WS activities where shooting is used include, but are not limited to, removal of mammals in damage situations pursuant to MDNR authorization.

Surveillance and sharpshooting from helicopters has been a very effective method in removing feral swine across the U.S. Aerial surveillance would be conducted throughout the year by low level helicopter flight to determining presence of feral hogs prior to initiating other control methods. Aerial sharpshooting would be conducted during the winter (approximately January through March) after leaves have fallen from trees. WS would not conduct aerial sharpshooting on a property without the consent of the landowner/manager. All aerial activities would be conducted in accordance with the policies established in WS Directive 2.62 – Aviation Safety and Operations and the WS Aviation Safety and Operations manuals. Aerial sharpshooting has been identified as a viable tool for feral swine management in the U.S. (Campbell et al. 2010, West et al. 2009). Reported removal rates for aerial removal of feral swine range from 9-39 swine per hour (Campbell et al. 2010, Saunders and Bryant 1988, Hone 1983). Differences in swine density, climate, terrain and plant cover account for most of the variation in capture rates. Although aerial sharpshooting is an expensive method, WS' experience with feral swine removals indicates that the staff time, travel time and labor required to achieve similar results using ground-based methods will likely make aerial sharpshooting a cost-effective option.

Aerial shooting or aerial hunting (shooting from an aircraft) is a commonly used method. Aerial hunting is species-specific and can be used for immediate control to reduce swine populations if weather, terrain, and cover conditions are favorable. Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters, with better maneuverability, have greater utility and are safer over rugged terrain and timbered areas. In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen. The WS program aircraft-use policy helps ensure that aerial hunting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must be certified under established WS program procedures and only properly trained WS employees are approved as gunners.

Cervical Dislocation is sometimes used to euthanize small rodents which are captured in live traps and when relocation is not a feasible option. The animal is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. When done properly, the AVMA approves this technique as humane method of euthanasia and states that cervical dislocation is a humane technique for euthanasia of small rodents (AVMA 2013). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (AVMA 2013).

Body Gripping (Conibear) Traps are steel framed devices used to capture and quickly kill

mammals, especially aquatic species. These traps come in a variety of sizes and may be used on land or in the water depending on trap size and state and local laws. The traps are made of two steel square frames that are hinged on two sides and have one or two springs.

Snap traps are used to remove small rodents. The trap treadle is baited with peanut butter or other taste attractants and attached near the damage area. These traps pose no imminent danger to pets or the public. Snap traps are a commonly used to survey small rodent populations, such as mice and voles.

Sport Hunting/Trapping is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted and/or trapped, and activities can meet site security and safety objectives. A valid hunting or trapping license and other licenses or permits may be required by the MDNR. This method provides sport, income and/or food for hunters/trappers and requires no cost to the landowner. Sport hunting/trapping is occasionally recommended if it can be conducted safely for coyotes, feral hogs, bear, deer and other damage causing mammals.

LETHAL METHODS (CHEMICAL)

All chemicals used by WS are registered as required by U.S. Department of Justice Drug Enforcement Administration (DEA) and MDARD. WS personnel that use restricted-use chemical methods are WS certified and are required to adhere to all certification requirements set forth in FIFRA and Michigan pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

Potassium chloride, a common laboratory chemical, is injected by WS personnel as a euthanizing agent after an animal has been anesthetized.

Zinc Phosphide is a toxicant used to kill rodents, lagomorphs and nutria. It is two to 15 times more toxic to rodents than to carnivores (Hill and Carpenter 1982). Secondary risks appear to be minimal to predators and scavengers that scavenge carcasses of animals killed with zinc phosphide (Hill and Carpenter 1983, Tietjen 1976, Hegdal and Gatz 1977, Hegdal et al. 1980, and Johnson and Fagerstone 1994). This is because: 1) 90% of the zinc phosphide ingested by rodents is detoxified in the digestive tract (Matschke unpubl. as cited in Hegdal et al. 1980), 2) 99% of the zinc phosphide residues occur in the digestive tracts, with none occurring in the muscle, 3) the amount of zinc phosphide required to kill target rodents is not enough to kill most other predatory animals that consume prairie dog tissue (Johnson and Fagerstone 1994).

All chemicals used by WS are registered under MDARD and administered by DEA. Zinc phosphide is federally registered for use by APHIS/WS. Specific bait applications are designed to minimize non-target hazards (Evans 1970). WS personnel that use chemical methods are certified as pesticide applicators by MDARD and are required to adhere to all certification requirements and pesticide control laws and regulations set forth by MDARD. No chemicals are used on federal or private lands without authorization from the land management agency or property owner/manager.

In addition, zinc phosphide has a strong emetic action (i.e., causes vomiting) and most non-target animals in research tests regurgitated bait or tissues contaminated with zinc phosphide without succumbing to the toxicant (Hegdal and Gatz 1977, Hegdal et al. 1980, Johnson and Fagerstone 1994). Furthermore, predators tend to eviscerate zinc phosphide-poisoned rodents before eating them or otherwise avoid the digestive tract and generally do not eat the stomach and intestines (Hegdal et al. 1980, Johnson and Fagerstone 1994). Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. Many birds appear capable of distinguishing treated from untreated baits and they prefer untreated grain when given a choice (Johnson and Fagerstone 1994). Birds appear particularly susceptible to the emetic effects of zinc phosphide, which would tend to offer an extra degree of protection against bird species dying from zinc phosphide grain bait consumption or, for scavenging bird species, from eating poisoned rodents. Use of rolled oats instead of whole grain also appears to reduce bird acceptance of bait. Uresk et al. (1988) reported on the effects of zinc phosphide on six non-target rodent populations. They determined that no differences were observed from pretreatment until after treatment in populations of eastern cottontail rabbits (*Sylvilagus floridanus*) and white-tailed jackrabbits (*Lepus townsendii*). However, primary consumption of bait by non-target wildlife can occur and potentially cause mortality. Uresk et al. (1988) reported a 79% reduction in deer mouse (*Peromyscus maniculatus*) populations in areas treated with zinc phosphide, however the effect was not statistically significant because of high variability in densities and the reduction was not long-term (Deisch et al. 1990).

