ENVIRONMENTAL ASSESSMENT

An Integrated Wildlife Damage Management Approach
for the Management of Pigeon, Starling, and Sparrow Damage
in the State of Michigan as Conducted by USDA-Wildlife Services

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ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BDM	Bird Damage Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
EEE	Eastern Equine Encephalomyelitis
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MDA	Michigan Department of Agriculture
MDNR	Michigan Department of Natural Resources
MIS	Management Information System
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
OSHA	Occupational Safety and Health Administration
SLE	St. Louis Encephalomyelitis
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TGE	Transmissible Gastroenteritis
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WEE	Western Equine Encephalomyelitis
WS	Wildlife Services

NOTE: On August 1, 1997, the Animal Damage Control program was officially renamed to Wildlife Services. The terms Animal Damage Control, ADC, Wildlife Services, and WS are used synonymously throughout this Environmental Assessment.

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

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 wildlife which increases the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for all wildlife; this protection can create localized conflicts between human and wildlife activities. The *Animal Damage Control Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (USDA) 1997):

> "*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is 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 and damage to property . . . Sensitivity to varying perspectives and value 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*."

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1990). Wildlife Services (WS) (WS was formerly known as Animal Damage Control) uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (ADC Directive 2.105[1]), in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of USDA (1997). These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may also require that local populations be reduced through lethal means.

This environmental assessment (EA) documents the analysis of the potential environmental effects of a proposed feral pigeon (*Columbia livia*), European starling (*Sturnus vulgaris*), and English sparrow (*Passer domesticus)* bird damage management (BDM) program to alleviate damage to agriculture, property, livestock, natural resources and human health and safety. This analysis relies mainly on existing data contained in published documents (Appendix A), including the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997) to which this EA is tiered. The final environmental impact statement (USDA 1997) may be obtained by contacting the USDA, Animal and Plant Health Inspection Service (APHIS), WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS is the Federal agency directed by law and authorized to protect American resources from

[1] WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

damage associated with wildlife (Animal Damage Control Act of March 2, 1931, as amended 46 Stat. 1486; 7 USC. 426-426c and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 USC 426C)), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767). To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources, property, livestock, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Therefore, wildlife damage management is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public.

Normally, according to the APHIS procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, (1995)). WS has decided in this case to prepare 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. All wildlife damage management that would take place in Michigan would be undertaken according to relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA). Notice of the availability of this document will be published in newspapers, consistent with the agency's NEPA procedures.

WS is a cooperatively funded, service-oriented program that receives requests for assistance from private and public entities, including other governmental agencies. Before any wildlife damage management is conducted, Cooperative Agreements, Agreements for Control or other comparable documents are in place. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. WSs' mission, developed through its strategic planning process, is: *1) "To provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety."*

WS's Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- Training of wildlife damage management professionals;
- Development and improvement of strategies to reduce losses and threats to humans

from wildlife;
- Collection, evaluation, and dissemination of management information;
- Informing and educating the public on how to reduce wildlife damage;
- Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1989)

1.1 PROPOSED ACTION

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) proposes to continue the current feral pigeon (*Columbia livia*), European starling (*Sturnus vulgaris*) and English sparrow (*Passer domesticus)* damage management program in the State of Michigan. An Integrated Wildlife Damage Management (IWDM) approach would be implemented to reduce damage activities to property, agricultural and natural resources, livestock, and public health and safety. Damage management would be conducted on private or public property in Michigan when the resource owner (property owner) or manager requests assistance. An IWDM strategy would be recommended and used, encompassing 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 damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, habitat modification or harassment would be recommended and utilized to reduce damage. In other situations, birds would be removed as humanely as possible using: shooting, trapping, and registered pesticides. 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 there could be instances where application of lethal methods alone would be the most appropriate strategy.

1.2 PURPOSE

The purpose of bird damage management in Michigan is primarily directed to the alleviation of bird damage to agricultural resources, damage to urban/suburban landscaping, damage to property, threats to human safety, and concerns about the spread of disease.

Under the Proposed Action, bird damage management could be conducted on private, federal, state, tribal, county, and municipal lands in the State of Michigan upon request for WS assistance.

1.3 BACKGROUND AND NEED FOR ACTION

1.3.1 Threats to Human Health and Safety from Disease Transmission

Feral domestic pigeons, European starlings and English sparrows have been suspected in the transmission of 29 different diseases to humans, (Davis et.al. 1971, Stickely and Weeks 1985, and Weber 1979). These include viral diseases such as meningitis and seven different forms of encephalitis; bacterial diseases such as erysipeloid, salmonellosis, paratyphoid, Pasteurellosis, and Listeriosis; mycotic (fungal) diseases such as aspergillosis, blastomycosis, candidiasis, cryptococcosis, histoplasmosis, and sarcosporidiosis; protozoal diseases such as American trypansomiasis and toxoplasmosis; and rickettsial/chlamydial diseases such as chlamydiosis and Q fever. As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and English sparrows (Weber 1979). Table 1-1 shows the more typical diseases affecting humans that can be transmitted by pigeons, European starlings and English sparrows. In most cases, in which human health concerns are a major reason for requesting BDM, no actual cases of bird transmission of disease to humans have been proven to occur. Thus, it is the risk of disease transmission that is the primary reason for requesting and conducting BDM. Situations in Michigan where the threat of disease associated with feral domestic pigeon, European starling, or English sparrow populations might occur could be:

- Exposure by residents to a European starling roost which has been in a residential area for more than three years
- Disturbance of a large deposit of droppings in an attic where a flock of feral domestic pigeons routinely roosts or nests
- Accumulated droppings from roosting feral domestic pigeons, European starlings, or English sparrows on structures at an industrial site where employees must work in areas of accumulation
- English sparrows or European starlings nesting or loafing around a food court area of a recreational facility or other site where humans eat in close proximity to concentrated numbers of these birds

In Michigan, European starlings form large communal roosts of the kind associated with disease organisms which grow in soils enriched by bird excrement, such as *Histoplasma capsulatum* . Sometimes, such roosts occur in urban environments. Public health officials and residents at such sites express concerns for human health related to the potential for disease transmission where dropping deposits accumulate. WS may receive requests for assistance in resolving problems related to large urban starling roosts in Michigan.

Many times, individuals or property owners that request assistance with feral domestic pigeon or European starling roost problems are concerned about potential disease risks but are unaware of the types of diseases that can be associated with these birds. In most such situations, BDM is requested because the mess associated with droppings left by concentrations of birds is aesthetically displeasing and can result in continual clean-up costs. Under the proposed action, WS could agree to assist in resolving these types of problems.

Table 1-1. Information On Some Diseases Transmissible To Humans And Livestock That

Are Associated With Feral Domestic Pigeons, European Starlings, And English Sparrows. Information Taken From Weber (1979)

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
Bacterial:			
Erysipeloid	skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	sometimes - particularly to young children, old or infirm people	serious hazard for the swine industry
Salmonellosis	gastroenteritis, septicaemia, persistent infection	possible, especially in individuals weakened by other disease or old age	causes abortions in mature cattle, possible mortality in calves, decrease in milk production in dairy cattle
Pasteurellosis	respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	rarely	may fatally affect chickens, turkeys and other fowl
Listeriosis	conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	sometimes - particularly with newborns	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles
Viral:			
Meningitis	inflammation of membranes covering the brain, dizziness, and nervous movements	possible — can also result as a secondary infection with listeriosis, salmonellosis, cryptococcosis	causes middle ear infection in swine, dogs, and cats
Encephalitis (7 forms)	headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	mortality rate for eastern equine encephalomyelitis may be around 60%	may cause mental retardation, convulsions and paralysis
Mycotic (fungal):			

Aspergillosis	affects lungs and broken skin, toxins poison blood, nerves, and body cells	Not usually	causes abortions in cattle
Blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	rarely	affects horses, dogs and cats
Candidiasis	infection of skin, fingernails, mouth, respiratory system, intestines, and urogenital tract	Rarely	causes mastitis, diarrhea, vaginal discharge and aborted fetuses in cattle
Cryptococcosis	lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	possible especially with meningitis	chronic mastitis in cattle, decreased milk flow and appetite loss
Histoplasmosis	pulmonary or respiratory disease. May affect vision	possible, especially in infants and young children or if disease disseminates to the blood and bone marrow	actively grows and multiplies in soil and remains active long after birds have departed
Protozoal:			
American trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
Toxoplasmosis	inflammation of the retina, headaches, fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness	possible	may cause abortion or still birth in humans, mental retardation
Rickettsial /Chlamydial:			
Chlamydiosis	pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe	occasionally, restricted to old, weak or those with concurrent diseases	in cattle, may result in abortion, arthritis, conjunctivitis, and enteritis

	headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate		
Q fever	sudden pneumonitis, chills, fever, weakness, severe sweating, chest pain, severe headaches and sore eyes	possible	may cause abortions in sheep and goats

1.3.2 Threats to Aviation

The risk that birds pose to aircraft is well documented with the worst case reported in Boston in 1960 when 62 people were killed in the crash of an airliner which collided with a flock of European starlings (Terres 1980). Other examples include:

- In fiscal year (FY) 1996, Canada geese were struck by an Air Force AWACS plane in Elmendorf Alaska, causing the death of 24 airmen when the plane crashed. In addition a $190 million plane was lost (Dolbeer 1997).

- In 1999 when a Boeing 757 struck a flock of European starlings at the Cincinnati/ Northern Kentucky International Airport and was forced to abort the flight (NTSB 1999). Damages were assessed at more than $500,000 by airport officials (D.T. Little, WS Pers. Comm. 1999).

European starlings and blackbirds, when in large flocks or flight lines entering or exiting winter roost at or near airports, present a safety threat to aviation. Starlings and blackbirds are particularly dangerous birds to aircraft during take-offs and landings because of their high body density and tendency to travel in large flocks of hundreds to thousands of birds (Seamans et al. 1995).

Generally, bird collisions occur when aircraft are near the ground. More than 45% of bird/aircraft collisions occur within 100 feet of the ground and more than 75% occur within 1,500 feet of the ground (Cleary et al. 1998). From 1990-1999 birds were involved with over 97% of the reported wildlife strikes to civil aircraft in the USA (Cleary et al. 2000). Of the birds species identified as wildlife strikes, pigeons, starlings and sparrows, accounted for 4%, 5% and 7%, respectively (Cleary et al. 2000). From 1997-2002 over 788 bird strikes were reported to the FAA in Michigan, of these only about 56%of the strikes were positively identified. These included 7 pigeon strikes, 55 sparrow, and 56 European starlings (FAA Wildlife Strike Database

2003). This number is likely to be much greater since an estimated 80% of civil bird strikes go unreported (Cleary et al. 2000).

WS receives requests annually for assistance regarding bird damage management at airports in Michigan. These requests are considered serious because of the potential for loss of human life and because damage to aircraft can be extremely expensive. WS could provide operational BDM at the request of any aviation facility in the State.

1.3.3 Threats to Livestock Health and Safety from Disease Transmission

European starlings, English sparrows, and, to a lesser extent, feral domestic pigeons often cause damage at cattle feeding facilities and dairies by congregating in large numbers to feed on the grain component of cattle feed. Such feeding strategies present disease threats to livestock at such sites. The birds also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and which generally is considered an unsightly nuisance and potential health hazard for the feedlot/dairy operators and their personnel.

Scope of Livestock Feed Losses. The problem of starling damage to livestock feed has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968). The concentration of larger numbers of cattle eating huge quantities of feed in confined pens results in a tremendous attraction to European starlings, English sparrows, and feral domestic pigeons. Diet rations for cattle contain all of the nutrients and fiber that cattle need, and are so thoroughly mixed that cattle are unable to select any single component over others. The basic constituent of most rations is silage and the high energy portion is usually provided as corn or barley, which may be incorporated as whole grain, crushed, or ground cereal. While cattle cannot select individual ingredients from that ration, European starlings can and do select the high energy portions, thereby altering the energetic value of the complete diet. The removal of this high energy fraction by European starlings, is believed to reduce milk yields, weight gains, and is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, and freezing temperatures and the number of livestock on feed.

The economic significance of feed losses to European starlings has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 birds in 1967. Forbes (1995) reported European starlings consume up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems of which 6.3% experienced considerable economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily brown-headed cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000.

Scope of Livestock Health Problems. A number of diseases that affect livestock have been

associated with feral domestic pigeons, European starlings, and English sparrows (Weber 1979). Transmission of diseases such as Transmissible Gastroenteritis Virus (TGE), Tuberculosis (TB), and Coccidiosis to livestock has been linked to migratory flocks of European starlings. Estimates of the dollar value of this type of damage are not available. A consulting veterinarian for a large cattle feeding facility in Texas indicated problems associated with coccidiosis declined following reduction of starling numbers using the facility (R. Smith, WS, Canyon District, TX, pers. comm.).

Table 1-2 summarizes some diseases associated with European starlings, feral domestic pigeons, and English sparrows. The table also summarizes types of livestock affected, typical symptoms and comments regarding implications for the listed diseases.

Table 1-2. Some Diseases Of Livestock That Have Been Linked To Feral Domestic Pigeons, European Starlings, And/Or English Sparrows. Information From Weber (1979).

Disease	Livestock affected	Symptoms	Comments
Bacterial:			
Erysipeloid	cattle, swine, horses, sheep, goats, chickens, turkeys, ducks	Pigs - arthritis, skin lesions, necrosis, septicemia Sheep - lameness	serious hazard for the swine industry, rejection of swine meat at slaughter due to speticemia, also affects dogs
Salmonellosis	all domestic animals	abortions in mature cattle, mortality in calves, decrease in milk production in dairy cattle Colitis in pigs,	over 1700 serotypes
Pasteurellosis	cattle, swine, horses, rabbits, chickens, turkeys	Chickens and turkeys die suddenly without illness pneumonia, bovine mastitis, abortions in swine, septicemia, abscesses	also affects cats and dogs
Avian tuberculosis	chickens, turkeys, swine, cattle, horses, sheep	Emaciation, decrease in egg production, and death in poultry. Mastitis in cattle	also affects dogs and cats
Streptococcosis	cattle, swine, sheep, horses, chickens, turkeys, geese,	Emaciation and death in poultry. Mastitis in cattle, abscesses and	feral pigeons are susceptible and aid in

	ducks, rabbits	inflamation of the heart , and death in swine	transmission
Yersinosis	cattle, sheep, goats, horses, turkeys, chickens, ducks	abortion in sheep and cattle	also affects dogs and cats
Vibriosis	cattle and sheep	In cattle, often a cause of infertility or early embryonic death. In sheep, the only known cause of infectious abortion in late pregnancy	of great economic importance
Listeriosis	Chickens, ducks, geese, cattle, horses, swine, sheep, goats	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles	also affects cats and dogs
Viral:			
Meningitis	cattle, sheep, swine, poultry	inflamation of the brain, newborn calves unable to suckle	associated with listeriosis, salmonellosis, cryptococcosis
encephalitis (7 forms)	horses, turkeys, ducks	drowsiness, inflamation of the brain	mosquitos serve as vectors
Mycotic (fungal):			
Aspergillosis	cattle, chickens, turkeys, and ducks	abortions in cattle	common in turkey poults
Blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	Rarely	affects horses, dogs and cats
Candidiasis	cattle, swine, sheep, horses, chickens, turkeys	In cattle, mastitis, diarrhea, vaginal discharge, and aborted fetuses	causes unsatisfactory growth in chickens
Cryptococcosis	cattle, swine, horses	chronic mastitis in cattle, decreased milk flow and appetite loss	also affects dogs and cats
Histoplasmosis	horses cattle and swine	(in dogs) chronic cough, loss of appetite,	also affects dogs; actively grows and

		weakness, depression, diarrhea, extreme weight loss	multiplies in soil and remains active long after birds have departed
Coccidiosis	poultry, cattle, and sheep	bloody diarrhea in chickens, dehydration, retardation of growth	almost always present in English sparrows; also found in pigeons and European starlings
Protozoal:			
American trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
Toxoplasmosis	cattle, swine, horses, sheep, chickens, turkeys	In cattle, muscular tremors, coughing, sneezing, nasal discharge, frothing at the mouth, prostration and abortion	also affects dogs and cats
Rickettsial/Chlamydial:			
Chlamydiosis	cattle, horses, swine, sheep, goats, chickens, turkeys, ducks, geese	In cattle, abortion, arthritis, conjunctivitis, enteritis	also affects dags and cats and many wild birds and mammals
Q fever	affects cattle, sheep, goats, and poultry	may cause abortions in sheep and goats	can be transmitted by infected ticks

1.3.4 Bird Damage to Agricultural Crops

Several studies have shown that European starlings can pose a great economic threat to agricultural producers (Besser et. al. 1968, Dolbeer et.al. 1978, and Feare 1984). Bird damage to crops has been identified as a problem in Michigan particularly with cherry and blueberry crops.

1.3.5 Bird Damage to Property

Birds frequently damage structures on private property, or public facilities, with fecal contamination. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on automobiles, can occur because of uric acid from bird droppings. Electrical utility companies frequently have problems with birds causing power outages by shorting out transformers and substations. Persons and businesses concerned about these types of damage may request WS assistance.

Pigeons, starlings, and sparrows cause economic damage to aircraft in hangars. Accumulation of fecal droppings on planes, helicopters, maintenance equipment, and hangar floors result in unscheduled maintenance to clean planes and buildings to protect painted surfaces from acidic fecal droppings and maintain a sanitary work environment. Furthermore, birds may build nests in engines of idle aircraft which may cause engine damage or cause a fire.

1.3.6 Threats to Other Wildlife Including T&E Species

Some bird species including those listed as threatened or endangered under the Endangered Species Act of 1973 are preyed upon or otherwise adversely affected by certain bird species. Interspecific nest competition has been well documented in European starlings. Miller (1975) and Barnes (1991) reported European starlings were responsible for a severe depletion of the eastern bluebird (*Sialis sialis*) population due to nest competition. Nest competition by European starlings has also been known to adversely impact American kestrels (sparrow hawks) (Von Jarchow 1943, Nickell 1967, and Wilmer 1987), red-bellied woodpeckers (*Centurus carolinus*), Gila woodpeckers (Centurus uropygial is) (Kerpez et.al. 1990 and Ingold 1994), and wood ducks (*Aix sponsa*) (Shake 1967, McGilvery et.al 1971, Heusmann et.al. 1977, and Grabill 1977). Weitzel (1988) reported nine native species of birds in Nevada had been displaced by starling nest competition, and Mason et al. (1972) reported European starlings evicting bats from nest holes.