Ramey et al. (2000) reported that five weeks after treatment, no ring-necked pheasants (*Phasianus colchicus*) had been killed as a result of zinc phosphide baiting. In addition, Hegdal and Gatz (1977) determined that zinc phosphide did not affect non-target populations and more radio-tracked animals were killed by predators than died from zinc phosphide intoxication (Hegdal and Gatz 1977, Ramey et al. 2000). Tietjen (1976) observed horned larks (*Eremophila alpestris*) and mourning doves (*Zenaida macroura*) on zinc phosphide-treated prairie dog colonies, but observations after treatment did not locate any sick or dead birds, a finding similar to Apa et al. (1991). Uresk et al. (1988) reported that ground feeding birds showed no difference in numbers between control and treated sites. Apa et al. (1991) further states that zinc phosphide was not consumed by horned larks because: 1) poison grain remaining for their consumption was low (i.e., bait was accepted by prairie dogs before larks could consume it), 2) birds have an aversion to black-colored foods, and 3) birds have a negative sensory response to zinc phosphide. Reduced impacts on birds have also been reported by Tietjen and Matschke (1982). Deisch et al. (1989) reported on the effect zinc phosphide has on invertebrates. They determined that zinc phosphide bait reduced ant densities, however, spider mites, crickets, wolf spiders, ground beetles, darkling beetles and dung beetles were not affected. Wolf spiders and ground beetles showed increases after one year on zinc phosphide treated areas (Desich 1986). Generally, direct long-term impacts from rodenticide treatments were minimal for the insect populations sampled (Deisch et al. 1989). Long-term effects were not directly related to rodenticides, but more to habitat changes (Deisch 1986) as vegetative cover and prey diversity increased without prairie dogs grazing and clipping the vegetation (Deisch et al. 1989).

The primary proposed use of zinc phosiphide would be in and around airport structures to reduce

rodent populations. This helps reduce the attractiveness of the site to raptor populations on airports that cause hazards to aircraft. Airports where WS may use zinc phosphide already have bird hazard management programs in place to minimize or eliminate raptor activity at the site through harassment, relocation and habitat modification (i.e., eliminating perching structures). These efforts will substantially reduce any risks that raptors would be able to access rodent that had consumed zinc phosphide bait.

Gas Cartridges are incendiary devices composed of carbon and sodium nitrate. When ignited and placed in the target animal's burrow, the resultant carbon monoxide and other gases cause asphyxiation. WS will not use gas cartridges in areas where state and federally listed species may be in burrows with the target animal

CARCASS DISPOSAL

Commercial Landfills that are approved for animal disposal are strictly regulated by the EPA and local authorities. Environmental risks are mitigated by the landfill operator. Landfill operators are required to collect and treat leachate to protect groundwater, cover waste to protect air quality and reduce scavenging, and implement other measures to protect other environmental resources and public health risks. Landfill disposal and associated transportation increase operational costs. In some situations (e.g., depopulation of captive animals for disease management), transportation of carcasses may be a concern because of potential disease transmission risks, and additional precautions may be implemented as directed by the applicable animal health organization.

Leaving Carcasses in Place or on site simulates natural death by allowing carcasses to remain in the ecosystem for scavenging and other natural processes. Leaving carcasses on site is the lowest cost disposal option. Carcass retrieval is avoided, therefore access challenges, transporting carcasses, additional vehicle use, and disturbance of sensitive ecosystems are avoided. In Michigan, WS only aniticipates using this method for MDM activities in the rare instance of aerial hunting for feral swine in remote locations where retrieval of carcasses is prohibitive because of logistics, safety risk to staff, or risk of environmental harm from vehicles needed to remove carcasses. Leaving carcasses on site also minimizes the potential for disease transmission to off-site locations and may be preferred by state and local animal health authorities.

The APHIS program has committed to using lead-free ammunition within the constraints of availability when using aerial shooting to remove feral swine, which should eliminate concerns about risks of adverse environmental impacts from lead ammunition. Decisions on using this option must consider public exposure to visual and odor effects and land use conflicts, and must comply with land owner agreements and federal, state, territorial, tribal, and local laws and regulations regarding carcass disposition.

There are important environmental impact considerations and mitigations when using this method. Leaving carcasses on site can attract predators to vulnerable protected species such as ground-nesting birds. Measures to avoid or minimize harmful effects include identification of issues and resolutions through ESA consultations, coordination with land managers, and by

avoiding sensitive areas altogether or during critical life stages such as breeding, nesting, or birthing seasons. Feral swine carcasses that are left on site would pose only a very limited disease risk to human health and safety because the putrefaction process destroys most disease causing agents. Most disease agents require a live host and fail to survive when their host dies. Although prion diseases are known to be particularly persistent in the environment they are not known to occur in feral swine. Feral swine carcasses left in the field would not be left in locations frequented by the general public and would only be left with landowner permission. The potential for the general public to encounter a feral swine carcass would be expected to be extremely remote.

Feral swine carrying the pseudorabies virus (PRV) can present a mortality risk to domestic animals and other non-target mammals if they ingest tissues from a fresh carcass. A decomposing carcass is not likely to pose a risk, thus leaving feral swine on site presents only a short term risk. The potential for carcasses to serve as a source of infection may be unknown unless the feral swine were specifically targeted for disease monitoring. In any case, feral swine that are host to a disease agent would have died in place and/or may have spread the disease to other swine or other animals if it was not removed in FSDM. Thus overall risks from leaving carcasses on site may not exceed the status quo as long as carcass numbers are not concentrated.

Incineration would be conducted in approved facilities that comply with federal, state, and local regulations. Availability of incineration facilities approved for large numbers of large animals can be a limitation. WS does not typically use this option, but it would be used by state agencies that receive animal carcasses for disease monitoring.

Donation for Human Consumption may be used for deer removed during MDM programs, as long as no chemical methods have been used to immobilize or euthanize the animal. Cost of processing is paid by the cooperator. Meat is subsequently donated to food pantries. Risks associated with use of lead ammunition are mitigated either through the use of non-lead ammunition or by using head/neck shots which minimize the risk of lead fragments in meat.

The Federal Meat Inspection Act requires feral swine to be inspected live, slaughtered under inspection, and processed under inspection to be eligible for donation to charities. Animals euthanized off-site and delivered to USDA-licensed facilities are not eligible for donation. However, provided the animals have not been treated with chemicals that would preclude use as food (e.g., immobilization and euthanasia chemicals), and if state regulations and permits allow, euthanized swine may be offered to the landowners for personal consumption. Challenges associated with transport of feral swine and local limitations on the availability of facilities willing and able to process swine limit the utility of this method.

When landowners prefer to keep a feral swine carcass that was killed on its property, APHIS-WS provides information about food safety and the safe handling of the carcass and proper cooking of the meat to reduce risks. Therefore risks to human safety are minimized by emphasizing precautions for safe handling and consumption. In addition, landowners are advised not to feed pets or other animals uncooked meat or other raw carcass products.

APPENDIX D: SECTION 7 CONSULTATION LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
East Lansing Field Office (ES)
2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6316

IN REPLY REFER TO:

April 17, 2014

Mr. Peter H. Butchko
USDA APHIS
Wildlife Services
2803 Jolly Road
Suite 100
Okemos, Michigan 48864

Re: Endangered Species Act Section 7 Consultation for the Integrated Mammal Damage Management Program

Dear Mr. Butchko:

Thank you for your letter of December 3, 2013, requesting consultation under section 7 of the Endangered Species Act of 1973, as amended (Act). Under this project, the U.S. Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services (Wildlife Services) proposes to implement the Integrated Mammal Damage Management (IMDM) program throughout the state of Michigan.

According to your letter, proposed IMDM actions may include the applications of non-lethal and non-chemical techniques to minimize exposure of a protected resource; non-lethal chemicals to capture or repel wildlife; use of lethal non-chemical methods for capturing and removing wildlife; and lethal chemicals primarily targeted for rodents and lagomorphs. These actions could be conducted on private, federal, state, county, and municipal lands.

Your analyses addressed potential effects on the below species. Based on the habitat characteristics, you have determined that the proposed project is not likely to adversely affect these species and request our concurrence with your determination.

Common name	Taxonomic name	Status
Indiana bat	*Myotis sodalis*	Endangered
Piping plover	*Charadrius melodus*	Endangered
Michigan monkey-flower	*Mimulus michiganensis*	Endangered
Northern long-eared bat	*Myotis septentrionalis*	Proposed as endangered
Copperbelly water snake	*Nerodia erythrogaster neglecta*	Threatened
Canada lynx	*Lynx canadensis*	Threatened
Dwarf lake iris	*Iris lacustris*	Threatened
Eastern prairie fringed orchid	*Platanthera leucophaea*	Threatened
Houghton's goldenrod	*Solidago houghtonii*	Threatened
Pitcher's thistle	*Cirsium pitcheri*	Threatened

Indiana bat

According to your letter, the proposed actions generally do not occur in habitat that would support Indiana bat and WS generally does not recommend removal of suitable roosting trees. Additionally, you have advised that if the proposed action may involve capture, handling, or removal of Indiana bat from someone's home or property or removal of potential roosting trees, WS will consult with the U.S. Fish and Wildlife Service (USFWS) prior to implementing any of these actions. As such, it appears that contact with Indiana bats would be rare or unlikely to occur. We concur that the proposed action is not likely to adversely affect the Indiana bat and based upon this information, any effects on Indiana bats from this project would be discountable.

Piping plover and critical habitat

We concur that the proposed action is not likely to adversely affect piping plover for the following reasons. You have advised that WS provides assistance to the National Park Service for protecting piping plovers from predators, primarily avian, with possible management of mammalian predators in the future. Management methods may include traps, firearms, and barriers. Protection from predators would not affect piping plover habitat or its designated critical habitat. Eliminating or reducing predation on the plovers aids in increasing the population. Based upon this information, any effects to piping plovers from this project would be beneficial.

Federally listed plant species

According to your April 11, 2014 email to Tameka Dandridge of this office, you advised that impacts to the federally listed plants indicated in the table are not anticipated. Shallow holes dug for leg-hold traps are typically placed on bare ground. Additionally, WS will familiarize and educate IMDM program cooperators on the federally listed plant species in locations where leg-hold traps are proposed for use to avoid and minimize impacts to the plants. We therefore concur that the proposed action is not likely to adversely affect these plant species, and any effects to the plants would be discountable.

Canada lynx

Currently, the best available information, including historic records and recent surveys, indicates that if Canada lynx are present in the U.P., they are likely limited to a small number of dispersing individuals. There is no indication of recent or current lynx breeding in the U.P., which is at the southern periphery of the species' range. We concur that the proposed action is not likely to adversely affect the Canada lynx because you propose to avoid or minimize contact with lynx during implementation of the IMDM program. Although traps designed to capture other mammals will be used in the IMDM program, you propose to follow the best management practices developed by the Association of Fish and Wildlife Agencies, and will use traps that will not harm lynx and will place them in locations that are unlikely to be encountered by lynx. If a lynx should become captured in a trap, WS will initiate formal consultation with the USFWS. Given the low numbers of lynx, if any, in the project area, any effects on lynx from this project would be discountable.

Copperbelly water snake

According to your letter and April 11, 2014 email to Tameka Dandridge of this office, beaver dam removal is an action that could potentially impact copperbelly water snake (CBWS); however, WS has never received requests for mammal damage management work in counties known to support the snakes. Additionally, WS proposes to avoid and minimize impacts to CBWS. Since CBWS may use beaver dams, any dams requiring removal will be done using hand tools. Also, WS will observe beaver dams for CBWS activity while removing dam material in locations with documented CBWS occurrences. All CBWS sightings will be reported to the U.S. Fish and Wildlife Service. We concur that the proposed action is not likely to adversely affect CBWS as the snakes are unlikely to be encountered during the course of the program, as well as implementation of actions to avoid injury to the snakes.