1.4 ACTIVITIES BY WS TO ALLEVIATE BIRD DAMAGE IN MICHIGAN

Wildlife Services in Michigan has been involved in a number of activities to help reduce the negative impacts of overabundant bird populations. Some examples include:

- Since 1997, WS-MI has assisted MI dairy farmers with controlling starling damage during the winter months. Starlings are known to consume and contaminate feed thus resulting in a decline in milk production. DRC-1339 has been used by WS personnel to reduce local starling populations on 278 farms.

- In 1997, WS entered into a cooperative agreement with [redacted] to reduce pigeon damage at their facility in Grand Rapids and Saginaw. Air rifles have been used to effectively reduce the local population of pigeons, European starlings, and sparrows.

- In 1992, WS entered into a cooperative agreement with the city of Cadillac to reduce pigeon damage in the immediate downtown area. Air rifles and DRC-1339 have been used to reduce the local pigeon population.

- In 1999, WS entered into a cooperative agreement with the city of Reading to reduce pigeon damage in the immediate downtown area. Air rifles were used to successfully reduce the local pigeon population.

- In 2001, WS entered into a cooperative agreement with Detroit Metropolitan Airport to reduce starling hazards to aviation. Distress call tapes, pyrotechnics, and netting on trees were all used to reduce starling numbers.

1.5 NEED FOR BIRD DAMAGE MANAGEMENT IN MICHIGAN

WS maintains a Management Information System (MIS) database to document assistance that the agency provides in addressing wildlife damage conflicts. MIS data is limited to information that is collected from people who have requested services or information from Wildlife Services. It does not include requests received or responded to by local, State or other Federal agencies, and it is not a complete database for all wildlife damage occurrences. The number of requests for assistance does not necessarily reflect the extent of need for action, but this data does provide an indication that needs exists. The database includes, but not limited to, the following information: species of wildlife involved, the number of individuals involved in a damage situation; tools and methods used or recommended to alleviate the conflict; and the resource that is in need of protection.

Conflicts between humans and wildlife are common in Michigan. The Michigan WS Program received 357 requests for bird damage management assistance from the public between FY97 and FY02. WS received 207 requests for pigeon damage assistance, 135 requests for starling damage assistance, and 15 requests for sparrow damage assistance from the public during this period.

The need for action in Michigan is based on the necessity for a program to protect agricultural and natural resources, livestock, property, and human health and safety from pigeon, starling, and sparrow damage. Pigeon, starling, and sparrow populations can have a negative economic impact in Michigan. Comprehensive surveys of pigeon, starling, and sparrow damage in Michigan have not been conducted. However, Michigan WS compiled estimates of the types of damage perceived by property and resource owners or managers who requested WS assistance, and public health and safety risks. Damage data obtained for FY97 through FY02 are summarized (Tables 1-3). These data represent only a portion of the total damage caused by pigeons, starlings, and sparrows because not all people who experience damage request assistance from WS.

Table 1-3. Number of Damage Reports Received by Wildlife Services for Pigeons, Starlings, and Sparrows (MIS 1997, 1998, 1999, 2000, 2001, 2002)**.**

FY	Species	Agriculture[1]	Natural Resources	Property	Public Health/Safety
97	Pigeons	0	1	28	0
	Starlings	0	0	1	0

	Sparrows	0	0	1	0
98	Pigeons	0	0	24	4
	Starlings	0	0	0	1
	Sparrows	0	0	2	0
99	Pigeons	0	0	17	7
	Starlings	0	0	0	0
	Sparrows	0	0	0	0
00	Pigeons	0	0	6	1
	Starlings	0	0	2	1
	Sparrows	1	0	1	0
01	Pigeons	3	0	3	3
	Starlings	14	0	2	2
	Sparrows	0	0	1	0
02	Pigeons	5	0	23	7
	Starlings	98	0	11	1
	Sparrows	1	0	2	0

1.6 WILDLIFE SERVICES OBJECTIVES

- Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Michigan WS personnel, applying the ADC Decision Model (Slate et al. 1992)
- Hold the lethal take of non-target animals by WS personnel during damage management to less than 5% of the total animals taken.

1.7 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

1.2.1 ADC Programmatic Environmental Impact Statement. WS has issued a Final EIS on the national APHIS/WS program (USDA 1997). Pertinent and current information available in the EIS has been incorporated by reference into this EA.

1.8 DECISION TO BE MADE

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

- Should WS implement a IWDM strategy, including non-lethal and lethal methods, to meet the need for bird damage management in Michigan?
- If not, should WS attempt to implement one of the alternatives to an IWDM strategy as described in the EA?
- Would the proposed action have significant impacts on the quality of the human environment, requiring preparation of an EIS?

1.9 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

Actions Analyzed. This EA evaluates bird damage management by WS to protect: 1) property, 2) agricultural and natural resources, 3) livestock and dairies, and 4) public health and safety in Michigan. Protection of other resources or other program activities would be addressed in other NEPA analysis, as appropriate.

American Indian Lands and Tribes. Currently, Michigan WS does not have any MOUs with any American Indian tribe. If WS enters into an agreement with a tribe for BDM, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA. MOUs, agreements and NEPA compliance would be conducted as appropriate before conducting BDM on tribal lands.

Period for which this EA is Valid. This EA would remain valid until Michigan WS 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. Review of the EA would be conducted each year to ensure that the EA is sufficient.

Site Specificity. This EA analyzes the potential impacts of BDM and addresses activities on all lands in Michigan under MOU, Cooperative Agreement and in cooperation with the appropriate public land management agencies. It also addresses the impacts of BDM on areas where additional agreements may be signed in the future. Because the proposed 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 BDM efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of bird damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will 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, insurance companies, etc. Although some of the sites where bird damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever bird damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Michigan (see Chapter 3 for a description of the Decision Model and its application).

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within the analysis area. In this way, APHIS-WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission.

Summary of Public Involvement. Issues related to the proposed action were initially developed by WS. Issues were defined and preliminary alternatives were identified. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified.

New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.10 AUTHORITY AND COMPLIANCE

1.10.1. Wildlife Services Legislative Authority

The USDA is directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Animal Damage Control Act of 1931 amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767), which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date*

of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."

Since 1931, with the changes in societal values, WS policies and its programs place greater emphasis on the part of the Act discussing "bringing (damage) under control", rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative directive and authority of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"*That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammals and birds species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.10.2 Authority of State Wildlife Agencies in Michigan

The Michigan Department of Natural Resources authority in wildlife management is given under Article I, Part 5, Regulation 324.503 of Public Act 451 of 1994. This section states in part;

The department shall protect and conserve the natural resources of this state; provide and develop facilities for outdoor recreation; prevent the destruction of timber and other forest growth by fire or otherwise; promote the reforesting of forest lands belonging to the state; prevent and guard against the pollution of lakes and streams within the state and enforce all laws provided for that purpose with all authority granted by law; and foster and encourage the protecting and propagation of game and fish.

10.1.3 U.S. Fish and Wildlife Service (USFWS)

The U.S. Fish and Wildlife Service's (USFWS) authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

CFR 50 Subchapter C - The National Wildlife Refuge System - Part 30 - Feral Animals - Subpart B-30.11 - Control of feral animals states: (a) Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized federal or state personnel or by private persons

operating under permit in accordance with applicable provisions of federal or state law or regulation.

10.1.4 Michigan Department of Agriculture (MDA)

The Pesticide and Plant Pest Management Division of MDA is responsible for the implementation of programs and enforcement of laws concerning agricultural products, export commodities, pesticide sale and use, pest management and groundwater protection. Under the Michigan Pesticide Control Act, the division regulates pesticide control measures and the regulation that pertains to pesticide applicators.

10.1.5 Compliance with Federal and State Statutes

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

National Environmental Policy Act. Environmental documents pursuant to NEPA must be completed before operational activities consistent with the NEPA decision can be implemented. This EA meets the NEPA requirement for the proposed action in Michigan. When WS direct management assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency. However, WS could agree to complete NEPA documentation at the request of the other federal agency. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern.

Endangered Species Act. 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 United States Fish and Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency. . . is not likely to jeopardize the continued existence of any endangered or threatened species. . . each agency shall use the best scientific and commercial data available" (Sec. 7(a)(2)). WS obtained a Biological Opinion (B.O.) from the U.S. Fish and Wildlife Service describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 40 Stat. 755), as Amended . The Migratory Bird Treaty Act (MBTA) provides the USFWS regulatory authority to protect families of birds that contain species which migrate outside the United States. The law prohibits any "*take*" of these species by any entities, except as permitted by the USFWS; therefore, the USFWS issues permits to requesters for reducing bird damage.

European starlings, feral domestic pigeons, and English sparrows are not classified as protected migratory birds and therefore have no protection under this Act. (50 CFR 21.43).

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

Investigational New Animal Drug (INAD). The drug alpha-chloralose (AC) has been used as a sedative for animals and is registered with the Food and Drug Administration (FDA) to capture waterfowl, coots, and pigeons. FDA approval for use under INAD (21 CFR, Part 511) authorized WS to use the drug as a non-lethal form of capture.

Executive Order 13112 of February 3, 1999. This Order prevents the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that invasive species cause. Pigeons, starlings, and English sparrows are recognized as invasive species that have adverse economic, ecological, and human health impacts.

Executive Order 13186 of January 10, 2001 "Responsibilities of Federal Agencies to Protect Migratory Birds." This Order states that each federal agency, taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Order and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

Occupational Safety and Health Act of 1970. The Occupational Safety and Health Act of 1970 and its implementing regulations (29CFR1910) 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 birds 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 require 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 National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. Bird damage management could benefit historic properties if such properties were being damaged by starling, pigeons or sparrows. In those cases, the officials responsible for management of such properties would make the request and would select the methods to be used in their bird damage management program. Harassment techniques that involve noise making could conceivably disturb users of historic properties if they were used at or in close proximity to such properties; however, it would be an exceedingly rare event for noise producing devices to be used in close proximity to such a property unless the resource being protected from bird damage was the property itself, in which case the primary effect would be beneficial. Also, the use of such devices is generally short term and could be discontinued if any conflicts with historic properties arose. WS has determined BDM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties.

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, the Michigan Department of Agriculture, 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 (USDA 1997, Appendix P). 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 bird 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. 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. BDM as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action would not increase environmental health or safety risks to children.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

Chapter 2 contains a discussion of the issues, including issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues used to develop mitigation measures and SOPs, and issues not considered in detail, with the rationale. Pertinent portions of the affected environment are included in this chapter and in the discussion of issues used to develop mitigation measures. Additional affected environments are incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the proposed program in Chapter 3.

2.1 AFFECTED ENVIRONMENT

The areas of the proposed action could include areas in and around buildings and parks, bridges, industrial sites, urban/suburban woodlots, on ship fleets, or at any other sites where birds may roost, loaf, or nest. Damage management activities could be conducted at agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, grain mills, and grain handling areas (e.g. railroad yards) where birds destroy crops, feed on spilled grains, or

contaminate food products for human or livestock consumption. Additionally, the area of the proposed action could include airports and surrounding property where birds represent a threat to aviation safety.

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 bird species
- Effects on other wildlife species, including T&E species
- Effects on public health and safety
- Impacts to stakeholders, including aesthetics
- Humaneness and animal welfare concerns of methods used

2.2.1 Effects on Target Bird Species

A common concern among members of the public is whether wildlife damage management actions adversely affect the viability of target species populations. The target species selected for analysis in this EA are feral pigeon (*Columbia livia*), European starling (*Sturnus vulgaris*), and English sparrow (*Passer domesticus)*.

Impacts of West Nile virus on bird populations

West Nile (WN) virus has emerged in recent years in temperate regions of North America, with the first appearance of the virus in North America occurring in New York City in 1999 (MMWR 2002, Rappole et al. 2000). Since 1999 the virus has spread across the United States and was reported to occur in 44 states and the District of Columbia in 2002 (MMWR 2002). West Nile virus is typically transmitted between birds and mosquitoes. Mammals can become infected if bitten by an infected mosquito, but individuals in most species of mammals do not become ill from the virus. The most serious manifestation of the WN virus is fatal encephalitis in humans, horses, and birds. West Nile virus has been detected in dead bird species of at least 138 species (CDC 2003). Although birds infected with WN virus can die or become ill, most infected birds do survive and may subsequently develop immunity to the virus (CDC 2003, Cornell University 2003). In some bird species, particularly Corvids (crows, blue jays, ravens, magpies), the virus causes disease (often fatal) in a large percentage of infected birds (Audubon 2003, CDC 2003, Cornell University 2003, MMWR 2002). In 2002, WN virus surveillance/monitoring programs revealed that Corvids accounted for 90% of the dead birds reported with crows representing the highest rate of infection (MMWR 2002). Large birds that live and die near humans (i.e. crows) have a greater likelihood of being discovered, therefore the reporting rates tend to be higher for these bird species and are a "good indicator" species for the presence of WV virus in a specific area (Cornell University 2003, Audubon 2003). According to US Geological Survey (USGS), National Wildlife Health Center (2003), information is not currently available to know whether

or not WN virus is having an impact on bird populations in North America. USGS states that it is not unusual for a new disease to cause high rates of infection or death because birds do not have the natural immunity to the infection. Furthermore, it is not known how long it will take for specific bird population to develop sufficient immunity to the virus. Surveys of wild birds completed in the last three years have shown that some birds have already acquired antibodies to the virus (USGS-WHC 2003). Based upon available Christmas Bird Counts and Breeding Bird Surveys, USGS-WHC (2003) states that there have been declines in observations of many local bird populations, however they do not know if the decline can be attributed to WN virus or to some other cause. A review of available crow population data by Audubon (2003) reveals that at least some local crow populations are suffering high WN virus related mortality, but crow numbers do not appear to be declining drastically across broad geographic areas. USGS does not anticipate that the commonly seen species, such as crows and blue jays, will be adversely affected by the virus to the point that these bird species will disappear from the U.S. (USGS-WHC 2003).

2.2.2 Effects on Other Wildlife Species, Including T&E Species.

A common concern among members of the public and wildlife professionals, including WS personnel, is whether the proposed action or any of the alternatives might result in adverse impacts to populations of other wildlife, particularly T&E species. WS's mitigation measures and SOPs are designed to reduce the effects on non-target species' populations and are presented in Chapter 3. To reduce the risks of adverse affects to non-target species, WS would select damage management methods that are target-selective or apply such methods in ways to reduce the likelihood of capturing or killing non-target species.

Special efforts are made to avoid jeopardizing Threatened and Endangered Species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential effects of BDM methods on T&E species and has obtained a Biological Opinion (B.O.). For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997). WS is also in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed. Formal risk assessment (USDA 1997, Appendix P) has also shown that there are no probable risks to T&E species in Michigan from bird damage control methods. The USFWS and the State of Michigan lists of T&E species were reviewed to identify potential effects on federal and state T&E species in Michigan. These lists are included in Appendices C & D.

Some members of the public are concerned that the use of registered toxicants to reduce bird damage would have adverse impacts on other wildlife species, including T&E species. Under the alternatives proposed in this EA, the primary toxicant proposed for use by WS is DRC-1339 (WS may also recommend the use of Starlicide®, a similar product), which would be used to remove feral domestic pigeons and European starlings in damage situations. DRC-1339 and Starlicide® use are regulated by the EPA through FIFRA, by Michigan State Pesticide Control

Laws, and by WS Directives. Another chemical method that could be used is Avitrol. Avitrol is classified as an avian distressing agent and is normally used to deter target bird species from using certain problem areas. Other chemicals available for use include the tranquilizer Alpha-chloralose (for live-capturing pigeons) anthraquinone (Flight Control®), and methyl and di-methyl anthranilate (artificial grape flavoring, which also has bird repellent capabilities). See Appendix B for detailed description of these chemicals and their potential effects.

2.2.2 Effects on Public Health and Safety.

A common concern is whether the proposed action or any of the alternatives pose an increased threat to public health and safety. In particular, there is concern that the lethal methods of bird removal (i.e., pesticide application and shooting) may be hazardous to people and pets, or that continued increases in bird populations might threaten public health or safety. Formal risk assessment (USDA 1997, Appendix P) has shown that there are no probable risks to public health and safety in Michigan from bird damage control methods.

Safety and efficacy of chemical control methods.

Some individuals may have concerns that chemicals used for bird control should not be used because of potential adverse effects on people from being exposed to the chemicals directly or to the birds that have died as a result of the chemical use. The use of registered chemical toxicants and repellants for bird damage management poses no risk to public health and safety. WS personnel who apply pesticides are certified restricted use pesticide applicators and apply pesticides according to label instructions. Certification is obtained after passing written tests administered by the MDA. See Appendix B for a detailed description of these chemicals and their potential effects.

Impacts on human safety of non-chemical BDM methods

Some people may be concerned that WS's use of firearms, traps, and pyrotechnic scaring devices could cause injuries to people. WS personnel occasionally use traps, rifles, and shotguns to remove birds that are causing damage. There is some potential fire hazard to agricultural sites and private property from pyrotechnic use.

Firearm use is a very sensitive public concern because of safety relating to the public and the threat of misuse. 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 every 2 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Impacts on human health and safety from birds

The concern stated here is that the absence of adequate BDM would result in adverse effects on human health and safety, because bird 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.

2.2.3 Impacts to Stakeholders, Including Aesthetics.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. 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. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

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 stability of 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 up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). 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 caused by birds insist upon their removal from the property or public location when they cause damage. Some people have an idealistic view and believe that all wildlife should be captured and relocated to

another area to alleviate damage or threats to public health or safety. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to bird damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. Some people would strongly oppose removal of birds regardless of the amount of damage. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Michigan WS only conducts wildlife damage management at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for bird damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.4 Humaneness and Animal Welfare Concerns of Methods Used.