Conclusion

If project plans change or new information about the project becomes available that indicates listed species, proposed species or critical habitat may be affected in a manner or to an extent not previously considered, you should reinitiate consultation with this office. Because endangered species data change continuously, we recommend you revisit our technical assistance website (*http://www.fws.gov/midwest/endangered/section7/s7process/index.htm*) if more than six months pass prior to commencement of proposed activities.

We appreciate the opportunity to cooperate with you in conserving endangered species. If you have any questions regarding these comments, please contact Tameka Dandridge of this office at 517-351-8315 or tameka_dandridge@fws.gov.

Sincerely,

Scott Hicks

Scott Hicks
Field Supervisor

cc: Dan Kennedy, MDNR, Wildlife Division, Lansing

APPENDIX E: STATE AND FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES IN MICHIGAN

Notes:

- This report shows the listed species associated in some way with this state.
- This list does not include experimental populations and similarity of appearance listings.

Summary of Animal Listings
Federal Listings (http://www.fws.gov/midwest/Endangered/lists/michigan-spp.html)
State Listings (http://mnfi.anr.msu.edu/data/specialanimals.cfm#grp4)
Last accessed 09/18/2014

MAMMALS	**STATUS**	
Species	**Federal**	**State**
Canada Lynx (*Lynx canadensis*)	T	E
Cougar (*Felis concolor*)		E
Evening Bat (*Nycticeius humeralis*)		T
Indiana Bat (*Myotis sodalis*)	E	E
Least Shrew (*Cryptotis parva*)		T
Northern Long-Eared Bat (*Myotis septentrionalis*)	PE	
Prairie Vole (*Microtus ochrogaster*)		E
Smoky Shrew (*Sorex fumeus*)		T
AMPHIBIANS	**STATUS**	
Species	**Federal**	**State**
Blanchard's Cricket Frog (*Acris crepitans blanchardi*)		T
Marbled Salamander (*Ambystoma opacum*)		E
Smallmouth Salamander (*Ambystoma texanum*)		E
BIRDS	**STATUS**	
Species	**Federal**	**State**
Barn Owl (*Tyto alba*)		E
Caspian Tern (*Sterna caspia)*		T
Cerulean Warbler (*Dendroica cerulea*)		T
Common Loon (*Gavia immer)*		T
Common Moorhen (*Gallinula chloropus*)		T
Common tern (*Sterna hirundo*)		T
Forster's tern (*Sterna forsteri*)		T
Henslow's Sparrow (*Ammodramus henslowii*)		E
King Rail (*Rallus elegans*)		E
Kirtland's Warbler (Setophaga kirtlandii=Dendroica kirtlandii)	E	E
Least bittern (*Ixobrychus exilis*)		T
Long-Eared Owl (*Asio otus*)		T
Louisiana Waterthrush (*Seiurus motacilla*)		T

Merlin (*Falco columbarius*)		T
Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)		E
Peregrine Falcon (*Falco peregrinus*)		E
Piping Plover (*Chradrius melodus*)	E	E
Prairie Warbler (*Dendroica discolor*)		E
Red-Shouldered Hawk (*Buteo lineatus*)		T
Rufa Red Knot (*Calidris canutus rufa*)	PT	
Short-Eared Owl (*Asio flammeus*)		E
Trumpeter Swan (*Cygnus buccinator*)		T
Yellow Rail (*Coturnicops noveboracensis*)		T
Yellow-Throated Warbler (*Dendroica dominica*)		T
FISH	**STATUS**	
Species	**Federal**	**State**
Channel Darter (*Percina copelandi*)		E
Creek Chubsucker (*Erimyzon claviformis*)		E
Eastern Sand Darter (*Ammocrypta pellucida*)		T
Ives Lake Cisco (*Coregonus hubbsi*)		T
Lake Herring or Cisco (*Coregonus artedi*)		T
Lake Sturgeon (*Acipenser fulvescens*)		T
Mooneye (*Hiodon tergisus*)		T
Northern Madtom (*Noturus stigmosus*)		E
Pugnose Minnow (*Opsopoeodus emiliae*)		E
Pugnose Shiner (*Notropis anogenus*)		E
Redside Dace (*Clinostomus elongatus*)		E
River Darter (*Percina shumardi*)		E
River Redhorse (*Moxostoma carinatum*)		T
Sauger (*Sander canadensis*)		T
Shortjaw Cisco (*Coregonus zenithicus*)		T
Silver Shiner (*Notropis photogenis*)		E
Siskiwit Lake Cisco (*Coregonus bartlettii*)		T
Southern Redbelly Dace (*Phoxinus erythrogaster*)		E
INSECTS	**STATUS**	
Species	**Federal**	**State**
Dukes' Skipper (*Euphyes dukesi*)		T
Frosted Elfin (*Incisalia irus*)		T
Grey Petaltail (*Tachopteryx thoreyi*)		T
Henry's Elfin (*Incisalia henrici*)		T
Hine's Emerald Dragonfly (*Somatochlora hineana*)	E	E
Hungerford's Crawling Water Beetle (*Brychius hungerfordi*)	E	E
Huron River Leafhopper (*Flexamia huroni*)		T