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but 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.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would *"... probably be causes for pain in other animals ..."* (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (CDFG 1991).

Pain and suffering, as it relates to WS damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *"... neither medical or veterinary curricula explicitly address suffering or its relief"* (CDFG 1991).

Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on

an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

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 BDM methods are used in situations where nonlethal damage management methods are not practical or effective.

Michigan WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures/SOPs used to maximize humaneness are listed in Chapter 4.

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.

Funding for WS comes from a variety of sources in addition to federal appropriations. Michigan agency funds, county funds, city funds, private funds, and other federal agency funds are applied to the program under Cooperative Agreements. 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, since aspects of wildlife damage management are a government responsibility and authorized and directed by law.

2.3.2 Bird Damage Should be Managed by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce bird 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. Additionally, use of the pesticide DRC-1339 may be the most effective damage management method in some situations, either used alone or as part of an IWDM program. This avicide is registered only for use by WS and is not available to private nuisance wildlife control agents or property owners. However, the restricted use pesticide, Starlicide®, is similar to DRC-1339 and may be used by certified applicators.

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

Some individuals might question whether preparing an EA for an area as large as the State of Michigan would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire State may provide a better analysis than multiple EA's covering smaller zones. In addition, Michigan WS only conducts bird damage management in a very small area of the State where damage is occurring or likely to occur.

CHAPTER 3: ALTERNATIVES

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected, and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the Council on Environmental Quality's (CEQ's) definition (CEQ 1981).

The four alternatives analyzed in detail are:

- Alternative 1 - Integrated Bird Damage Management Program. This is the "Proposed Action" and "No Action" alternative.
- Alternative 2 – Non-lethal Bird Damage Management Only By WS
- Alternative 3 - Technical Assistance Only. Under this alternative, WS would not conduct any direct operational BDM activities in Michigan. If requested, affected requesters would be provided with technical assistance information only.
- Alternative 4 - No Federal WS Bird Damage Management. This alternative consists of no Federal BDM program by WS.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

The proposed action is to continue the current feral pigeon (*Columbia livia*), European starling (*Sturnus vulgaris*), and English sparrow (*Passer domesticus)* damage management program in the State of Michigan. An Integrated Wildlife Damage Management (IWDM) approach would be implemented to reduce damage activities to property, agricultural and natural resources, livestock, and public health and safety. Damage management would be conducted on private and public property in Michigan when the resource owner (property owner) or manager requests assistance. An IWDM strategy would be recommended and used, encompassing 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 damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, habitat modification or harassment would be recommended and utilized to reduce damage. In other situations, birds would be removed as humanely as possible using shooting, trapping, and registered pesticides. 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 there could be instances where application of lethal methods alone would be the most appropriate strategy. Appendix B provides a more detailed description of the methods that could be used under the proposed action.

3.1.2 Alternative 2 – Non-lethal Bird Damage Management Only By WS

This alternative would require WS to use non-lethal methods only to resolve bird damage problems. Requests for information regarding lethal management approaches would be referred to MDNR, USFWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS non-lethal recommendations, implement lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, or take no action. Persons receiving WS' non-lethal technical and direct control assistance could still resort to lethal methods that were available to them. Currently, DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these chemicals by private individuals would be illegal. However, the restricted use pesticide, Starlicide®, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators. Appendix B describes a number of non-lethal methods available for use by WS under this alternative.

3.1.3 Alternative 3 - Technical Assistance Only

This alternative would not allow for WS operational BDM in Michigan. WS would only provide technical assistance and make recommendations when requested. Producers, property owners, agency personnel, or others could conduct BDM using any lethal or non-lethal method that is legal. Currently, DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these two chemicals by private individuals would be illegal. However, the restricted use pesticide, Starlicide®, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators. Appendix B describes a number of methods that could be employed by private individuals or other agencies after receiving technical assistance advice under this alternative.

3.1.4 Alternative 4 - No Federal WS Bird Damage Management

This alternative would eliminate Federal involvement in BDM in Michigan. WS would not provide direct operational or technical assistance and requesters of WS services would have to conduct their own BDM without WS input. Information on BDM methods would still be available to producers and property owners through other sources such as USDA Agricultural Extension Service offices, universities, or pest control organizations. Requests for information regarding lethal management approaches would be referred to MDNR, USFWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement BDM temselves, use contractual services of private businesses, or take no action. DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these chemicals by private individuals would be illegal. However, the restricted use pesticide, Starlicide®, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators.

3.2 BDM STRATEGIES AND METHODOLOGIES AVAILABLE TO WS IN MICHIGAN

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2 and 3 described above. Alternative 4 would terminate both WS technical assistance and operational BDM by WS. Appendix B 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 a cost-effective[2] 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, or any combination of these, depending on the circumstances of the specific damage problem.

3.2.2 The IWDM Strategies That WS Employs

3.2.2.1 Technical Assistance Recommendations

2 The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. 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 non-WS entities to use. Technical assistance may be provided through a personal or telephone consultation or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application.

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 bird damage problems.

3.2.2.2 Direct Damage Management Assistance (Direct Control)

Direct damage management assistance is 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 *Agreements for Control* or other comparable instruments are provided for direct damage management by WS. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. 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.

3.2.2.3 Educational Efforts

Education is an important element of WS program activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to producers, homeowners, state and county agents, 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, laws and regulations, and agency policies.

3.2.2.4 Research and Development

The National Wildlife Research Center (NWRC) 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. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC research was instrumental in the development of Methyl Anthranilate. In addition, NWRC is currently testing new experimental drugs that inhibit bird reproduction. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

3.2.2.5 Examples of WS Direct Operational and Technical Assistance in BDM in Michigan

Management of Hazards to Aircraft and Air Passengers in Michigan

WS participates with the Federal Aviation Administration, under a MOU, to provide BDM information or services, to airports in Michigan. Upon request, WS evaluates wildlife hazards at airports and provides Wildlife Hazard Assessments outlining the wildlife hazards found. These assessments assist airports in developing Wildlife Hazard Management Plans to address specific wildlife hazards and threats using an IWDM approach to resolving wildlife conflicts. WS also assists airports in obtaining USFWS depredation permits by providing recommendations to the USFWS for purpose of managing hazards and threats posed by migratory birds.

Currently, WS utilizes seven full-time employees to conduct IWDM programs and to monitor wildlife hazards at airports in Michigan. WS direct operational activities consist of various harassment, live capture with translocation, and lethal removal techniques to insure the protection of human lives, aircraft and property. WS personnel provide ongoing technical advice to airport managers about how to reduce the presence of wildlife in airport environs, which may include technical advice and information on habitat modifications. In an effort to reduce bird strike hazards at airport facilities, WS promotes improved bird strike record keeping and maintains a program of bird identification and monitoring of bird numbers at participating airports.

WS may receive requests for assistance in resolving wildlife hazards to aviation in the future from airports previously discussed, or any other airports in Michigan. WS may provide technical assistance and /or direct operational assistance using any combination of approved methods discussed in this EA, which are appropriate for use in airport environments.

Feral Domestic Pigeon Problems

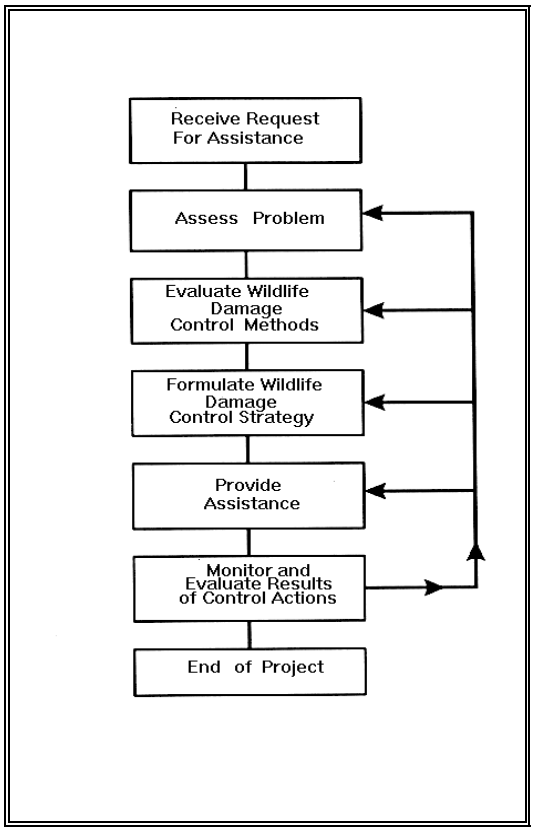
Feral domestic pigeons are responsible for the majority of nuisance bird damage and human health and safety requests for assistance in Michigan. The most common situation with this species involves pigeons roosting and nesting on buildings and structures. The main problem is from the birds' droppings, which cause concerns for diseases, create an unsightly mess, and result in high clean-up costs. These problems are frequently addressed by recommending exclusion devices/barriers (such as netting, hardware cloth, screen, porcupine wire) or habitat

modification and local population reduction. Methods that could be used or recommended for population reduction include shooting with pellet rifles, low-velocity .22 caliber rifle rounds (that shoot bullets at about the same velocity as a pellet rifle), shotguns (mostly in rural or semi-rural situations), live capture with cage traps followed by euthanasia, DRC-1339 baiting, or Avitrol.

WS has been requested in the past to manage damage caused by feral domestic pigeons through direct operational projects. These projects have included activities to reduce local pigeon numbers in or at several cities and facilities around the State. WS expects to receive future requests from entities presently or previously assisted, as well as other entities across the State. WS could respond with technical assistance, direct operational assistance, or a combination of both in any situation in the State.

3.2.3 WS Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints that are depicted by the WS Decision Model described by Slate et al., in 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 for acceptably reducing damage. WS personnel assess the problem; 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, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. 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 documenting process, but a mental problem-solving process common to most if not all professions.



3.2.4 Bird Damage Management Methods Available for Use (See Appendix B)

3.2.4.1 Non-chemical, Non-lethal Methods (See Appendix B for detailed descriptions)

Agricultural producer and property owner practices consist primarily of non-lethal preventive methods such as **cultural methods[2] and habitat modification.**

Animal behavior modification refers to tactics that alter the behavior of birds to reduce damages. Some but not all of these tactics include the following:

- Exclusions such as netting
- Propane exploders (to scare birds)
- Pyrotechnics (to scare birds)

[3] Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife damage..

- Distress calls and sound producing devices (to scare birds)
- Visual repellents and scaring tactics

Relocation or dispersal of damaging birds to other areas.

Nest destruction of the target species before eggs or young are in the nest.

Egg addling/oiling/destruction is the practice of destroying the embryo in the egg prior to hatching; physically breaking eggs; or directly removing eggs from a nest and destroying them.

Habitat/environmental modification to attract or repel certain bird species.

Live traps are various types of traps designed to capture birds alive for relocation or euthanasia. Some examples are clover traps, decoy traps, nest box traps, mist nets, corrals, etc.

Decoy and nest box traps are sometimes used by WS to capture European starlings, English sparrows, and feral domestic pigeons. Decoy traps are set in limited numbers in selected locations where a resident population is causing localized damage or where other techniques cannot be used. Decoy traps may be similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds are placed in the trap with sufficient food and water to assure their survival. Feeding behavior and calls of the decoys attract other birds into the trap. Birds taken in these traps are euthanized.

Lure crops/alternate foods are crops planted or other food resources provided to mitigate the potential loss of higher value crops.

3.2.4.2 Chemical, Non-lethal Methods (See Appendix B for detailed descriptions)

Avitrol is a chemical frightening agent registered for use on pigeons, crows, gulls, blackbirds, European starlings, and English sparrows in various situations. This chemical works by causing distress behavior in the birds that consume treated baits from a mixture of treated and untreated bait, which generally frightens the other birds from the site. Generally birds that eat the treated bait will die (Johnson and Glahn 1994).

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant, and used to capture waterfowl or other birds. It is generally used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single baits consisting of bread or corn are fed directly to the target birds.

Methyl Anthranilate (MA) and **Di-methyl Anthranilate** (artificial grape flavoring food

additive) have been shown to be effective repellents for many bird species, including waterfowl. They can be applied to turf or surface water or as a fog to repel birds from small areas. They may also become available for use as a livestock feed additive that has bird repellent value.

Tactile repellents reportedly deter birds from roosting, perching, or nesting on certain structural surfaces by creating a tacky or sticky surface that the birds avoid.

Other repellents: Other bird repellents that might become available include anthraquinone (Avery et al. 1997) and charcoal particles (e.g., adhered to livestock feed).

3.2.4.3 Mechanical, Lethal Methods (See Appendix B for detailed descriptions)

Shooting is more effective as a dispersal technique than as a way to reduce bird numbers. The number that can be killed by shooting is generally very small in relation to the number involved in damage situations. Usually only a few dozen birds can be shot from individual flocks that can number anywhere from a few hundred to many thousands or hundreds of thousands before the rest of the birds become gun shy. Shooting, however, can be helpful in some situations to supplement and reinforce other dispersal techniques. It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with rifles, shotguns, or pellet guns (rifles or pistols) is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible.

Cervical dislocation is approved by the American Veterinary Medical Association (AVMA) and may be used to euthanize birds which are captured in live traps.

3.2.4.4 Chemical, Lethal Methods (See Appendix B for detailed descriptions)

DRC-1339 is a slow acting avicide for reducing damage from several species of birds, including blackbirds, European starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds and mammals. This chemical would be the primary lethal chemical method used for feral domestic pigeon and starling damage management under the proposed program.

Starlicide® (3-chloro-p-toluidine hydrochloride) is a restricted use pesticide that is formulated as a 0.1% ready-to-use product and is commercially available to certified applicators or persons under their supervision. This avicide may be recommended or used by WS to control European starlings and pigeons. Starlicide may be used in feedlots, around buildings and fenced non-crop areas, bird staging and roosting areas, federal and state wildlife refuges, and other sites (EPA

1995). Starlicide is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the properties of this product are similar to DRC-1339.

Carbon dioxide (CO_2) gas is an American Veterinary Medical Association (AVMA) approved euthanasia method that is sometimes used to euthanize birds which are captured in live traps or by chemical immobilization and when relocation is not a feasible option. Live birds are placed in a container or chamber into which CO_2 gas is released. The birds quickly expire after inhaling the gas.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered, but not analyzed in detail. These were:

3.3.1 Lethal Bird Damage Management only by WS

Under this alternative, WS would not conduct any non-lethal control of birds for BDM purposes in the State, but would only conduct lethal BDM. This alternative was eliminated from further analysis because some bird damage problems can be resolved effectively through non-lethal means and at times lethal methods may not be available for use due to safety concerns or local ordinances prohibiting the use of some lethal methods, such as the discharge of firearms. For example, a number of damage problems involving the encroachment of injurious birds into buildings can be resolved by installing barriers or repairing of structural damage to the buildings, thus excluding the birds. Further, such damage situations as immediately clearing a runway of a large flock of injurious birds could not be implemented immediately, while scaring them away through noise harassment might resolve the air passengers' threat at once.

3.3.2 Compensation for Bird Damage Losses

The Compensation alternative would require the establishment of a system to reimburse persons impacted by bird damage. This alternative was eliminated from further analysis because no Federal or State laws currently exist to authorize such action. Under such an alternative, WS would not provide any direct control or technical assistance. Aside from lack of legal authority, analysis of this alternative in the FEIS indicated that the concept has many drawbacks (USDA 1997):

- It would require larger expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation.

- Compensation would most likely be below full market value. It is difficult to make timely responses to all requests to assess and confirm damage, and certain types of damage could not be conclusively verified. For example, it would be impossible to prove conclusively in individual situations that birds were responsible for disease outbreaks

even though they may actually have been responsible. Thus, a compensation program that requires verification would not meet its objective for mitigating such losses.

- 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.

3.3.3 Short Term Eradication and Long Term Population Suppression

An eradication alternative would direct all WS program efforts toward total long term elimination of bird populations on private, State, local and Federal government lands wherever a cooperative program was initiated in the State.

Although generally difficult to achieve, eradication of a local population of feral domestic pigeons, English sparrow or European starlings may be the goal of individual BDM projects in fulfillment of Executive Order 13112 on Invasive Species (see Subsection 1.7.2.7). This is because feral domestic pigeons, English sparrows and European starlings are not native to North America and are only present because of human introduction. However, eradication as a general strategy for managing bird damage will not be considered in detail because:

- Eradication is not acceptable to most people.

- Because European starlings are migratory, eradication would have to be targeted at the entire North American populations of this species to be successful. That would not be feasible or desirable.

Suppression would direct WS program efforts toward managed reduction of certain problem populations or groups. In areas where damage can be attributed to localized populations of birds, WS can decide to implement local population suppression as a result of using the WS Decision Model. Furthermore, it is not realistic or practical to consider large-scale population suppression as the basis of the WS program. Typically, WS activities in the State would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species. Problems with the concept of suppression are similar to those described above for eradication.

3.3.4 Use of Bird-proof Feeders in Lieu of Lethal Control at Dairies and Cattle Feeding Facilities

A method proposed by Animal Protection of New Mexico, Inc. for excluding birds at dairies and

cattle feeding facilities in that State, is a “bird-proof” feeder that involves the installation of 1/8" thick steel panel feed troughs covered by parallel 4-6 inch spaced steel cables or wires running from the outer top edge of the trough up at a 30-45 degree angle to the top of the head chutes that cattle use to access the feed. Vertical canvas strips are hung from the cables. The feeder was reportedly designed for use with horses. A copy of a diagram of this system was sent to Mr. Jim Glahn, Bird Control Research Biologist, National Wildlife Research Center (NWRC), who has nearly 12 years of experience researching problems caused by European starlings at livestock feeding operations, and to the Extension Wildlife Specialist and Livestock Specialist at New Mexico State University (Dr. John Boren, Dr. Ron Parker, NMSU Coop. Ext. Service, pers. comm. 1999) for opinions regarding the potential effectiveness and practicality of the feeder. Concerns expressed were:

- no efficacy data were available on the effectiveness of the design in excluding European starlings. Unresolved concerns were that the cables could provide temporary perching sites for the birds and that birds might enter the trough from the rear where the cows insert their heads through the chutes to access feed (Boren and Parker).