Karner Blue Butterfly (*Lycaeides melissa samuelis*)	E	T
Lake Huron Locust (*Trimerotropis huroniana*)		T
Leadplant Moth (*Schinia lucens*)		E
Mitchell's Satyr (*Neonympha mitchellii mitchellii*)	E	E
Northern Blue (*Lycaeides idas nabokovi*)		T
Ottoe Skipper (*Hesperia ottoe*)		T
Persius Dusky Wing (*Erynnis persius persius*)		T
Phlox Moth (*Schinia indiana*)		E
Poweshiek Skipperling (*Oarisma poweshiek*)	PE	T
Pygmy Snaketail (*Ophiogomphus howei*)		T
Regal Fritillary (*Speyeria idalia*)		E
Silphium Borer Moth (*Papaipema silphii*)		T
Six-Banded Longhorn Beetle (*Dryobius sexnotatus*)		T
Three-Staff Underwing (*Catocala amestris*)		E
MUSSELS	**STATUS**	
Species	**Federal**	**State**
Black Sandshell (*Ligumia recta*)		E
Clubshell (*Pleurobema clava*)	E	E
Eastern Pondmussel (*Ligumia nasuta*)		E
Fawnsfoot (*Truncilla donaciformis*)		T
Hickorynut (*Obovaria olivaria*)		E
Lilliput (*Toxolasma parvus*)		E
Northern Riffleshell (*Epioblasma torulosa rangiana*)	E	E
Purple Lilliput (*Toxolasma lividus*)		E
Purple Wartyback (*Cyclonaias tuberculata*)		T
Rayed Bean (*Villosa fabalis*)	E	E
Round Hickorynut (*Obovaria subrotunda*)		E
Round Lake Floater (*Pyganodon subgibbosa*)		T
Salamander Mussel (*Simpsonaias ambigua*)		E
Slippershell (*Alasmidonta viridis*)		T
Snuffbox (*Epioblasma triquetra*)	E	E
Threehorn Wartyback (*Obliquaria reflexa*)		E
Wavyrayed Lampmussel (*Lampsilis fasciola*)		T
REPTILES	**STATUS**	
Species	**Federal**	**State**
Copperbelly Water Snake (*Nerodia erythrogaster neglecta*)	T	E
Eastern Fox Snake (*Pantherophis gloydi*)		T
Eastern Massasauga (*Sistrurus catenatus*)	C	
Kirtland's Snake (*Clonophis kirtlandii*)		E
Six-Lined Racerunner (*Aspidoscelis sexlineata*)		T
Spotted Turtle (*Clemmys guttata*)		T

SNAILS	STATUS	
Species	**Federal**	**State**
A land snail (no common name) (*Catinella gelida*)		T
A land snail (no common name) (*Catinella protracta*)		E
A land snail (no common name) (*Euconulus alderi*)		T
A land snail (no common name) (*Vallonia gracilicosta albula*)		E
A land snail (no common name) (*Vertigo modesta modesta*)		E
A land snail (no common name) (*Vertigo modesta parietalis*)		E
Acorn Ramshorn (*Planorbella multivolvis*)		E
An aquatic snail (no common name) (*Planorbella smithi*)		E
Broadshoulder Physa (*Physella parkeri*)		T
Bugle Fossaria (*Fossaria cyclostoma*)		T
Carinate Pillsnail (*Euchemotrema hubrichti*)		T
Cherrystone Drop (*Hendersonia occulta*)		T
Deep-Throat Vertigo (*Vertigo nylanderi*)		E
Deepwater Pondsnail (*Stagnicola contracta*)		E
Delicate Vertigo (*Vertigo bollesiana*)		T
Foster Mantleslug (*Pallifera fosteri*)		T
Hubricht's Vertigo (*Vertigo hubrichti*)		E
Lambda Snaggletooth (*Gastrocopta holzingeri*)		E
Petoskey Pondsnail (*Stagnicola petoskeyensis*)		E
Pleistocene Catinella (*Catinella exile*)		T
Proud Globe (*Mesodon elevatus*)		T
Six-Whorl Vertigo (*Vertigo morsei*)		E
Sterki's Granule (*Guppya sterkii*)		E

E=Endangered; T=Threatened; PE=Proposed Endangered; PT=Proposed Threatened; C= Candidate

Summary of Plant Listings

Federal Listings (http://www.fws.gov/midwest/Endangered/lists/michigan-spp.html)

State Listings (http://mnfi.anr.msu.edu/data/specialplants.cfm)

Last accessed 09/18/2014

PLANTS	STATUS	
Species	**Federal**	**State**
Alpine Bistort (*Polygonum viviparum; Bistorta vivipara*)		T
Alpine Blueberry (*Vaccinium uliginosum*)		T
Alpine Bluegrass (*Poa alpina*)		T
Alpine Sainfoin (*Hedysarum alpinum*)		E
American Chestnut (*Castanea dentata*)		E

PLANTS	STATUS	
Species	**Federal**	**State**
American Hart's Tongue Fern (*Asplenium scolopendrium var. americanun = Phyllitis japonica ssp. a.*)	T	E
American Lotus (*Nelumbo lutea; Nelumbo pentapetala*)		T
American Rock-Brake (*Cryptogramma acrostichoides*)		T
Annual Hedge Hyssop (*Gratiola virginiana*)		T
Arrowhead (*Sagittaria montevidensis; Sagittaria calycina, Lophotocarpus calycinus*)		T
Ashy Whitlow Grass (*Draba cana*)		T
Assiniboia Sedge (*Carex assiniboinensis*)		T
Atlantic Blue-Eyed-Grass (*Sisyrinchium atlanticum*)		T
Awlwort (*Subularia aquatica*)		E
Bald-Rush (*Rhynchospora scirpoides; Psilocarya scirpoides*)		T
Bastard Pennyroyal (*Trichostema dichotomum*)		T
Bayonet Rush (*Juncus militaris*)		T
Beach Three-Awned Grass (*Aristida tuberculosa*)		E
Beak Grass (*Diarrhena obovata; Diarrhena americana*)		T
Beaked Agrimony (*Agrimonia rostellata*)		T
Beard Tongue (*Penstemon calycosus*)		T
Bedstraw (*Galium kamtschaticum*)		E
Big-Leaf Sandwort (*Moehringia macrophylla; Arenaria macrophylla*)		T
Black Crowberry (*Empetrum nigrum*)		T
Black Sedge (*Carex nigra*)		E
Black Twinberry (*Lonicera involucrata*)		T
Bladderwort (*Utricularia subulata*)		T
Blunt-Lobed Woodsia (*Woodsia obtusa*)		T
Bog Bluegrass (*Poa paludigena*)		T
Bowman's Root (*Gillenia trifoliata; Porteranthus trifoliatus*)		E
Broad-Leaved Sedge (*Carex platyphylla*)		E
Broomrape (*Orobanche fasciculata*)		T
Bulrush Sedge (*Carex scirpoidea*)		T
Calypso or Fairy-Slipper (*Calypso bulbosa*)		T
Canada Rice Grass (*Oryzopsis canadensis; Piptatherum canadense*)		T
Canadian Burnet (*Sanguisorba canadensis*)		E
Canadian Milk Vetch (*Astragalus canadensis*)		T
Canbyi's Bluegrass (*Poa canbyi; Poa secunda*)		E

PLANTS	STATUS	
Species	**Federal**	**State**
Carey's Smartweed (*Polygonum careyi; Persicaria careyi*)		T
Cattail Sedge (*Carex typhina*)		T
Chives (*Allium schoenoprasum; Allium schoenoprasum var. sibiricum*)		T
Climbing Fern (*Lygodium palmatum*)		E
Compass Plant (*Silphium Laciniatum*)		T
Corn Salad (Valerianella umbilicata)		T
Cranefly Orchid (*Tipularia discolor*)		E
Cream Wild Indigo (*Baptisia leucophaea*)		E
Creeping St. John's-Wort (*Hypericum adpressum*)		T
Creeping Whitlow Grass (*Draba reptans*)		T
Cup Plant (*Silphium perfoliatum*)		T
Cut-Leaved Water Parsnip (*Berula erecta; Berula pusilla*)		T
Devil's Club (*Oplopanax horridus*)		T
Downy Gentian (*Gentiana puberulenta; Gentiana puberula*)		E
Downy Sunflower (*Helianthus mollis*)		T
Dropseed (*Sporobolus clandestinus*)		E
Drummond's Aster (*Aster drummondii; Symphyotrichum drummondii*)		T
Dwarf Bilberry (*Vaccinium cespitosum*)		T
Dwarf Burhead (*Echinodorus tenellus; Echinodorus parvulus*)		E
Dwarf Lake Iris (*Iris lacustris*)	T	T
Dwarf Milkweed (*Asclepias ovalifolia*)		E
Dwarf Raspberry (*Rubus acaulis; Rubus arcticus ssp. Acaulis*)		E
Dwarf Spike-Rush (*Eleocharis parvula*)		E
Eastern Few-Fruited Sedge (*Carex oligocarpa*)		T
Eastern Prairie Fringed Orchid (*Plantathera leucophaea*)	T	E
Edible Valerian (*Valeriana edulis var. ciliata; Valeriana ciliata*)		T
Encrusted Saxifrage (*Saxifraga paniculata*)		T
Engelmann's Quillwort (*Isoetes engelmannii*)		E
Evening Campion (*Silene nivea*)		T
Eyebright (*Euphrasia hudsoniana*)		T
Eyebright (*Euphrasia nemorosa; Euphrasia arctica*)		T
Fairy Bells (*Prosartes hookeri; Disporum hookeri*)		E

PLANTS	STATUS	
Species	**Federal**	**State**
False Asphodel (*Tofieldia pusilla*)		T
False Hop Sedge (*Carex lupuliformis*)		T
False Pennyroyal (*Trichostema brachiatum; Isanthus brachiatus*)		T
False Violet (*Dalibarda repens*)		T
Farwell's Sater Milfoil (*Myriophyllum farwellii*)		T
Few-Flowered Nut Rush (*Scleria pauciflora*)		E
Fire Pink (*Silene virginica*)		E
Flattened Spike Rush (*Eleocharis compressa*)		T
Fleabane (*Erigeron acris*)		T
Fleshy Stitchwort (*Stellaria crassifolia*)		E
Floating Bladderwort (*Utricularia inflata; Utricularia radiata*)		E
Floating Marsh Marigold (*Caltha natans*)		T
Forest Skullcap (*Scutellaria ovata*)		T
Forked Aster (*Aster furcatus*)		T
Fragile Prickly Pear (*Opuntia fragilis*)		E
Franklin's Phacelia (*Phacelia franklinii*)		T
Frost Grape (*Vitis vulpina*)		T
Gattinger's Gerardia (*Agalinis gattingeri*)		E
Ginseng (*Panax quinquefolius*)		T
Globe Beak-Rush (*Rhynchospora recognita; Rhynchospora globularis*)		E
Globe-Fruited Seedbox (*Ludwigia sphaerocarpa*)		T
Goblin Moonwort (*Botrychium mormo*)		T
Goldenseal (*Hydrastis canadensis*)		T
Goosefoot Corn Salad (*Valerianella chenopodiifolia*)		T
Great Northern Aster (*Aster modestus; Canadanthus modestus*)		T
Hairy Mountain Mint (*Pycnanthemum pilosum*)		T
Hairy Wild Petunia (*Ruellia humilis*)		T
Hall's Bulrush (*Schoenoplectus hallii; Scirpus hallii*)		T
Hay-Scented Fern (*Dennstaedtia punctilobula*)		T
Heart-Leaved Arnica (*Arnica cordifolia; Arnica whitneyi*)		E
Heart-Leaved Plantain (*Plantago cordata*)		E
Hedge-Hyssop (*Gratiola aurea; Gratiola lutea*)		T
Hill's Pondweed (*Potamogeton hillii*)		T
Hollow-Stemmed Joe-Pye Weed (*Eupatorium fistulosum; Eutrochium fistulosum*)		T
Houghton's Goldenrod (*Solidago houghtonii*)	T	T