- a major flaw in the design is the spacing of the cables at 4-6" which would allow European starlings to drop through. Reducing the spacing to 2" as recommended by Johnson and Glahn (1994) would likely interfere with the delivery of feed to the troughs. This is because the feed mixture currently used by most dairies is a mixture of chopped alfalfa hay and corn silage with a grain component. The alfalfa/corn silage portion would likely hang up on the cable or wire strands of the troughs and much would fall outside the troughs, with increased feed waste a result (Glahn).

- the spacing of the canvas strips is not specified, and canvas would deteriorate quickly from cattle licking and weather (Glahn).

- altering from an open platform feeding system to enclosed troughs would pose problems with removal of rejected or spoiled feed. The troughs would likely require substantial increases in manual labor to clean versus the current method of using a tractor-mounted blade or front-end loader (Boren and Parker; Glahn).

- the cable/wire barriers would likely hinder the application of injectable medicines which is currently achieved by use of the “lockup” feeding chutes that restrain the cows by the head and neck for this purpose (Boren and Parker).

- feed consumption might be reduced, at least temporarily, due to reluctance of cows to put their heads into a semi-enclosed environment (Boren and Parker).

- the conversion to the suggested feed trough design would likely be substantial. Most dairy/feedlot managers would be reluctant to convert considering initial cost and the added inconveniences discussed above (Boren and Parker).

Dr. Boren and Dr. Parker suggested that, at a minimum, a replicated field study should be conducted to address these concerns before such a system is implemented. Mr. Glahn expressed the opinion, based on Twedt and Glahn (1982) and Feare (1984), that exclusion methods to reduce starling depredations at livestock feeding operations are usually the least cost-effective solution.

Despite the above concerns about the bird-proof feeder system recommended by APNM, Inc., similar type systems could be recommended by WS under the current program should any become available that are effective, practical, and economically feasible for producers to implement.

3.4 MITIGATION AND STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Mitigation in Standard Operating Procedures (SOPs)

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for effects that otherwise might result from that action. The current WS program, nationwide and in Michigan, uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's Standard Operating Procedures include:

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

- Reasonable and prudent measures or alternatives are identified through consultation with the USFWS and are implemented to avoid adverse affects to T&E species.

- 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.

- All WS Specialists in the State who use restricted chemicals are trained and certified by, or else operate under the direct supervision of, program personnel or others who are experts in the safe and effective use of chemical BDM materials.

- The presence of non-target species is monitored before using DRC-1339 to reduce the risk of mortality of non-target species populations.

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

Some additional mitigating factors specific to the current program include:

- Management actions would be directed toward localized populations or groups of target species and/or individual offending members of those species. Generalized population suppression across the State, or even across major portions of the State, would not be conducted.

- WS uses BDM devices and conducts activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low according to a formal risk assessment (USDA 1997, Appendix P). 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.

3.4.2 Additional Mitigation Specific to the Issues

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

3.4.2.1 Effects on Target Species Populations

- BDM activities are directed to resolving bird damage problems by taking action against individual problem birds, or local populations or groups, not by attempting to eradicate populations in the entire area or region.

- WS take is monitored by comparing numbers of birds killed by species or species group (e.g., starlings) with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse effects (See Chapter 4).

3.4.2.2 Effects on Non-target Species Populations Including T&E Species

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

- Observations of birds feeding at feedlots, dairies, or European starling staging areas; or of birds that are associated with feral domestic pigeon or house sparrow concentrations are made to determine if non-target or T&E species would be at risk from BDM activities.

- WS has consulted with the USFWS regarding potential effects of control methods on T&E species, and abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For

the full context of the Biological Opinion see the ADC FEIS, Appendix F (USDA 1997).

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

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. The chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. This section analyzes the environmental consequences of each alternative in comparison with the no action alternative to determine if the real or potential effects would be greater, lesser, or the same.

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, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Cumulative Effects: 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 nontarget 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.

Effects on sites or resources protected under the National Historic Preservation Act: WS BDM actions are not undertakings that could adversely affect historic resources (See Section 10.1.5).

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

4.1.1 Effects on Target Species Bird Populations

4.1.1.1 Alternative 1. - Integrated Bird Damage Management Program (Proposed Action / No Action)

Analysis of this issue is limited to those species killed during WS BDM. The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997). Magnitude is described in USDA (1997) as " . . . *a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or

qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage.

Breeding Bird Surveys. Bird populations can be monitored by using data from the Breeding Bird Surveys (BBS). The BBS is a large-scale inventory of North American birds coordinated by the U.S. Geological Survey, Patuxent Wildlife Research Center (Sauer et al 2003). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The BBS was started in 1966, and routes are surveyed in June by experienced birders. The stated primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, as a result of variable annual local habitat and climatic conditions. Trends can be determined using different population equations, and statistically tested to determine if a trend is significant. The significance of a trend's "change" is reflected in the calculated P-value (probability) for that species.

The BBS data is best used to monitor population trends. However, the average number of birds per route (relative abundance) can be used to theoretically estimate the population size (relative abundance/10 mi^2 x 96,705 (total land/water area in Michigan)). To use these population estimates the following assumptions would need to be accepted.

1. All birds within a quarter mile of the observer are seen at all stops on a BBS route; this assumption is faulty because observers often cannot see a quarter mile in radius at all stops due to obstructions such as hills, trees, and brush and because some bird species can be very elusive. Therefore, the number of birds seen per route would provide a conservative estimate of the population.
2. The chosen survey routes are totally random and are fully representative of available habitats. When BBS routes are established, survey rules allow the observers to make stops for surveys based on better quality habitat or convenient parking areas, even though the survey sites are supposed to be spaced a half-mile apart. Therefore, if survey areas had stops with excellent food availability, the count survey could be biased. This would tend to overestimate the population. However, if these sites were not on a route at all, the population could be underestimated.
3. Birds are equally distributed throughout the survey area and routes were randomly selected. Routes are randomly picked throughout the State, but are placed on the nearest available road. Therefore, the starting point is picked for accessibility by vehicle. However a variety of habitat types are typically covered since most BBS routes are selected because they are "off the beaten path" to allow observers to hear birds without interruption from vehicular noise.

Christmas Bird Counts. The National Audubon Society (NAS) conducts nationwide bird surveys in December to early January (the NAS Christmas Counts). The Christmas Bird Counts

(CBC) reflect the number of birds frequenting the state during the winter months. The CBC data does not provide a population estimate, but can be used as an indicator of trends in the population. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (National Audubon Society 2002).

European Starling Population Effects

Colonization of North America by the European Starling began on March 6, 1890 when 80 European starlings were released into New York's Central Park by a Mr. Eugene Scheifflin, a member of the Acclimatization Society. The birds thrived and exploited their new habitat. By 1918, the advance line of migrant juveniles extended from Ohio to Alabama; by 1926 from Illinois to Texas; by 1941 from Idaho to Kentucky; and by 1946 to California and Canadian coasts (Miller 1975). In just 50 short years the starling had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984).

Breeding Bird Survey trend data from 1966-2002 indicate that European starling populations have have decreased at an annual rate of -1.4%, -0.6%, and -0.9% throughout Michigan, the United States, the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 74.73, a total Michigan summer starling population could be estimated at approximately 722,700 birds. Michigan Christmas Bird Count data from 1966-2002 shows a relatively stable population trend for wintering populations of starlings throughout the state (National Audubon Society 2002).

Precise counts of starling populations do not exist but one estimate placed the nationwide starling population at an estimated at 140 million birds (Johnson and Glahn 1994). Natural mortality in starling populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). Therefore the estimated natural mortality of starlings in the U.S should be between 70 and 91 million birds annually.

During FY 1996 -02 Michigan WS killed an estimated 324,214 European starlings during all program activities in Michigan. This is an annual average of 54,035 European starlings for the six-year period. From 1996 through 2001, states in the WS Eastern Region reported a total kill of 1,104,825 European starlings. This is an annual average of 184,137 European starlings in the WS Eastern Region (USDA- WS MIS Database). No other sources of major human-caused starling mortality are known. Based upon an anticipated increase in requests for services, WS' lethal management of starlings in Michigan would be expected to be no more than approximately .067% of the estimated average nationwide natural mortality in any single year under the current program.

Starlings are non-indigenous and often have negative impacts on and competition with native birds. Therefore, starlings are considered by many wildlife biologists and ornithologists to be an

undesirable component of North American wild and native ecosystems. Any reduction in starling populations in North America, even to the extent of complete eradication, could be considered a beneficial impact to native bird species.

Based on the above information and WS limited lethal take of starlings in Michigan, WS should have minimal effects on local, statewide, regional or continental starling populations.

Feral Domestic Pigeon Population Effects

Domestic pigeons, or rock doves, are a non-indigenous species that were first introduced into the United States by European settlers as a domestic bird to be used for sport, carrying messages, and as a source of food (USFWS 1981). Many of these birds escaped and eventually formed the feral pigeon populations that are now found throughout the United States, southern Canada, and Mexico (Williams and Corrigan 1994). However, because pigeons are an introduced rather than a native species, they are not protected by federal law or by Michigan state law.

Pigeons are highly dependent on humans to provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, they are commonly found around city buildings, bridges, parks, farmyards, grain elevators, feed mills, and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects, and any other available bits of food (Williams and Corrigan 1994).

Breeding Bird Survey trend data from 1966-2002 indicate that pigeon populations have decreased at an annual rate of -2.1% throughout Michigan, are stable (0.0%) throughout the United States and have increased at an annual rate of 0.1% throughout the eastern region (Sauer et al. 2003). With a relative abundance of 8.87, a total Michigan summer pigeon population could be estimated at approximately 85,800 birds. Michigan Christmas Bird Count data from 1966-2002 shows an increasing population trend for wintering populations of pigeons throughout the state (National Audubon Society 2002).

Any BDM involving lethal control actions by WS for this species would be restricted to isolated, individual sites, or communities. In those cases where feral domestic pigeons are causing damage or are a nuisance, complete removal of the local population could be achieved. This would be considered to be a beneficial impact on the human environment since it would be requested by the affected property owner or administrator. Although regional population effects would be minor, even if large regional or nationwide reductions could be achieved, this would not be considered an adverse impact on the human environment because the species is not part of native ecosystems. In addition, local reductions or elimination of pigeon flocks would be considered a positive impact to those individuals who are offended by the presence of these birds, and whose enjoyment of native songbirds is diminished by their presence. However, major population reduction in some localities may be considered to have negative effects by some individuals who experience aesthetic enjoyment of pigeons.

Between FY 1996 and FY 2002, Michigan WS took an average of 673 pigeons per year statewide, primarily to reduce sanitation problems and human health and safety threats associated with accumulations of droppings in areas used by humans. This relatively small number of pigeons taken at multiple sites undoubtedly had little effect on overall pigeon populations in Michigan.

Based upon an anticipated increase in requests for services, WS' lethal management of pigeons in Michigan would be expected to be no more than approximately 1,000 pigeons in any one year under the Proposed Action. Based on the above information and WS limited lethal take of pigeons in Michigan, WS should have minimal effects on local, statewide, regional or continental pigeon populations.

English Sparrow Population Effects

English sparrows, or house sparrows, were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). The species is not protected by Federal or State laws. Like European starlings and pigeons, because of their negative effects and competition with native bird species, English sparrows are considered by many wildlife biologists, ornithologists, and naturalists to be an undesirable component of North American native ecosystems. English sparrows are found in nearly every habitat except dense forest, alpine, and desert environments. They prefer human-altered habitats, and are abundant on farms and in cities and suburbs (Robbins et al. 1983).

Breeding Bird Survey trend data from 1966-2002 indicate that English sparrow populations have decreased at an annual rate of -2.8, -2.5, and -2.7% throughout Michigan, the United States, and the eastern region, respectively (Sauer et. al 2003).). With a relative abundance of 49.94, a total Michigan summer sparrow population could be estimated at approximately 483,000 birds. Michigan Christmas Bird Count data from 1966-2002 shows a decreasing population trend for wintering populations of sparrows throughout the state (National Audubon Society 2002).

One aspect of changing farming practices, which might have been a factor, would be the considerable decline in small farms and associated disappearance of a multitude of small feedlots, stables and barns, a primary source of food for these birds in the early part of the 20th century. Ehrlich et al. (1988) suggested that English sparrow population declines might be linked to the dramatic decrease during the 20th century in the presence of horses as transport animals. Grain rich horse droppings were apparently a major food source for this species.

Although precise population numbers for English sparrows were not available for Michigan and the region, Breeding Bird Surveys and the Audubon Society's, Christmas bird count (Saur et. al. 1996) revealed that this species was relatively, very abundant. Fourteen bird count locations in Kentucky, Tennessee, Illinois, Missouri, Indiana, Ohio, West Virginia and Virginia were randomly sampled by WS from the interactive Christmas Bird Count Internet web site by point

and click method to evaluate relative bird abundance for the region. Results from sites sampled revealed that for those areas sampled, English sparrows were among the eleven most abundant species. Because they are considered extremely abundant and are not afforded protection by Federal or State law, depredation permits are not required before the public can take them with lethal means.

Any BDM involving lethal control of English sparrows by WS would probably be restricted to individual sites. As stated previously, because English sparrows are not native to North America, any reduction in English sparrow populations, even to the extent of complete eradication, could be considered a beneficial impact on populations of native bird species. Therefore, any reduction in this species' populations in North America should not be considered as having any significant adverse impact on the quality of the human environment. Some individuals who watch or feed English sparrows, or those who might have established human-affectionate bonds with individual birds would be offended by reductions in populations or removal of individual birds.

Based upon an anticipated increase in requests for services, WS' lethal management of English sparrows in Michigan would be expected to be no more than approximately 500 sparrows in any one year under the Proposed Action. Based on the above information and WS limited lethal take of English sparrows in Michigan, WS should have minimal effects on local, statewide, regional or continental sparrow populations.

4.1.1.2 Alternative 2 – Non-Lethal Bird Damage Management only by WS

Under this alternative, WS would not take any target species because no lethal methods would be used. Although WS lethal take of English sparrows, feral domestic pigeons and European starlings would not occur, it is likely that, without WS conducting some level of lethal BDM activities for these specie, private BDM efforts would increase, leading to potentially similar or even greater effects on target species populations than those of the current program alternative. For the same reasons shown in the population effects analysis in section 4.1.1.1, however, it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC-1339 and the tranquilizer alpha-chloralose are currently only available for use by WS employees and would not be available for use under this alternative. Effects and hypothetical risks of illegal chemical toxicant use under this alternative would probably be about the same as those under Alternative 3, but less than Alternative 4.

4.1.1.3 Alternative 3 - Technical Assistance Only

Under this alternative, WS would have no impact on English sparrows, feral domestic pigeons and European starling populations in the State because the program would not conduct any operational BDM activities but would be limited to providing advice only. Private efforts to

reduce or prevent bird damage and perceived disease transmission risks could increase which could result in similar or even greater effects on those populations than the current program alternative. For the same reasons shown in the population effects analysis in section 4.1.1.1, however, it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC-1339 and the tranquilizer alpha-chloralose are currently only available for use by WS employees and would not be available for use under this alternative. Effects and hypothetical risks of illegal chemical toxicant use under this alternative would probably be about the same as those under Alternative 2.

4.1.1.4 Alternative 4 - No Federal WS Bird Damage Management

Under this alternative, WS would have no impact on English sparrows, feral domestic pigeons and European starling populations in the State. Private efforts to reduce or prevent depredations could increase which could result in effects on target species populations to an unknown degree. Effects on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by private persons. For the same reasons shown in the population effects analysis in section 4.1.1.1 it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC-1339 and the tranquilizer alpha-chloralose are currently only available for use by WS employees and would not be available for use under this alternative.

4.1.2 Effects on Other Wildlife Species, Including T&E Species

4.1.2.1 Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

Adverse Effects on Non-target (non-T&E) Species. There has been no lethal take of non-target species by WS while conducting BDM activities in Michigan over the past six years. WS personnel are experienced and trained in wildlife identification, and to select the most appropriate methods for taking targeted animals and excluding nontarget species. Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. Any non-target species captured in a live trap would be released unharmed on site. No adverse impacts from the use of registered pesticides and repellents are anticipated. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997).

Although it is possible that some non-target birds may be unknowingly killed by use of DRC-

1339 for pigeon or starling control, the method of application is designed to minimize or eliminate that risk. For example, DRC-1339 treated bait is only applied after a period of prebaiting with untreated bait material and when non-target birds are not observed coming to feed at the site. WS take of non-target species during BDM activities is expected to be extremely low to non-existent. Furthermore, the inherent safety features of DRC-1339/Starlicide use that precludes or minimize hazards to birds, mammals, and plants are described in Appendix B and in a formal risk assessment in the ADC Final EIS (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no adverse effects on mammalian or bird scavengers from the proposed action.

Although it is possible that some non-target birds were unknowingly killed by use of DRC-1339 for pigeon or starling control, the method of application is designed to minimize or eliminate that risk. For example, DRC-1339 treated bait is only applied after a period of pre-baiting with untreated bait material and when non-target birds are not observed coming to feed at the site.

While every precaution is taken to safeguard against taking non-target birds, at times changes in local flight patterns and other unanticipated events can result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program. WS take of non-target species during BDM activities is expected to be extremely low to non-existent.

Beneficial Effects on Non-target Species. Control operations as proposed in this alternative could reduce starling populations on a local level. Reduction in nest site competition would be a beneficial impact on the native bird species that are adversely affected by interspecific nest competition by starlings.

T&E Species Effects. WS has reviewed the list of Federally and State listed T&E species for Michigan has determined that the proposed WS actions will not adversely affect Federal and State T&E species in Michigan. T&E species that are Federally listed (or proposed for listing) for the State of Michigan are listed in Appendix C. T&E species that are State listed for the State of Michigan are listed in Appendix D.