PLANTS	STATUS	
Species	**Federal**	**State**
Hudson Bay Sedge (*Carex heleonastes*)		E
Hyssop-Leaved Fleabane (*Erigeron hyssopifolius*)		T
Jacob's Ladder (*Polemonium reptans*)		T
Kitten-Tails (*Besseya bullii*)		E
Lake Cress (*Armoracia lacustris; Armoracia aquatica*)		T
Lake Huron Tansy (*Tanacetum huronense; Tanacetum bipinnatum ssp. Huronense*)		T
Lakeside Daisy (*Hymenoxy acaulis var. glabra*)	T	E
Lapland Buttercup (*Ranunculus lapponicus*)		T
Large Toothwort (*Dentaria maxima; Cardamine maxima*)		T
Large Water Starwort (*Callitriche heterophylla*)		T
Leggett's Pinweed (*Lechea pulchella; Lechea leggettii*)		T
Leiberg's Panic Grass (*Dichanthelium leibergii; Panicum leibergii*)		T
Lesser Ladies'-Tresses (Spiranthes ovalis)		T
Limestone Oak Fern (*Gymnocarpium robertianum*)		T
Longleaf Arnica (*Arnica lonchophylla*)		E
Low Northern Rock Cress (*Braya humilis*)		T
Macoun's Buttercup (*Ranunculus macounii*)		T
Marsh Grass-Of-Parnassus (*Parnassia palustri*s)		T
Maryland Meadow Beauty (*Rhexia mariana; Rhexia mariana var. mariana*)		T
Mat Muhly (*Muhlenbergia richardsonis*)		T
Mermaid-Weed (*Proserpinaca pectinata*)		E
Michigan Monkey-Flower (*Mimulus michiganesis*)	E	E
Mikania (*Mikania scandens*)		T
Missouri Goldenrod (Solidago missouriensis)		T
Moonwort (*Botrychium acuminatum*)		E
Moor Rush (*Juncus stygius*)		T
Mountain Cranberry (*Vaccinium vitis-idaea*)		E
Mountain Mint (*Pycnanthemum muticum*)		T
Mullein-Foxglove (*Dasistoma macrophylla; Seymeria macrophylla*)		E
Narrow-Leaved Gentian (*Gentiana linearis*)		T
Narrow-Leaved Reedgrass (*Calamagrostis stricta*)		T
Netted Nut Rush (*Scleria reticularis*)		T
New England Sedge (*Carex novae-angliae*)		T
New England Violet (*Viola novae-angliae*)		T
Nodding Pogonia or Three Birds Orchid (*Triphora trianthophora*)		T

PLANTS	STATUS	
Species	**Federal**	**State**
Nodding Rattlesnake-Root (*Prenanthes crepidinea*)		T
Northern Bayberry (*Myrica pensylvanica*)		T
Northern Fairy Bells (*Prosartes trachycarpa; Disporum trachycarpum*)		T
Northern Marsh Violet (*Viola epipsila*)		E
Northern Oak Fern (*Gymnocarpium jessoense*)		E
Northern Prostrate Clubmoss (*Lycopodiella margueritae; Lycopodiella appressa*)		T
Northern Ragwort (*Senecio indecorus; Packera indecora*)		T
Northern Reedgrass (*Calamagrostis lacustris*)		T
Northern Woodsia (*Woodsia alpina*)		E
Orange- or Yellow-Fringed Orchid (*Platanthera ciliaris; Habenaria ciliaris*)		E
Painted Trillium (Trillium undulatum)		E
Pale Indian Paintbrush (*Castilleja septentrionalis*)		T
Panic Grass (*Panicum longifolium; Panicum rigidulum var. pubescens*)		T
Panicled Hawkweed (*Hieracium paniculatum*)		T
Panicled Screwstem (*Bartonia paniculata*)		T
Pearlwort (*Sagina nodosa*)		T
Philadelphia Panic-Grass (*Panicum philadelphicum*)		T
Pine-Drops (*Pterospora andromedea*)		T
Pitcher's Thistle (*Cirsium pitcheri*)	T	T
Prairie Birdfoot Violet (*Viola pedatifida*)		T
Prairie Buttercup (*Ranunculus rhomboideus*)		T
Prairie Cinquefoil (*Potentilla pensylvanica*)		T
Prairie Coreopsis (*Coreopsis palmata*)		T
Prairie Golden Alexanders (*Zizia aptera*)		T
Prairie Moonwort or Dunewort (*Botrychium campestre*)		T
Prairie or Pale Agoseris (*Agoseris glauca*)		T
Prairie Smoke (*Geum triflorum*)		T
Prairie Trillium (*Trillium recurvatum*)		T
Prickly Saxifrage (*Saxifraga tricuspidata*)		T
Pumpelly's Bromegrass *(Bromus pumpellianus*)		T
Pumpkin Ash (*Fraxinus profunda; Fraxinus tomentosa*)		T
Purple Cliff Brake (*Pellaea atropurpurea*)		T
Purple Milkweed (Asclepias purpurascens)		T
Purple Spike Rush (*Eleocharis atropurpurea*)		E
Purple Turtlehead (Chelone obliqua)		E

PLANTS	STATUS	
Species	**Federal**	**State**
Pygmy Water Lily (*Nymphaea leibergii; Nymphaea tetragona*)		E
Queen-of-the-Prairie (*Filipendula rubra*)		T
Rattlesnake-Master or Button Snakeroot (*Eryngium yuccifolium*)		T
Raven's-Foot Sedge (*Carex crus-corvi*)		E
Red Mulberry (*Morus rubra*)		T
Rock Cress (*Arabis perstellata; Boechera dentata*)		T
Rock-Jasmine (*Androsace occidentalis*)		E
Rock-Rose (*Chamaerhodos nuttallii var. keweenawensis; Chamaerhodos erecta*)		E
Rosepink (*Sabatia angularis*)		T
Rosinweed (*Silphium integrifolium*)		T
Ross's Sedge (*Carex rossii*)		T
Rosy Pussytoes (*Antennaria rosea*)		E
Rough Fescue (*Festuca scabrella; Festuca altaica var. scabrella*)		T
Round-Fruited St. John's-Wort (*Hypericum sphaerocarpum*)		E
Round-Seed Panic-Grass (*Dichanthelium polyanthes; Panicum polyanthes*)		E
Sand Cinquefoil (*Potentilla paradoxa*)		T
Scirpus-Like Rush (*Juncus scirpoides*)		T
Seaside Crowfoot (*Ranunculus cymbalaria*)		T
Sedge (*Carex albolutescens*)		T
Sedge (*Carex atratiformis*)		T
Sedge (*Carex conjuncta*)		T
Sedge (*Carex media*)		T
Sedge (*Carex seorsa*)		T
Sedge (*Carex tincta*)		T
Shooting Star (*Dodecatheon meadia*)		E
Short-Beak Beak-Rush (*Rhynchospora nitens; Psilocarya nitens*)		E
Short-Fruited Rush (*Juncus brachycarpus*)		T
Shortstalk Chickweed (*Cerastium brachypodum*)		T
Showy Orchis (*Galearis spectabilis; Orchis spectabilis*)		T
Side-Oats Grama Grass (*Bouteloua curtipendula*)		E
Skinner's Gerardia (*Agalinis skinneriana*)		E
Skullcap (*Scutellaria nervosa*)		E
Slender Beard Tongue (*Penstemon gracilis*)		E
Slender Manna Grass (Glyceria melicaria)		T