Nationally, WS has consulted with the USFWS regarding potential impacts of bird control methods on T&E species, and abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For the full context of the Biological Opinion see the ADC FEIS, Appendix F (USDA 1997).

WS BDM activities in Michigan would not adversely affect the bald eagle, Indiana bat, piping plover, gray wolf, eastern cougar, and small whorled pogonia. This determination is based on the conclusions made by the USFWS during their 1992 programmatic consultation of WS activities and subsequent Biological Opinion (USDA 1997, Appendix F). The USFWS determined that the management activities being utilized for WS BDM activities are not likely to adversely affect these listed species. Furthermore, WS has determined that the use of BDM

methods will have no effect on those T&E species not included in the 1992 BO or their critical habitats. WS has determined that the use Alpha-chloralose and lasers will have no effect on any listed T&E species.

As stated in the 1992 Biological Opinion, the USFWS has determined that the only BDM method that might adversely affect the bald eagle was above ground use of strychnine treated bait for "nuisance birds." Strychnine is no longer registered for above ground use and would not be used by WS for BDM in the State. DRC-1339 poses no primary hazard to eagles because eagles do not eat grain or other bait materials on which this chemical might be applied during BDM, and, further, because eagles are highly resistant to DRC-1339 - up to 100 mg doses were force fed to captive golden eagles with no mortality or adverse effects noted other than regurgitation and head-shaking (Larsen and Dietrich 1970). Secondary hazards to raptors from DRC-1339 and Avitrol are low to nonexistent (see Appendix B). Therefore, WS BDM in Michigan is not likely to have adverse effects on bald eagles.

The USFWS published the final rule to list the Canada lynx on March 24, 2000 (Federal Register, 50 CFR Part 17). The Final Rule identifies the listed population as the "U.S. District Population Segment" which occurs or historically occurred in forested portions of the States of Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, and Wisconsin. WS wildlife biologists consulted on the lynx with USFWS in Regions 3 and 5 in March 2001. The USFWS (letter from L. Lewis, USFWS, Acting Assistant Regional Director to G. Larson, WS Eastern Regional Director, May 9, 2001) determined that, "Canada lynx are unlikely to be affected by using guard dogs, scare devices, oral rabies vaccine, and shooting." This letter states that a "not likely to adversely affect" determination is appropriate for APHIS-WS operational programs.

Mitigation measures to avoid T&E effects were described in Chapter 3. The inherent safety features of DRC-1339 that precludes or minimizes hazards to mammals and plants are described in Appendix B and in a formal risk assessment in the ADC FEIS (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no jeopardy to T&E species or adverse effects on mammalian or non-T&E bird scavengers from the proposed action.

4.1.2.2 Alternative 2 Non-Lethal Bird Damage Management only by WS

Under this alternative, WS take of non-target animals would hypothetically be less than that of the proposed action because no lethal control actions would be taken by WS. However, non-target take would not differ substantially from the current program because the current program takes very few non-target animals. On the other hand, people whose bird damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of lethal control such as use of shooting by private persons or even illegal use of chemical toxicants. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds. 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 falcons, could therefore be greater under this alternative if frustrated private individuals use chemicals that are less selective or that cause secondary poisoning.

4.1.2.3 Alternative 3 - Technical Assistance Only

Alternative 3 would not allow any WS direct operational BDM in Michigan. There would be no impact on non-target or T&E species by WS activities from this alternative. Technical assistance or self-help information would be provided at the request of producers and others. Although technical support might lead to more selective use of control methods by private parties than that which might occur under Alternative 2, private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods leading to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that, similar to Alternative 2, 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 some T&E species. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if frustrated private individuals use chemicals that are less selective or that cause secondary poisoning.

4.1.2.4 Alternative 4 -No Federal WS Bird Damage Management

Alternative 4 would not allow any WS BDM in the State. There would be no impact on non-target or T&E species by WS BDM activities from this alternative. However, private efforts to reduce or prevent depredations could increase which could result in less experienced persons implementing control methods and could lead to greater take 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 frustrated private individuals use chemicals that are less selective or that cause secondary poisoning.

4.1.3 Effects on Public Health and Safety

4.1.3.1 Safety and Efficacy of Chemical Methods

Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

DRC-1339 DRC-1339 is the primary lethal chemical BDM method that would be used under the proposed program alternative. There has been some concern expressed by a few members of the public that unknown but significant risks to human health may exist from DRC-1339 used for

BDM.

This chemical is one of the most extensively researched and evaluated pesticides ever developed. Over 30 years of studies have demonstrated the safety and efficacy of this compound. Appendix B provides more detailed information on this chemical and its use in BDM. Factors that virtually eliminate any risk of public health problems from use of this chemical are:

- Its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions expressed by a few members of the public, DRC-1339 is not applied to feed materials that livestock can feed upon).

- DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours, which means that treated bait material generally is nearly 100% broken down within a week.

- It is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people.

- Application rates are extremely low (less than 0.1 lb. of active ingredient per acre) (EPA 1995).

- A human would need to ingest the internal organs of birds found dead from DRC-1339 to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur.

- The EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995). Notwithstanding, the extremely controlled and limited circumstances in which DRC-1339 is used would prevent any exposure of the public to this chemical.

The above analysis indicates that human health risks from DRC-1339 use would be virtually nonexistent under any alternative.

Avitrol (4-Aminopyridine). Avitrol is another chemical method that might be used by WS in BDM. Appendix B provides more detailed information on this chemical.

Avitrol is available as a prepared grain bait mixture or as a powder. It is formulated in such a way that ratios of treated baits to untreated baits are no greater than 1:9. Factors that virtually eliminate health risks to members of the public from use of this product as an avicide are:

- It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (ETOXNET 1996). Therefore, little of the chemical remains in killed birds to present a hazard to humans.

- A human would need to ingest the internal organs of birds found dead from Avitrol ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.

- Although Avitrol has not been specifically tested as a cancer-causing agent, the chemical was found not to be mutagenic in bacterial organisms (EPA 1997). Therefore, the best scientific information available indicates it is not a carcinogen. Notwithstanding, the extremely controlled and limited circumstances in which Avitrol is used would prevent exposure of members of the public to this chemical.

The above analysis indicates that human health risks from Avitrol use would be virtually nonexistent under any alternative.

Other BDM Chemicals. Other non-lethal BDM chemicals that might be used or recommended by WS would include repellents such as methyl or di-methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), which has been used as an area repellent, anthraquinone, which is presently marketed as Flight Control®, and the tranquilizer drug alpha-chloralose. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before the EPA or FDA would register them. 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 mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health.

Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997).

Alternative 2 Non-lethal Bird Damage Management only by WS

Alternative 2 would not allow for any lethal methods use by WS in the State. WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include the tranquilizer drug alpha-chloralose; and chemical repellents such as anthraquinone and methyl anthranilate (although already considered safe for human consumption because it is artificial grape flavoring) might nonetheless raise concerns about human health risks. Such chemicals must undergo rigorous testing and research to prove

safety, effectiveness, and low environmental risks before they would be registered by EPA or FDA. Any operational use of chemical repellents and tranquilizer drugs would be in accordance with labeling requirements under FIFRA and State pesticide laws and regulations and FDA rules which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health.

Excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS's assistance and resorting to other means of BDM. Such means could include illegal pesticide use. Hazards to humans and pets could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS's controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets and to mammalian and avian scavengers. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the proposed alternative.

Alternative 3 - Technical Assistance Only

Alternative 3 would not allow any direct operational BDM assistance by WS in the State. WS would only provide advice and, in some cases, equipment or materials (i.e., by loan or sale) to other persons who would then conduct their own damage management actions. Concerns about human health risks from WS's use of chemical BDM methods would be alleviated because no such use would occur. DRC-1339 is only registered for use by WS personnel and would not be available for use by private individuals. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and leading to a greater risk than the Proposed Action alternative. However, because some of these private parties would be receiving advice and instruction from WS, concerns about human health risks from chemical BDM methods use should be less than under Alternative 4. Commercial pest control services would be able to use Avitrol and Starlicide and such use would likely occur to a greater extent in the absence of WS's assistance. Use of Avitrol and Starlicide in accordance with label requirements should preclude any hazard to members of the public. Hazards to humans and pets could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS's controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets and to mammalian and avian scavengers. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the proposed alternative.

Alternative 4 - No Federal WS Bird Damage Management

Alternative 4 would not allow any WS BDM in the State. Concerns about human health risks

from WS's use of chemical BDM methods would be alleviated because no such use would occur. DRC-1339 is only registered for use by WS personnel and would not be available for use by private individuals. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the proposed action alternative. Commercial pest control services would be able to use Avitrol and Starlicide and such use would likely occur to a greater extent in the absence of WS's assistance. Use of Avitrol and Starlicide in accordance with label requirements should preclude any hazard to members of the public. However, 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. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS's controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets and to mammalian and avian scavengers. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the current program alternative.

4.1.3.2 Impacts of Human Safety of Non-chemical BDM Methods

Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

Non-chemical BDM methods that might raise safety concerns include shooting with firearms and harassment with pyrotechnics. Firearms are only used by WS personnel who are experienced in handling and using them. WS personnel receive safety training on a periodic basis to keep them aware of safety concerns. The Michigan WS program has had no accidents involving the use of firearms or pyrotechnics in which a member of the public was harmed. A formal risk assessment of WS's operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse effects on human safety from WS's use of these methods are expected.

Alternative 2 - Non-lethal Bird Damage Management only by WS

Under this alternative, non-chemical BDM methods that might raise safety concerns include shooting with firearms when used as a harassment technique and harassment with pyrotechnics. Firearms are only used by WS personnel who are experienced in handling and using them. WS personnel receive safety training on a periodic basis to keep them aware of safety concerns. The Michigan WS program has had no accidents involving the use of firearms or pyrotechnics in which a member of the public was harmed. A formal risk assessment of WS's operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse effects on human safety from WS's use of these methods are expected.

Alternative 3 - Technical Assistance Only

Under this alternative, WS would not engage in direct operational use of any non-chemical BDM

methods. Risks to human safety from WS's use of firearms and pyrotechnics would hypothetically be lower than the current program alternative, but not significantly because Michigan WS's current program has an excellent safety record in which no accidents involving the use of these devices have occurred that have resulted in a member of the public being harmed. Hazards to humans and property could be greater under this alternative if personnel conducting BDM activities using non-chemical methods are poorly or improperly trained.

Alternative 4 - No Federal WS Bird Damage Management

Alternative 4 would not allow any WS BDM in the State. Concerns about human health risks from WS's use of non-chemical BDM methods would be alleviated because no such use would occur. The use of firearms or pyrotechnics by WS would not occur in BDM activities in the State. However, private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the proposed action alternative. Commercial pest control services would be able to use pyrotechnics or firearms in BDM programs and this activity would likely occur to a greater extent in the absence of WS's assistance. Hazards to humans and property could be greater under this alternative if personnel conducting BDM activities using non-chemical methods are poorly or improperly trained.

4.1.3.3 Impacts on Human Health and Safety from Birds

Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

IWDM reduces damage or threats to public health or safety to people who would have no relief from such damage or threats if non-lethal methods were ineffective or impractical. As discussed in Chapter 1, birds are a threat to aviation safety and can carry or be involved in the cycle of diseases that are transmittable to humans and that can adversely affect human health. In most cases, it is difficult to conclusively prove that birds were responsible for transmission of individual human cases or outbreaks of bird-borne diseases. Nonetheless, certain requesters of BDM service may consider this risk to be unacceptable and may request such service primarily for that reason. In such cases, BDM, either by lethal or non-lethal means, would, if successful, reduce the risk of bird-borne disease transmission at the site for which BDM is requested.

In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. In such cases, lethal removal of the birds may actually be the best alternative from the standpoint of overall human health concerns in the local area. However, if WS is providing direct operational assistance in relocating birds, coordination with local authorities who may assist in monitoring the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations.

Alternative 2 - Non-lethal Bird Damage Management only by WS

Under this alternative, WS would be restricted to implementing and recommending only non-lethal methods in providing assistance with bird damage problems. The success or failure of the use of non-lethal methods can be quit variable. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. Some requesting entities such as city government officials would reject WS assistance for this reason and would likely seek to achieve bird control by other means. However, if WS is providing direct operational assistance in relocating birds, coordination with local authorities who may assist in monitoring the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations. Because DRC-1339 would not be available for use by non-WS personnel, it may be difficult to achieve local population reduction. In such cases, human health risks may remain the same or increase.

Alternative 3 - Technical Assistance Only

With WS technical assistance but no direct operational assistance, entities requesting BDM for human health concerns would either take no action, which means the risk of human health problems would likely continue or increase in each situation as bird numbers are maintained or increased, or implement WS recommendations for non-lethal and lethal control methods. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. Because DRC-1339 would not be available for use by non-WS personnel, it may be difficult to achieve local population reduction. In such cases, human health risks may remain the same or increase.

Alternative 4 -No Federal WS Bird Damage Management

With no WS assistance, private individuals and community government officials would either take no action, which means the risk of human health problems would likely continue or increase in each situation as bird numbers are maintained or increased, or implement their own non-lethal and lethal control methods. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. Because DRC-1339 would not be available for use by non-WS personnel, it may be difficult to achieve local population reduction. In such cases, human health risks may remain the same or increase. Under this alternative, human health problems could increase if private individuals were unable to find and implement effective means of controlling birds that cause damage problems.

4.1.4 Impacts to Stakeholders, Including Aesthetics

4.1.4.1 Effects on Human Affectionate-Bonds with Individual Birds and on Aesthetic Values of Wild Bird Species

Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

Some people who routinely view or feed individual birds such as feral domestic pigeons would likely be disturbed by removal of such birds under the current program.

WS is aware of such concerns and takes this into consideration to mitigate these affects. WS might sometimes be able to mitigate such concerns by leaving certain birds, which might be identified by interested individuals.

Some people have expressed opposition to the killing of any birds during BDM activities. Under the current program, some lethal control of birds would continue and these persons would continue to be opposed. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular birds that would be killed by WS's 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.

Lethal removal of birds from airports should not affect the public's enjoyment of the aesthetics of the environment since airport properties are closed to the public. The ability to view and interact with birds at these sites is usually either restricted to viewing from a location outside boundary fences or is forbidden.

Alternative 2 - Non-lethal Bird Damage Management only by WS

Under this alternative, WS would not conduct any lethal BDM but would still conduct harassment of birds that were causing damage. Some people who oppose lethal control of wildlife by 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 birds would not be affected by the death of individual birds under this alternative, but might oppose dispersal or translocation of certain birds. As discussed in this Subsection under Alternative One, WS might be able to mitigate such concerns by leaving certain birds which might be identified by interested individuals. In addition, the abundant populations of target bird species in urban environments would enable people to continue to view them and to establish affectionate bonds with individual wild birds. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the proposed action alternative.

Alternative 3 - Technical Assistance Only

Under this alternative, WS would not conduct any direct operational BDM but would still provide technical assistance or self-help advice to persons requesting assistance with bird damage. WS would also not conduct any harassment of birds that were causing damage. Some people who oppose direct operational assistance in wildlife damage management by the government but favor government technical assistance would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS's activities under this alternative because the individual birds would not be killed by WS. However, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the proposed action alternative.

Alternative 4 - No Federal WS Bird Damage Management

Under this alternative, WS would not conduct any lethal removal of birds nor would the program conduct any harassment of birds. Some people who oppose any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS's activities under this alternative. However, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the proposed action alternative.

4.1.4.2 Effects on Aesthetic Values of Property Damaged by Birds

Alternative 1 - Integrated Bird Damage Management Program (Proposed Action / No Action)

Under this alternative, operational assistance in reducing bird problems, in which droppings from the birds cause unsightly mess, would improve aesthetic values of affected properties. In addition, individuals who object to the presence of invasive nonnative species, such as European starlings, domestic feral pigeons, and English sparrows, and whose aesthetic enjoyment of other birds is diminished by the presence of such species, will be positively affected by programs which result in reductions in the presence of such birds.

Relocation or dispersal of nuisance roosting or nesting populations of birds (e.g., starling roosts) by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities who may assist in monitoring the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations.

Alternative 2 - Non-lethal Bird Damage Management only by WS

Under this alternative, WS would be restricted to non-lethal methods only. Assuming property

owners would choose to allow and pay for the implementation of these non-lethal methods, this alternative could result in birds relocating to other sites where they would likely cause or aggravate similar problems for other property owners. Thus, this alternative would likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the proposed action alternative.

Relocation or dispersal of nuisance roosting or nesting populations of birds (e.g., starling roosts) by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities who may assist in monitoring the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations.

Alternative 3 - Technical Assistance Only

Under this alternative, the lack of operational assistance in reducing bird problems could result in an increase of potential adverse affects on aesthetic values. However, potential adverse affects would likely be less than as those under Alternative 4, since WS would be providing technical assistance.

Relocation of nuisance roosting or nesting population of birds (e.g., starling roosts) through harassment, barriers, or habitat alteration can sometimes result in the birds causing the same problems at the new location. If WS has only provided technical assistance to local residents or municipal authorities, coordination with local authorities to monitor the birds' movements to assure the birds do not reestablish in other undesirable locations might not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

Alternative 4 - No Federal WS Bird Damage Management

Under this alternative, the lack of any operational or technical assistance in reducing bird problems would mean aesthetic values of some affected properties would continue to be adversely affected if the property owners were not able to achieve BDM some other way. In many cases, this type of aesthetic "damage" would worsen because property owners would not be able to resolve their problems and bird numbers would continue to increase.

Relocation of nuisance roosting or nesting population of birds (e.g., starling roosts) through harassment, barriers, or habitat alteration can sometimes result in the birds causing the same problems at the new location. Coordination of dispersal activities by local residents or municipal authorities with local authorities to monitor the birds' movements to assure the birds do not reestablish in other undesirable locations might not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.5 Humaneness and Animal Welfare Concerns of Methods Used.

4.1.5.1 Alternative 1 - Integrated Bird Damage Management Program

(Proposed Action / No Action)

Under this alternative, WS would use methods viewed by some persons as inhumane in BDM. These methods would include shooting and the use of toxicants/chemicals such as DRC-1339 and Avitrol.

Shooting, when performed by experienced professionals, usually results in a quick death for target birds. Occasionally, however, some birds are initially wounded and must be shot a second time or must be caught by hand and then dispatched or euthanized. Some persons would view shooting as inhumane.

The primary lethal chemical BDM method that would be used by WS under this alternative would be DRC-1339 (see discussion in Appendix B). This chemical causes a quiet and apparently painless death that results from uremic poisoning and congestion of major organs (Decino et al. 1966). The birds become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. However, the method appears to result in a less stressful death than that which probably occurs by most natural causes, which are primarily disease, starvation, and predation. For these reasons, WS considers DRC-1339 use to be a relatively humane method of lethal BDM. However, despite the apparent painlessness of the effects of this chemical, some persons will view any method that takes a number of hours to cause death as inhumane and unacceptable.

The chemical Avitrol repels birds by poisoning a few members of a flock, causing them to become hyperactive (see discussion in Appendix B). Their distress calls generally alarm the other birds and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. In most cases where Avitrol is used, only a small percentage of the birds are affected and killed by the chemical with the rest being merely dispersed. In experiments to determine suffering, stress, or pain in affected animals Rowsell, et. al. (1979) tested Avitrol on pigeons and observed subjects for clinical, pathological, or neural changes indicative of pain or distress. None were observed. Conclusions of the study were that the chemical met the criteria for a humane pesticide. Notwithstanding, some persons would view Avitrol as inhumane treatment of the birds that are affected by it based on the birds' distress-like behavior.

Occasionally, birds captured alive by use of the tranquilizer Alpha-chloralose, cage traps, or by hand or with nets would be euthanized. The most common method of euthanization would be by decapitation, cervical dislocation or CO_2 gas which are described and approved by AVMA as humane euthanasia methods (Beaver et al. 2001). Most people would view AVMA approved euthanization methods as humane.

4.1.5.2 Alternative 2 - Non-lethal Bird Damage Management only by WS

Under this alternative, WS would not use lethal methods viewed as inhumane by some persons. However, it is expected that many requesters of BDM assistance would reject non-lethal

methods recommended by WS and/or would not be willing to pay the extra cost of implementing and maintaining them and would seek alternative lethal means. Since DRC-1339 would not be available to non-WS entities, the only chemical BDM methods that could be legally used by these entities would be Avitrol and Starlicide. Avitrol would most likely be viewed as less humane than DRC-1339 because of the distress behaviors that it causes. Shooting could be used by non-WS entities and, similar to the current program alternative, would be viewed by some persons as inhumane. Live trapping/capture and euthanization by decapitation, cervical dislocation or CO_2 gas could be used by these entities. Overall, it is likely that BDM would actually be somewhat less humane with this alternative than under the proposed action alternative.

4.1.5.3 Alternative 3 - Technical Assistance Only

Under this alternative, WS would not conduct any lethal or non-lethal BDM, but would provide self-help advice only. Thus, WS would not use lethal methods viewed as inhumane by some persons. Without WS direct operational assistance, it is expected that many requesters of BDM would reject non-lethal recommendations or would not be willing to pay the extra cost of implementing and maintaining them and would seek alternative lethal means. Similar to Alternative 2, DRC-1339 would no longer be available for use since it is only registered for use by or under the direct supervision of WS personnel. Thus, the only chemical BDM methods legally available would be Avitrol and Starlicide. Avitrol would be viewed by many persons as less humane than DRC-1339 because of the distress behaviors that it causes. Live trapping/capture and euthanization by decapitation, cervical dislocation or CO_2 gas could be used by these entities. Overall, BDM under this alternative would likely be somewhat less humane than the proposed action alternative but slightly more humane than Alternative 4.

4.1.5.4 Alternative 4 - No Federal WS Bird Damage Management

Under this alternative, WS would not use methods viewed as inhumane by some persons. Similar to Alternative 2 and 3, DRC-1339 would no longer be available for use since it is only registered for use by or under the direct supervision of WS personnel. Thus, the only chemical BDM methods legally available would be Avitrol and Starlicide. Avitrol would be viewed by many persons as less humane than DRC-1339 because of the distress behaviors that it causes. Shooting could be used by non-WS entities and, similar to the proposed action alternative, would be viewed by some persons as inhumane. Live trapping/capture and euthanasia by decapitation, cervical dislocation or CO_2 gas could be used by these entities. Overall, BDM under this alternative would likely be less humane than the proposed action alternative.

4.2 CUMULATIVE IMPACTS

Cumulative impacts, as 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.

Under Alternatives 1, 2 and 3, WS would address damage associated with birds in a number of situations throughout the State. The WS BDM program would be the primary federal program with BDM responsibilities; however, some state and local government agencies may conduct BDM activities in Michigan as well. Through ongoing coordination with these agencies, WS is aware of such BDM activities and may provide technical assistance in such efforts. WS does not normally conduct direct damage management activities concurrently with such agencies in the same area, but may conduct BDM activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct BDM activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS BDM program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

Cumulative Impacts on Wildlife Populations

Bird Damage Management methods used or recommended by the WS program in Michigan will likely have no cumulative adverse effects on target and non-target wildlife populations. WS limited lethal take of target bird species is anticipated to have minimal impacts on target bird populations in Michigan, the region and the U.S. When control actions are implemented by WS the potential lethal take of non-target wildlife species is expected to be minimal to non-existent.

Cumulative Impact Potential from Chemical Components

BDM programs which include the use of pesticides as a lethal population management component may have the greatest potential for cumulative impacts on the environment as such impacts relate to deposit of chemical residues in the physical environment and environmental toxicosis. The avicides, DRC-1339 and Starlicide, and the frightening agent, Avitrol, are the only chemicals used or recommended by the Michigan WS BDM program for the purpose of obtaining lethal effects on birds. These chemicals have been evaluated for possible residual effects which might occur from buildup of the chemicals in soil, water, or other environmental sites.

> ***DRC-1339*** exhibits a low persistence in soil or water, and bioaccumulation of the chemical is unlikely (USDA 1997). Additionally, the relatively small quantity of DRC-1339 that will be used in BDM programs in Michigan, the chemical's instability which results in speedy degradation of the product, and application protocol used in WS programs further reduces the likelihood of any environmental accumulation. DRC-1339 is not used by any other entities in Michigan
>
> ***Starlicide*** is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the cumulative impact potential from Starlicide use should be similar to DRC-1339.

Avitrol may be used or recommended by the Michigan WS program. Most applications would not be in contact with soil, applications would not be in contact with surface or ground water, and uneaten baits will be recovered and disposed of according to EPA label specifications. Avitrol exhibits a high persistence in soil and water but, according to literature, does not bioaccumulate (USDA 1997 and EXTOXNET 2000). Because of Avitrol's characteristic of binding to soils, it is not expected to be present in surface or ground water as a result of its use on land (EPA 1980). A combination of chemical characteristics and baiting procedures used by WS would reduce the likelihood of environmental accumulation of Avitrol. The EPA has not required studies on the fate of Avitrol in the soil because, based on use patterns of the avicide, soil residues are expected to be low (EPA 1980).

Based on use patterns, the chemical and physical characteristics of DRC-1339, Starlicide, and Avitrol, and factors related to the environmental fate of these pesticides, no cumulative impacts are expected from the lethal chemical components used or recommended by the WS BDM program in Michigan.

Non-lethal chemicals may also be used or recommended by the WS BDM program in Michigan. Characteristics of these chemicals and use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use in WS BDM programs in Michigan.

Cumulative Impact Potential from Non-chemical Components

Non-chemical methods used or recommended by WS BDM program in may include exclusion through use of various barriers, habitat modification of structures or vegetation, live trapping and translocation or euthanasia of birds, harassment of birds or bird flocks, and shooting.

Because shooting may be considered as a component of the non-chemical, the deposition of lead shot in the environment is a factor considered in this EA.

Lead Shot. Threats of lead toxicosis to waterfowl from the deposition of lead shot in waters where such species fed were observed more than one hundred years ago (Sanderson and Belrose 1986). As a result of discoveries made regarding impacts to several species of ducks and geese, federal restrictions were placed on the use of lead shot for waterfowl hunting in 1991. "Beginning September 1, 1991, the contiguous 48 United States, and the States of Alaska and Hawaii, the Territories of Puerto Rico and the Virgin Islands, and the territorial waters of the United States, are designated for the purpose of Sec. 20.21 (j) as nontoxic shot zones for hunting waterfowl, coots, and certain other species. 'Certain other species' refers to those species, other than waterfowl or coots, affected by reason of being included in aggregate bags and concurrent seasons."

All WS BDM shooting activities conform to federal, state and local laws. If activities are conducted near or over water, WS uses steel shot during activities. Consequently, no

deposition of lead in nontoxic shot zones is likely to occur as a result of WS BDM actions in Michigan. Therefore, cumulative impacts are not likely to occur if toxic shot is used. Additionally, WS will evaluate other BDM actions which entail the use of shot on a case by case basis to determine if deposition of lead shot poses any risk to non-target animals, such as domestic livestock. If such risk exists, WS will use nontoxic shot in those situations.

Roost Harassment/Relocation. Some potential exists for cumulative impacts to human health and safety related to the harassment of roosting bird flocks such as European starlings in urban environments. If birds are dispersed from one site and relocate to another where human exposure to concentrations of bird droppings over time occurs, human health and safety could be threatened. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

SUMMARY

No significant cumulative environmental impacts are expected from any of the four alternatives. Under the Proposed Action, the lethal removal of birds by WS would not have a significant impact on overall starling, pigeon, and sparrow populations in Michigan, but some local reductions may occur. No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists/specialists would conduct and recommend BDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1, 2 and 3 and conduct their own BDM activities, and when no WS assistance is provided in Alternative 4. In all four Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS' participation in BDM activities on public and private lands within the state of Michigan, the analysis in this EA indicates that WS Integrated BDM program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 4-3 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-3. Summary of expected effects of each of the alternatives on each of the issues.

Issues	***Alternative 1*** ***Integrated Bird Damage Management Program (Proposed Action/No Action)***	***Alternative 2*** ***Non-lethal BDM Only by WS***	***Alternative 3*** ***Technical Assistance Only***	***Alternative 4*** ***No Federal WS BDM Program***
Effects on Target Bird Species	Low effect - reductions in local starling, pigeon, and sparrow numbers; would not significantly affect state and regional populations	Low effect - reductions in local starling, pigeon, and sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations.	No effect by WS. Low effect - reductions in local starling, pigeon, and sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations.	No effect by WS. Low effect - reductions in local starling, pigeon, sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations
Effects on Other Wildlife Species, Including T&E Species	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	No effect by WS. Impacts by non-WS personnel would be variable.	No effect by WS. Impacts by non-WS personnel would be variable.
Effects on Public Health and Safety	The proposed action has the greatest potential of successfully reducing this risk.	Impacts could be greater under this alternative than the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater potential of not reducing bird damage than under the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater potential of not reducing bird damage than under the proposed action.
Aesthetic Enjoyment of Birds	Low to moderate effect at local levels; Some local populations may be reduced; WS bird damage management activities do not adversely affect overall regional or state starling, pigeon, and sparrow populations.	Low to moderate effect. Local bird 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 affect on overall regional and state starling, pigeon, and sparrow populations.	Low to moderate effect. Local bird numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state starling, pigeon and sparrow populations.	Low to moderate effect. Local bird numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state starling, pigeon, and sparrow populations.
Aesthetic Damage Caused by Birds	Low effect - bird damage problems most likely to be resolved without creating or moving problems elsewhere.	Moderate to High effect - birds may move to other sites which can create aesthetic damage problems at new sites. Less likely than Alt. 1 and 4.	Moderate to High effect - birds may move to other sites which can create aesthetic damage problems at new sites.	High effect - bird problems less likely to be resolved without WS involvement. Birds may move to other sites which can create aesthetic damage problems at new sites

Issues	*Alternative 1* ***Integrated Bird Damage Management Program (Proposed Action/No Action)***	*Alternative 2* ***Non-lethal BDM Only by WS***	*Alternative 3* ***Technical Assistance Only***	*Alternative 4* ***No Federal WS BDM Program***
Humaneness and Animal Welfare Concerns of Methods Used	Low to moderate effect - methods viewed by some people as inhumane would be used by WS.	Lower effect than Alt. 2 since only non-lethal methods would be used by WS	No effect by WS. Impacts by non-WS personnel would be variable.	No effect by WS. Impacts by non-WS personnel would be variable.

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APPENDIX A

LITERATURE CITED

Audubon. 2003. West Nile Virus – Effects on Wildlife. www.audubon.org/bird/wnv/

AVMA (American Veterinary Medical Association). 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquim on Recognition and Alleviation of Animal Pain and Distress. 191:1186-1189.

Arhart, D.K. 1972. Some factors that influence the response of European starlings to aversive visual stimuli. M.S. Thesis. Oregon State University Corvallis.

_____ , M.L., J.S. Humphrey, and D.G. Decker. 1997. Feeding deterrence of anthraquinone, anthracene, and anthrone to rice-eating birds. J. Wildl. Manage. 61(4):1359-1365.

Barnes, T.G. 1991. Eastern bluebirds, nesting structure design and placement. College of Agric. Ext. Publ. FOR-52. Univ. of Kentucky, Lexington, KY, 4pp.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B.T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Franis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B.Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. J. Am. Vet Med Assoc 218:669-696.

Belant, J. L., T. W. Seamans, L. A. Tyson, and S. K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naive Canada geese. J. Wildl. Manage. 60:923-928.

Besser, J.F., W. C. Royal, and J. W. DeGrazio. 1967. Baiting European starlings with DRC-1339 at a cattle feedlot. J. Wildl. Manage. 3:48-51.

_____ , J. W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering European starlings and red-winged blackbirds at feedlots. Journal of Wildl. Manage. 32:179-180.

Bishop, R. C. 1987. Economic values defined. Pages 24 -33 in D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackwell, B.F., G.E. Bernhardt, R.A. Dolbeer. 2002. Lasers as nonlethal avian repellents. J. Wildl. Manage. 66:250-258.

Blanton, E. M., B. U. Constantin, and G. L. Williams. 1992. Efficacy and methodology of urban pigeon control with DRC-1339. Proc. East. Wildl. Damage Cont. Conf. 5:58-62.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring European starlings. Wild. Soc. Bull. 18:(2):151-156.

Boyd, F. L., and D. I. Hall. 1987. Use of DRC 1339 to control crows in three roosts in Kentucky and Arkansas. Third Eastern Wildlife Damage Control Conference 3:3-7

CDFG (California Department of Fish and Game). 1991. California department of fish and game. Final environmental document - bear hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13pp.

Center for Disease Control and Prevention (CDC). 2003. West Nile Virus. www.cdc.gov.ncidod/dvbid/westnile/birds&mammals.htm.

Clark, L. 1997. Dermal contact repellents for European starlings: foot exposure to natural plant products. J. Wildl. Manage. 61(4): 1352-1358.

Cleary, E.C., S.E. Wright, and R.A. Dolbeer. 1998. Wildlife Strikes to civil aircraft in the United States 1991-1997. U.S. Dept. of Trans., Federal Aviation Admin. Ser. Rep. No.4. Washington, D.C. 34 pp.

_____, E. C., S. E. Wright, and R. A. Dolbeer. 2000. Wildlife Strikes. U.S. Dept. of Trans., Federal Aviation Administration National Wildlife Strike Database Serial Report Number 6. Washington, DC. 61pp.

Conover, M. R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Cornell University. 2003. West Nile Virus: Transmission, Infection, & Symptoms. Environmental Risk Analysis Program, Cornell University – Department of Communication & Center for the Environment. http://environmentalrisk.cornell.edu/WNV/Summary2.cfm

Cummings, J. L., P. A. Pochop, J. E. Davis Jr., and H. W. Krupa. 1995. Evaluation of Rejex-It AG-36 as a Canada goose grazing repellent. J. Wildl. Manage. 59:47-50

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in European starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Davis, J.W., R.C. Anderson, L. Karstad, and D.O. Trainer. 1971. Infectious and Parasitic Diseases of Wild Birds. Iowa State University Press, Ames, Iowa.

Day, G. I., S. D. Schemnitz, and R. D. Taber. 1980. Capturing and marking wild animals. pp.

61-88 *in* Wildlife management techniques manual. S. D. Schemnitz ed. The Wildlife Society, Inc. Bethesda, MD. 686 pp.

Decino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to European starlings. J. Wildl.\ Manage. 30(2):249-253.

Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, 424 p.

DeHaven, R.W. and J.L. Guarino. 1969. A nest box trap for European starlings. Bird Banding 40:49-50.

Dolbeer, Richard A.; Woronecki, Paul P.; Stickley, Allen R., Jr. and White, Stephen B. 1978. Agricultural impact of winter population of blackbirds and starlings. Wilson Bull.:90 (1): 31-44.

_____ , P.P. Woronecki, and R.L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

_____ , M.A. Link, and P.P. Woronecki. 1988. Naphthalene shows no repellency for European starlings. Wildl. Soc. Bull. 16:62-64.

_____ , L. Clark, P.P. Woronecki, and T.W. Seamans. 1992. Pen tests of methyl anthranilate as a bird repellent in water. Proc. East. Wildl. Damage Control Conf. 5:112-116.

_____ , J.L. Belant, and L. Clark. 1993. Methyl anthranilate formulations to repel birds from water at airports and food at landfills. Proc. Great Plains Wildl. Damage Contr. Workshop. 11:42-52.

_____ , R.A. 1994. Blackbirds: damage prevention and control methods for blackbirds. pp E-25 to E-32 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

_____ , R. A. 1997. Feathered and furry fod - a serious problem at U. S. airports. Bird Strike Briefing, National Aerospace FOD Prevention Conf., 24-26 June 1997, Seattle WA. USDA / Wildl. Serv., National Wildl. Res. Ctr., Ohio Field Sta., 6100 Columbus Ave., Sandusky, OH 44870 USA.