PLANTS	STATUS	
Species	**Federal**	**State**
Slender Spike Rush (*Eleocharis nitida*)		E
Slough Grass (*Beckmannia syzigachne*)		T
Small Blue-Eyed Mary (*Collinsia parviflora*)		T
Small Log Fern (*Dryopteris celsa*)		T
Small Rround-Leaved Orchis (*Amerorchis rotundifolia; Orchis rotundifolia*)		E
Small Skullcap (*Scutellaria parvula*)		T
Small Whorled Pogonia (*Isotria medeoloides*)	T	E
Small Yellow Pond Lily (*Nuphar pumila; Nuphar microphylla*)		E
Small-Flowered Wood Rush (*Luzula parviflora*)		T
Small-Fruited Spike-Rush (*Eleocharis microcarpa*)		E
Smooth Ruellia (*Ruellia strepens*)		E
Smooth Whitlow Grass (*Draba glabella*)		E
Snow Trillium (*Trillium nivale*)		T
Southeastern Adder's-Tongue (*Ophioglossum vulgatum; Ophioglossum pycnostichum*)		E
Spatulate Moonwort (*Botrychium spathulatum*)		T
Spearwort (*Ranunculus ambigens*)		T
Spotted Pondweed (*Potamogeton pulcher*)		E
Squashberry or Mooseberry (*Viburnum edule*)		T
Starry Campion (*Silene stellata*)		T
Stiff Gentian (*Gentianella quinquefolia*)		T
Straw Sedge (*Carex straminea*)		E
Sullivant's Milkweed (*Asclepias sullivantii*)		T
Swamp or Black Cottonwood (*Populus heterophylla*)		E
Sweet Cicely (*Osmorhiza depauperata; Osmorhiza obtusa*)		T
Sweet Coltsfoot (*Petasites sagittatus; Petasites frigidus var. sagittatus*)		T
Tall Green Milkweed (*Asclepias hirtella*)		T
Tea-Leaved Willow (*Salix planifolia*)		T
Tennissee Bladder Fern (*Cystopteris tennesseensis*)		T
Three-Awned Grass (*Aristida longespica*)		T
Three-Ribbed Spike Rush (*Eleocharis tricostata*)		T
Three-Square Bulrush (*Schoenoplectus americanus; Scirpus olneyi*)		E
Tinted Spurge (*Euphorbia commutata*)		T
Toadshade (*Trillium sessile*)		T
Twisted Whitlow Grass (*Draba incana*)		T

PLANTS	STATUS	
Species	**Federal**	**State**
Umbrella-Grass (*Fuirena pumila*)		T
Upland Boneset (*Eupatorium sessilifolium*)		T
Vasey's Pondweed (*Potamogeton vaseyi*)		T
Vasey's Rush (*Juncus vaseyi*)		T
Virginia Bluebells (*Mertensia virginica*)		E
Virginia Flax (*Linum virginianum*)		T
Virginia Snakeroot (*Aristolochia serpentaria*)		T
Virginia Water-Horehound (*Lycopus virginicus*)		T
Walking Fern (*Asplenium rhizophyllum; Camptosorus rhizophyllus*)		T
Wall-Rue (*Asplenium ruta-muraria*)		E
Warty Panic Grass (*Panicum verrucosum*)		T
Water Willow (*Justicia americana*)		T
Watermeal (*Wolffia papulifera; Wolffia brasiliensis, Wolffia punctata*)		T
Waterthread Pondweed (*Potamogeton bicupulatus; Potamogeton capillaceus*)		T
Western Dock (*Rumex occidentalis*)		E
Western Moonwort (Botrychium hesperium)		T
Western Mugwort (*Artemisia ludoviciana*)		T
Western Silvery Aster (*Aster sericeus; Symphyotrichum sericeum*)		T
White Gentian (*Gentiana flavida; Gentiana alba*)		E
White Goldenrod (*Solidago bicolor*)		E
White Lady Slipper (*Cypripedium candidum*)		T
Whorled Pogonia (*Isotria verticillata*)		T
Wideflower Phlox (*Phlox ovata; Phlox latifolia*)		E
Widgeon Grass (*Ruppia maritima; Ruppia spiralis*)		T
Wild Hyacinth (*Camassia scilloides*)		T
Wild Lilac (*Ceanothus sanguineus*)		T
Wild Oats (*Chasmanthium latifolium; Uniola latifolia*)		E
Wild Potato Vine or Man-Of-The-Earth (*Ipomoea pandurata*)		T
Wild Rice (*Zizania aquatica var. aquatica*)		T
Wild Sweet William (*Phlox maculata*)		T
Wisteria (*Wisteria frutescens*)		T
Woodland Everlasting (*Gnaphalium sylvaticum; Omalotheca sylvatica*)		T
Woodland Lettuce (*Lactuca floridana*)		T
Yellow Fumewort (*Corydalis flavula*)		T

PLANTS	STATUS	
Species	**Federal**	**State**
Yellow Pitcher Plant (*Sarracenia purpurea f. heterophylla*)		T
Yellow-Flowered Leafcup (*Polymnia uvedalia;Smallanthus uvedalia*)		T

E=Endangered; T=Threatened; PE=Proposed Endangered; PT=Proposed Threatened; C= Candidate