_____ , T.W. Seamans, B.F. Blackwell, J.L. Belant. 1998. Anthraquinone formulation (Flight Control™) shows promise as avian feeding repellent. J. Wildl. Manage. 62(4)1558-1564.

Ehrlich, P. R.., D. S. Dobkin, and D. Wheye. 1988. The birder_s handbook: a field guide to the natural history of North American birds. Simon & Schuster, Inc. New York. 785pp.

EPA (U.S. Environmental Protection Agency). 1980 (Sept.). Pesticide registration standard: 4-aminopyridine: avitrol. Office of Pesticides and Toxic Substances. Washington, DC.

_____ . 1995. R.E.D. Facts — Starlicide (3-chloro-p-toluidine hydrochloride). USEPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003. 4 p.

_____ . 1997. 4-Aminopyridine. Health Assessment Information. Taken from USEPA IRIS data file No. 504-24-5 (03/01/97) at Internet site http://www.epa.gov/ngispgm3/irisdat/0440.DAT

ETOXNET (Extension Toxicology Network). 1996. 4-Aminopyridine. Pesticide Information Profiles. Coop. Ext. Offices at Cornell Univ., OR State Univ., Univ. of ID, Univ. of CA-Davis, and the Instit. for Envir. Toxicology, MI State Univ. Information taken from Internet site http://ace.ace.orst.edu/info/extoxnet/pips/4-aminop.htm.

_____ . 2000. 4-Aminopyridine. Pesticide Information Profiles. Coop. Ext. Offices at Cornell Univ., OR State Univ., Univ. of ID, Univ. of CA-Davis, and the Instit. for Envir. Toxicology, MI State Univ. Information taken from Internet site http://pmep.cce.cornell.edu/profiles/ extoxnet/24d-captan/4aminopyridine-ext.html

Feare, C., A.J. Isaacson, P.A. Sheppard, and J.M. Hogan. 1981. Attempts to reduce starling damage at dairy farms. Protection Ecol. 3(2):173-181.

_____ . 1984. The Starling. Oxford University Press. Oxford New York.

Fitzwater, W. D. 1994. House Sparrows. pp. E101-108 *in* Prevention and control of wildlife damage. S. Hygnstrom, R. Timm, and G. Larson eds. Coop. Ext. Serv. Univ. of Nebr.-Lincoln.

Forbes, J.E. 1995. European starlings are expensive nuisance on dairy farms. Ag. Impact. 17(1):4.

Fuller-Perrine, L.D. and M.E. Tobin. 1993. A method for applying and removing bird exclusion netting in commercial vineyards. Wildl. Soc. Bull. 21:47-51.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. Proc. Great Plains Wildl. Damage Control Workshop. 5:273-277.

_____ . 1983. Blackbird and starling depredations at Tennessee livestock farms. Proc. Bird Control Semin. 9:125-134.

_____ , and D.L. Otis. 1981. Approach for assessing feed loss damage by European starlings

at livestock feedlots. ASTM Spec. Tech. Publ. No.752. p.38-45.

_____ , and D.L. Otis. 1986. Factors influencing blackbird and European starling damage at livestock feeding operations. J. Wildl. Manage. 50:15-19.

_____ , S.K. Timbrook, and D.J. Twedt. 1987. Temporal use patterns of wintering European starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

_____ , and E. A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

_____, G. Ellis, P. Fiornelli, and B. Dorr. 2000. Evaluation of low to moderate power lasers for dispering double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference. 9:34-35.

Grabill, B.A. 1977. Reducing starling use of wood duck boxes. Wildl. Soc. Bull. 5(2):67-70.

Graves, G. E., and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Heusmann, H.W., W.W. Blandin, and R.E. Turner. 1977. Starling deterrent nesting cylinders in wood duck management. Wildl. Soc. Bull. 5(1):14-18.

_____ , and R. Bellville. 1978. Effects of nest removal on starling populations. Wilson Bull. 90(2):287-290.

Holler, N. R. and E. W. Schafer. 1982. Potential secondary hazards of Avitrol baits to sharp-shinned hawks and American kestrels. J. Wildl. Manage. 46:457-462

Ingold, D.J. 1994. Influence of nest site competition between European starlings and woodpeckers. Wilson Bull 1106(2):227-241.

Johnson, R. J. 1994. American crows. Pages E33-40 in S.E. Hyngstrom, R. M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska. Lincoln, NE.

_____, R.J., and J.F. Glahn. 1994. European starlings. p. E-109 - E-120 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

_____, J. J., D. B. Hurlbut, M. L. Avery, and J. C. Rhyans. 1999. Methods for the diagnosis

of acute 3-chloro-p-toluidine hydrochloride poisoning in birds and the estimation of secondary hazards to wildlife. Environ. Toxicology and Chemistry. 18:2533-2537.

Knittle, C.E. and J.L. Guarino. 1976. Reducing a local population of European starlings with nest-box traps. Proc. Bird Control. Semin. 7:65-66.

Kreps, L. B. 1974. Feral pigeon control. Proc. Vertebr. Pest. Conf. 6:257-262.

Kerpez, T.A. and N.S. Smith. 1990. Competition between European starlings and native woodpeckers for nest cavities in saguaros. Auk. 107:367-375.

Larsen, K. H., and J. H. Dietrich. 1970. Reduction of a raven population on lambing grounds with DRC-1339. J. Wildl. Manage. 34:200-204.

Mason, J.R., R.E. Stebbings and G.P. Winn. 1972. Noctules and European starlings competing for roosting holes. J. Zool. 166:467.

_____ , A. H. Arzt, and R.F. Reidinger. 1984. Evaluation of dimethylanthranilate as a nontoxic starling repellent for feedlot settings. Proc. East. Wildl. Damage Control Conf. 1:259-263.

_____ , M.A. Adams, and L. Clark. 1989. Anthranilate repellency to European starlings: chemical correlates and sensory perception. J. Wildl. Manage. 53:55-64.

_____ , and L. Clark. 1992. Nonlethal repellents: the development of cost-effective, practical solutions to agricultural and industrial problems. Proc. Vertebr. Pest Conf. 15:115-129.

McCracken H.F. 1972. Starling control in Sonoma County. Proc. Vertebr. Pest Conf. 5:124-126.

McGilvrey, F.B. and F.M. Uhler. 1971. A starling deterrent wood duck nest box. J. Wildl. Manage. 35:793-797.

Miller, J.W. 1975. Much ado about European starlings. Nat. Hist. 84(7):38-45.

Morbidity and Mortality Weekly Report (MMWR). 2002. Provisional Surveillance Summary of the West Nile Virus Epidemic – United States, January-November 2002. Center for Disease and Surveillance; December 20, 2002. Vol. 51; No. 50.

Mott. D.F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Conf. 2:156-162.

National Audubon Society. 2002. The Christmas Bird Count Historical Results. www.audubon.org/bird/cbc. August 2003.

Nickell, W.P. 1967. European starlings and sparrow hawks occupy same nest box. Jack-Pine Warbler 45:55

NTSB (National Transportation Safety Board). 1999. Safety Recommendation to the Federal Aviation Administration, Washington, D.C. 20591. A-99-86 through -94.

Pochop, P.A. 1998. Comparison of white mineral oil and corn oil to reduce hatchability of ring-billed gull eggs. Proc. Vertebr. Pest Conf. 18:411-413.
_____ , J.L. Cummings, J.E. Steuber, and C.A. Yoder. 1998. Effectiveness of several oils to reduce hatchability of chicken eggs. J. Wildl. Manage. 62(1):395-398.

Rappole, J.H., S.R. Derrickson, and Z. Hubalek. 2000. Migratory birds and the spread of West Nile virus in the Western Hemisphere. Emerging Infectious Diseases 6(4):319-328.

RJ Advantage, Inc. 1997.

Robbins, C. S., B. Bruun, and H. S. Zim. 1983. A guide to field identification birds of North America. Golden books publ. Co., Inc., Racine, Wisconsin. 360pp.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving European starlings from their sleeping areas. Emberiza 2(3):176-179.

Rowsell, E. V.; Carnie, J. A.; Wahbi, S. D.; Al-Tai, A. H. and Rowsell, Kathleen V. 1979. L-serine dehydratase and L-serine-pyruvate aminotransferase activities in different animal species. Comp. Biochem. Physiol. B Comp. Biochem.; 63 (4): 543-555.

Royall, T.J. DeCino, and J.F. Besser. 1967. Reduction of a Starling Population at a Turkey Farm. Poultry Science. Vol. XLVI No. 6. pp 1494-1495.

Sanderson, Glen C., and Frank C. Bellrose. 1986. A review of the problem of lead poisoning in waterfowl. Illinois Natural History Survey, Champaign, IL. Spec. Publ. 4. Jamestown ND: Northern Prairie Wildl. Res. Ctr. Home Page. Http://www.npwrc.usgs.gov/resource/othrdata/pbpoison/pbpoison.htm (Version 170CT97). 34pp.

Sauer, J. R., S. Schwartz, and B. Hoover. 1996. The Christmas bird count home page. Version 95.1. Patuxent Wildlife Research Center, Laurel, MD (Info. retreived from http://www.mbr-pwrc.usgs.gov/bbs/cbc.html).

_____., J. E. Hines, and J. Fallon. 2001. The North American breeding bird survey, results and analysis 1996 - 2000. Version 2001.2, USGS Patuxent Wildlife Research Center. Laurel, MD.

_____., J. E. Hines, and J. Fallon. 2003. The North American breeding bird survey, results and analysis 1996 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center. Laurel, MD.

Schafer, E. W., Jr. 1981. Bird control chemicals – nature, modes of action, and toxicity. Pages 129-139 in CRC handbook of pest management in agriculture. Vol. 3. CRC Press, Cleveland, OH.

_____, E. W., Jr. 1984. Potential primary and secondary hazards of avicides. Proc. Vert. Pest Conf. 11:217-222.

_____, E. W. 1991. "Bird control chemicals-nature, mode of action and toxicity." pp. 599-610 *in* CRC Handbook of Pest Management in Agriculture Vol. II. CRC Press, Cleveland, OH.

Schmidt, R.H. and R.J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Seamans, T.W., D.W. Hamershock, and G.E. Bernhardt. 1995. Determination of body density for twelve bird species. Ibis 137:424-428.

Shake, W.F. 1967. Starling wood duck interrelationships. M.S. Thesis. Western Illinois University, Macomb.

Shirota, Y.M. and S. Masake. 1983. Eyespotted balloons are a device to scare gray European starlings. Appl. Ent. Zool. 18:545-549.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Stickley, A.R. and R.J. Weeks. 1985. Histoplasmosis and its impact on blackbird/starling roost management. Proc. East. Wildl. Damage Control. Conf. 2:163-171.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds. Wings Bros. New York, New York.

Tobin, M. E., P. P. Woronecki, R. A. Dolbeer, R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

Twedt, D.J., and J.F. Glahn. 1982. Reducing starling depredations at livestock feeding operations through changes in management practices. Proc. Vertebr. Pest Conf. 10:159-163.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC) Strategic Plan. 1989. USDA, APHIS, ADC Operational

Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

_____ , (APHIS) Animal and Plant Health Inspection Service, (ADC) Animal Damage Control Program. 1997. Final Environmental Impact Statement. USDA, APHIS, ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

United States Geological Survey (USGS)-National Wildlife Health Center (NWHC). 2003. NWHC West Nile Virus Project. www.nwhc.usgs.gov/research/west_nile.html

U.S. Fish & Wildlife Service. 1981. Domestic Pigeon. USDI,, 4 pp.

Vogt, P.F. 1997. Control of nuisance birds by fogging with REJEX-IT®TP-40. Proc. Great Plains Wildl. Damage Contr. Workshop 13. p. 63-66.

Von Jarchow, B.L. 1943. European starlings frustrate sparrow hawks in nesting attempt. Passenger Pigeon. 5(2):51.

Weber, W.J. 1979. Health Hazards from Pigeons, European starlings, and English Sparrows. Thompson Publ. Fresno, Calif. 138 p.

Weitzel, N.H. 1988. Nest site competition between the European starling and native breeding birds in northwestern Nevada. Condor. 90(2):515-517.

West, R.R., J.F. Besser and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. Proc. Vertebr. Pest Conf. San Francisco, CA.

_____ , and J.F. Besser. 1976. Selection of toxic poultry pellets from cattle rations by European starlings. Proc. Bird Control Semin. 7:242-244.

Wildlife Society, The. 1990. Conservation policies of the Wildlife Society. The Wildlife Society. Wash., D.C. 20 pp.

Williams, R. E. 1983. Integrated management of wintering blackbirds and their economic impact at south Texas feedlots. Ph.D. Dissertation, Tex. A&M Univ., College Station. 282 pp.

Williams, D.E., and R.M. Corrigan. 1994. Pigeons (Rock Doves). pp E-87 to E-96 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Wilmer, T.J. 1987. Competition between European starlings and kestrels for nest boxes: a review. Raptor Res. Rep. No. 6 p. 156-159.

Woronecki, P. P., R. A. Dolbeer, and T. W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Proc. Vertbr. Pest Conf. 14:343-349.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. Bull. OEPP. 9:85-89.

APPENDIX B

BIRD DAMAGE MANAGEMENT (BDM) METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE MICHIGAN WILDLIFE SERVICES PROGRAM

NON-LETHAL METHODS – NON-CHEMICAL

Agricultural Producer and Property Owner Practices. These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Cultural methods and other management techniques are implemented by the agricultural producer or property owners/managers. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include:

Cultural methods. These may include altering planting dates so that crops are not young and more vulnerable to damage when the damage-causing species is present, or the planting of crops that are less attractive or less vulnerable to such species. At feedlots or dairies, cultural methods generally involve modifications to the level of care or attention given to livestock which may vary depending on the age and size of the livestock. Animal husbandry practices include but are not limited to techniques such as night feeding, indoor feeding, closed barns or corrals, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994).

Environmental/habitat modification can be an integral part of BDM. Wildlife production and/or presence is directly related to the type, quality, and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species or to repel certain birds. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of BDM strategies at or near airports to reduce bird aircraft strike problems by eliminating bird nesting, roosting, loafing, or feeding sites. Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat management is often necessary to minimize damage caused by crows, blackbirds, and starlings that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees or

selectively thinning the stand.

Animal Behavior Modification. This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of scare tactics or fencing to deter or repel animals that cause loss or damage (Twedt and Glahn 1982).
Some but not all methods that are included by this category are:

- Bird-proof barriers
- Electronic guards
- Propane exploders
- Pyrotechnics
- Distress Calls and sound producing devices
- Chemical frightening agents
- Repellents
- Scare crows
- Mylar tape
- Eye-spot balloons
- Lasers

These techniques are generally only practical for small areas. Scaring devices such as distress calls, helium filled eye spot balloons, raptor effigies and silhouettes, mirrors, and moving disks can be effective but usually for only a short time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota et al. 1983, Conover 1982, Arhart 1972). Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et al. 1988).

Bird proof barriers can be effective but are often cost-prohibitive, particularly because of the aerial mobility of birds which requires overhead barriers as well as peripheral fencing or netting. Exclusion adequate to stop bird movements can also restrict movements of livestock, people and other wildlife (Fuller-Perrine and Tobin 1993).

Netting can be used to exclude birds from a specific area by the placement of bird proof netting over and around the specific resource to be protected. Exclusion may be impractical in most settings (e.g., commercial agriculture), however it can be practical in small areas (e.g., personal gardens) or for high-value crops (e.g., grapes) (Johnson 1994). Although this alternative would provide short-term relief from damage, it may not completely deter birds from feeding, loafing, staging, or roosting at that site. A few people would find exclusionary devices such as netting unsightly, trashy, and a lowering of the aesthetic value of the neighborhood when used over personal gardens.

Auditory scaring devices such as propane exploders, pyrotechnics, electronic guards, scare crows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective but usually only for a short

period of time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Mott 1985, Shirota and Masake 1983, and Arhart 1972). Williams (1983) reported an approximate 50% reduction in blackbirds at two south Texas feedlots as a result of pyrotechnics and propane cannon use. However, they are often not practical in dairy or feedlot situations because of the disturbance to livestock, although livestock can generally be expected to habituate to the noise. Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Visual scaring techniques such as use of mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, effigies (scarecrows), sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et.al. 1986, and Tobin et.al. 1988). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Lasers are a non-lethal technique recently evaluated by the USDA, APHIS, WS, National Wildlife Research Center (NWRC) (Blackwell et al. 2002, Glahn et al. 2000). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallard with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002). As with other BDM tools, lasers are most effective when used as part of an integrated management program.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has proven effective in some applications.

Lure crops/alternate foods. When depredations cannot be avoided by careful crop selection or

modified planting schedules, lure crops can sometimes be used to mitigate the loss potential. Lure crops are planted or left for consumption by wildlife as an alternative food source. This approach provides relief for critical crops by sacrificing less important or specifically planted fields.

Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area.

NON-LETHAL METHODS - CHEMICAL

Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol, however, is not completely non-lethal in that a small portion of the birds are generally killed (Johnson and Glahn 1994). Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, gulls, blackbirds, starlings, and English sparrows in various situations.

Avitrol treated bait is placed in an area where the targeted birds are feeding and usually a few birds will consume a treated bait and become affected by the chemical. The affected birds then broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used during anytime of the year, but is used most often during winter and spring. Any granivorous bird associated with the target species could be affected by Avitrol. Avitrol is water soluble, but laboratory studies demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol may form covalent bonds with humic materials, which may serve to reduce its availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991).

Avitrol is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and crows appear to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published Lethal Dose (LD_{50}) in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. Some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Holler and Shafer 1982, Schafer 1981). A formal Risk Assessment found no probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for non-target indicator species tested on this

compound (USDA 1997, Appendix P).

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be a promising repellent for many bird species, including waterfowl (Dolbeer et al. 1993). Cummings et al. (1995) found effectiveness of MA declined significantly after 7 days. Belant (1996) found MA ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. MA is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et al. 1984; Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[4]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[5]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992; RJ Advantage, Inc. 1997). It has been listed as "Generally Recognized as Safe" (GRAS) by the U.S. Food and Drug Administration (FDA) (Dolbeer et al. 1992).

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb. with retreating required every 3-4 weeks (RJ Advantage, Inc. 1997). Cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water (RJ Advantage, Inc. 1997) which indicates the repellent effect is short-lived.

Another potentially more cost effective method of MA application is by use of a fog-producing

[4] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

[5] An LC_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being nonirritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site (Dr. P. Vogt, RJ Advantage, Inc., pers. comm. 1997). Applied at a rate of about .25 lb./ acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or the FDA.

Particulate feed additives have been investigated for their bird-repellent characteristics. In pen trials, European starlings rejected grain to which charcoal particles were adhered (L. Clark, NWRC, pers. comm. 1999). If further research finds this method to be effective and economical in field application, it might become available as a bird repellent on livestock feed. Charcoal feed additives have been explored for use in reducing methane production in livestock and should have no adverse effects on livestock, on meat or milk production, or on human consumers of meat or dairy products (L. Clark, NWRC, pers. comm. 1999).

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998). Compounds extracted from common spices used in cooking and applied to perches in cage tests have been shown repellent characteristics against roosting European starlings (Clark 1997). Naphthalene (moth balls) was found to be ineffective in repelling European starlings (Dolbeer et al. 1988).

Tactile repellents. A number of tactile repellent products are on the market which reportedly deter birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1992). The repellency of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by running down the sides of buildings in hot weather.

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove nuisance waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981), but is typically used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment.

Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening, therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990) but the compound is not generally soluble in water and therefore should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, nontarget species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

Egg oiling is a method for suppressing reproduction of nuisance birds by spraying a small quantity of food grade vegetable oil or mineral oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos and has been found to be 96-100% effective in reducing hatchability. (Pochop 1998; Pochop et al. 1998). The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not renest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under FIFRA. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling.

LETHAL METHODS - MECHANICAL

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally shooting is conducted with shotguns, rifles or air rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997). It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire rifles is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. All firearm safety precautions are followed by WS when conducting BDM activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. 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 every 2 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Live traps include:

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Nest box traps may be used by WS for corrective damage management and are effective in capturing local breeding and post breeding European starlings and other targeted secondary cavity nesting birds (DeHaven and Guarino 1969, Knittle and Guarino 1976). Trapped birds are euthanized. Relocation to other areas following live capture would not generally be effective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and relocation would most likely result in bird damage problems at the new location. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats.

Mist nets are more commonly used for capturing small-sized birds such as English sparrows, finches, etc. but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. It was introduced in to the United States in the 1950's from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping "pockets" in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds such as pigeons, feral ducks, and waterfowl and use mortar projectiles to propel a net up and over birds which have been baited to a particular site. This type of net is especially effective for waterfowl that are

flightless due to molting and other birds which are typically shy to other types of capture.

Cervical dislocation is sometimes used to euthanize birds which are captured in live traps. The bird is stretched and the neck is hyperextended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and other small birds (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciouness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

Snap traps are modified rat snap traps used to remove individual woodpeckers, European starlings, and other cavity using birds. The trap treadle is baited with peanut butter or other food attractants and attached near the damage area caused by the offending bird. These traps pose no imminent danger to pets or the public, and are usually located in positions inaccessible to people and most non-avian animals. They are very selective because they are usually set in the defended territory of the target birds.

LETHAL METHODS - CHEMICAL

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA). WS personnel that use restricted-use chemical methods are certified as pesticide applicators by the Michigan Department of Agriculture 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.

CO2 is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (Beaver et al. 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Starlicide® (3-chloro-p-toluidine hydrochloride) is a restricted use pesticide that is formulated as a 0.1% ready-to-use product and is commercially available to certified applicators or persons under their supervision. This avicide may be recommended or used by WS to control ravens, European starlings, crows, pigeons, cowbirds, grackles, magpies, and certain gull species. Starlicide may be used in feedlots, around buildings and fenced non-crop areas, bird staging and roosting areas, federal and state wildlife refuges, and other sites (EPA 1995). Starlicide is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the properties of this product are similar to DRC-1339 (discussed below).

DRC-1339 is the principal chemical method that would be used for bird damage management in the proposed action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (West et al. 1967, Besser et al. 1967, Decino et al. 1966). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird/starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), dispersing crows roosts in urban/suburban areas (Boyd and Hall 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Johnson et al. 1999, Schafer 1991, 1981). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors (Schafer 1981), sparrows, and eagles are classified as non-sensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to non-target and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits, except crows eating gut contents of pigeons (Kreps 1974). During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent (Johnson et al. 1999, Schafer 1991, 1984). DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997). Appendix P of USDA (1997) contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion. That assessment concluded that no adverse effects are expected from use of DRC-1339.

DRC 1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the bird damage management project. Michigan WS used or supervised the use of an average of 1281 grams of DRC-1339 per year for the past 5 years (Table B-1).

Table B-1. DRC-1339 Used by Michigan WS.

FY	EPA Reg.	Species	Quantity Used (grams)
1998	56228-10	starlings	188
1999	56228-10	starlings	104
2000	56228-10	starlings	865
2001	56228-10	starlings	2000
2002	56228-10	starlings	3249

APPENDIX C

MICHIGAN FEDERAL ENDANGERED AND THREATENED SPECIES
U.S. FISH AND WILDLIFE SERVICE
EAST LANSING, MICHIGAN

Mammals

1. Gray wolf (T)
2. Indiana bat (E)
3. Eastern cougar (E, X)
4. Canada lynx (PT, X)

Birds

1. Kirtland's warbler (E)
2. Piping plover (E)
3. Bald eagle (T)

Reptiles

1. Northern copperbelly watersnake (T)

Insects

1. Mitchell's satry butterfly (E)
2. Karner blue butterfly (E)
3. Hungerford's crawling water beetle (E)
4. American burying beetle (E)
5. Hine's emerald dragonfly (E)

Mussels

1. Northern riffleshell (E)
2. Clubshell (E)

Plants

1. Michigan monkey-flower (E)
2. Pitcher's thistle (T)
3. Houghton's goldenrod (T)
4. Dwarf lake iris (T)
5. Eastern prairie fringed orchid (T)
6. American hart's-tongue fern (T)
7. Lakeside daisy (E)
8. Small whorled pogonia (T)

E = endangered; T = threatened; PT = proposed threatened
X = not currently found, status uncertain in Michigan

Appendix D
Michigan State Endangered and Threatened

R 299.1022 Insects.

Rule 2. (1) The following species of insects are included on the state list of endangered species:

(a) *Brychius hungerfordi* Spangler beetle	Hungerford's crawling water
(b) *Catocala amestris* Strecker	Three-staff underwing
(c) *Neonympha mitchellii mitchellii* French	Mitchell's satyr
(d) *Nicrophorus americanus* Olivier	American burying beetle
(e) *Schinia indiana* (Smith)	Phlox moth
(f) *Schinia lucens* (Morrison)	Leadplant moth
(g) *Somatochlora hineana* Williamson	Hine's emerald dragonfly
(h) *Speyeria idalia* (Drury)	Regal fritillary

(2) The following species of insects are included on the state list of threatened species:

(a) *Atrytonopsis hianna* Scudder	Dusted skipper
(b) *Erynnis persius persius* Scudder	Persius dusky wing
(c) *Euphyes dukesi* (Lindsey)	Dukes' skipper
(d) *Hesperia ottoe* Edwards	Ottoe skipper
(e) *Incisalia irus* Godart	Frosted elfin
(f) *Lepyronia gibbosa* Ball	Great Plains spittlebug
(g) *Lycaeides idas nabokovi* Masters	Northern blue
(h) *Lycaeides melissa samuelis* Nabakov	Karner blue
(i) *Oarisma powesheik* (Parker)	Powesheik skipperling
(j) *Papaipema silphii* Bird	Silphium borer moth
(k) *Trimerotropis huroniana* E. M. Walker	Lake Huron locust

R 299.1023 Fishes.

Rule 3. (1) The following species of fishes are included on the state list of endangered species:

(a) *Clinostomus elongatus* (Kirtland)	Redside dace
(b) *Erimyzon oblongus* (Mitchill)	Creek chubsucker
(c) *Notropis photogenis* (Cope)	Silver shiner
(d) *Noturus stigmosus* Taylor	Northern madtom
(e) *Opsopoeodus emiliae* Hay	Pugnose minnow
(f) *Percina shumardi* (Girard)	River darter
(g) *Percina copelandi* (Jordan)	Channel darter
(h) *Phoxinus erythrogaster* (Rafinesque)	Southern redbelly dace

(2) The following species of fishes are included on the state list of threatened species:

(a) *Acipenser fulvescens* Rafinesque	Lake sturgeon
(b) *Ammocrypta pellucida* (Putnam)	Eastern sand darter
(c) *Coregonus artedii* Lesueur	Cisco or lake herring
(d) *Coregonus zenithicus* (Jordan and Evermann)	Shortjaw cisco
(e) *Hiodon tergisus* Lesueur	Mooneye
(f) *Moxostoma carinatum* (Cope)	River redhorse
(g) *Stizostedion canadense* (Smith)	Sauger

(3) The following species of fishes are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

(a) *Coregonus johannae* (Wagner)	Deepwater cisco
(b) *Coregonus nigripinnis* (Gill)	Blackfin cisco

Species

(c) *Coregonus reighardi* (Koelz)	Shortnose cisco
(d) *Notropis amblops* (Rafinesque)	Bigeye chub
(e) *Notropis chalybaeus* (Cope)	Ironcolor shiner
(f) *Notropis texanus* (Girard)	Weed shiner
(g) *Polyodon spathula* (Walbaum)	Paddlefish
(h) *Stizostedion vitreum glaucum* (Hubbs)	Bluepike
(i) *Thymallus arcticus* (Richardson)	Arctic grayling

R 299.1024 Amphibians.

Rule 4. (1) The following species of amphibians is included on the state list of endangered species:

Ambystoma texanum (Matthews)	Smallmouth salamander

(2) The following species of amphibians is included on the state list of threatened species:

Ambystoma opacum (Gravenhorst)	Marbled salamander

R 299.1025 Reptiles.

Rule 5. (1) The following species of reptiles are included on the state list of endangered species:

(a) *Clonophis kirtlandii* (Kennicott)	Kirtland's snake
(b) *Nerodia erythrogaster neglecta* (Conant)	Copperbelly watersnake

(2) The following species of reptiles are included on the state list of threatened species:

(a) *Elaphe vulpina gloydi* Conant	Eastern fox snake
(b) *Clemmys guttata*	Spotted turtle

R 299.1026 Birds.

Rule 6. (1) The following species of birds are included on the state list of endangered species:

(a) *Asio flammeus* (Pontoppidan)	Short-eared owl
(b) *Charadrius melodus* Ord	Piping plover
(c) *Dendroica discolor* (Vieillot)	Prairie warbler
(d) *Dendroica kirtlandii* (Baird)	Kirtland's warbler
(e) *Falco peregrinus* Tunstall	Peregrine falcon
(f) *Lanius ludovicianus migrans* (Palmer)	Migrant loggerhead shrike
(g) *Rallus elegans* Audubon	King rail
(h) *Tyto alba* (Scopoli)	Barn owl

(2) The following species of birds are included on the state list of threatened species:

(a) *Ammodramus henslowii* Audubon	Henslow's sparrow
(b) *Asio otis* (Linnaeus)	Long-eared owl
(c) *Buteo lineatus* (Gmelin)	Red-shouldered hawk
(d) *Corturnicops noveboracensis* (Gmelin)	Yellow rail
(e) *Dendroica dominica* (Linnaeus)	Yellow-throated warbler
(f) *Falco columbarius* (Linnaeus)	Merlin
(g) *Gavia immer* (Brunnich)	Common loon
(h) *Haliaeetus leucocephalus* (Linnaeus)	Bald eagle
(i) *Ixobrychus exilis* (Gmelin)	Least bittern
(j) *Pandion haliaetus* (Linnaeus)	Osprey
(k) *Sterna caspia* Pallas	Caspian tern
(l) *Sterna hirundo* Linnaeus	Common tern
(m) *Cygnus buccinator* Richardson	Trumpeter swan

(3) The following species of birds are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

Chondestes grammacus (Say)	Lark sparrow

R 299.1027 Mammals.

Rule 7. (1) The following species of mammals are included on the state list of endangered species:

(a) *Canis lupus* Linnaeus	Gray wolf
(b) *Felis concolor* Linnaeus	Cougar
(c) *Lynx canadensis* Kerr	Lynx
(d) *Microtus ochrogaster* (Wagner)	Prairie vole
(e) *Myotis sodalis* Miller and Allen	Indiana bat

(2) The following species of mammals is included on the state list of threatened species:

Cryptotis parva (Say)	Least shrew

R 299.1028 Plants.

Rule 8. (1) The following species of plants are included on the state list of endangered species:

(a) *Agalinas gattingeri* Small [*Gerardia gattingeri* Small]	Gattinger's gerardia
(b) *A. skinneriana* (A. Wood) Britton [*Gerardia skinneriana* A. Wood]	Skinner's gerardia
(c) *Amerorchis rotundifolia* (Pursh) Hultén	Small round-leaved orchis
(d) *Asclepias ovalifolia* Dcne.	Dwarf milkweed
(e) *Androsace occidentalis* Pursh	Rock-jasmine
(f) *Arnica cordifolia* Hooker	Heart-leaved arnica
(g) *Asplenium ruta-muraria* L.	Wall-rue
(h) *A. scolopendrium* L. var. *americana* (Fernald) Kartesz & Ghandi [*Phyllitis scolopendrium* var. *americanum* Fern.]	Hart's-tongue fern
(i) *Baptisia leucophaea* Nutt.	Cream wild indigo
(j) *Botrychium acuminatum* W. H. Wagner	Moonwort
(k) *Carex heleonastes* Ehrh.	Hudson Bay sedge
(l) *C. nigra* (L.) Reichard	Black sedge
(m) *C. straminea* Willd.	Straw sedge
(n) *Castanea dentata* (Marsh.) Borkh.	American chestnut
(o) *Chamaerhodos nuttallii* Fern.	Rock-rose
(p) *Chelone obliqua* L.	Purple turtlehead
(q) *Cryptogramma acrostichoides* R. Br.	American rock-brake
(r) *Disporum hookeri* (Torrey) Nicholson	Fairy bells
(s) *Dodecatheon meadia* L.	Shooting star
(t) *Draba glabella* Pursh.	Smooth whitlow grass
(u) *Echinodorus tenellus* (Mart.) Buchenau	Dwarf burhead
(v) *Eleocharis atropurpurea* (Retz.) Kunth	Purple spike rush
(w) *E. microcarpa* Torrey	Small-fruited spike-rush
(x) *E. nitida* Fern.	Slender spike rush
(y) *Gentiana flavida* A. Gray [*G. alba* Muhl.]	White gentian
(z) *G. puberulenta* J. Pringle [*G. puberula* Michaux]	Downy gentian
(aa) *Gymnocarpium jessoense* (Koidz.) Koidz.	Northern oak fern
(bb) *Hedysarum alpinum* L.	Alpine sainfoin
(cc) *Hymenoxys herbacea* (Greene) Cusick	Lakeside daisy

	[*Hymenoxys acaulis* var. *glabra* (Gray) Parker	
(dd)	*Isoetes engelmannii* A. Braun	Engelmann's quillwort
(ee)	*Isotria medeoloides* (Pursh) Raf.	Smaller whorled pogonia
(ff)	*Lygodium palmatum* (Bernh.) Sw.	Climbing fern
(gg)	*Mimulus glabratus* var. *michiganensis* (Pennell) Fassett	Michigan monkey flower
(hh)	*Nuphar pumila* (Timm) DC. [*N. microphylla* (Pers.) Fern.]	Small yellow pond lily
(ii)	*Nymphaea tetragona* Georgi	Pygmy water lily
(jj)	*Opuntia fragilis* (Nutt.) Haw.	Fragile prickly pear
(kk)	*Panicum polyanthes* Schultes	Many-flowered panic grass
(ll)	*Penstemon gracilis* Nutt.	Slender beard tongue
(mm)	*Platanthera leucophaea* (Nutt.) Lindley [*Habenaria leucophea* (Nutt.) A. Gray]	Prairie white-fringed orchid
(nn)	Plantago cordata Lam.	Heart-leaved plantain
(oo)	*Poa canbyi* (Scribner) Piper	Canbyi's bluegrass
(pp)	*Populus heterophylla* L.	Swamp or Black cottonwood
(qq)	*Proserpinaca pectinata* Lam.	Mermaid-weed
(rr)	*Rhynchospora globularis* (Chapman) Small	Globe beak-rush
(ss)	*Rubus acaulis* Michaux	Dwarf raspberry
(tt)	*Rumex occidentalis* S. Wats	Western dock
(uu)	*Scleria pauciflora* Willd.	Few-flowered nut rush
(vv)	*Subularia aquatica* L.	Awlwort
(ww)	*Trillium undulatum* Willd.	Painted trillium
(xx)	*Utricularia inflata* Walter [*U. radiata* Small]	Floating bladderwort
(yy)	*Vaccinium vitis*-idaea L.	Mountain cranberry

(2) The following species of plants, listed by major group and family, are included on the state list of threatened species:

(a)	PTERIDOPHYTES:	
(i)	ASPLENIACEAE (Spleenwort Fanily):	
(A)	*Asplenium rhizophyllum* L. [*Camptosorus rhizophyllus* (L.) Link]	Walking fern
(B)	*A. trichomanes-ramosum* L. [*A. viride* Hudson]	Green spleenwort
(ii)	DRYOPTERIDACEAE (Wood Fern Family):	
(A)	*Dryopteris celsa* (W. Palmer) Small	Small log fern
(B)	*Gymnocarpium robertianum* (Hoffman) Newman	Limestone oak fern
(C)	*Woodsia alpina* (Bolton) S. F. Gray	Northern woodsia
(D)	*W. obtusa* (Sprengel) Torrey	Blunt-lobed woodsia
(iii)	LYCOPODIACEAE (Clubmoss family):	
	Lycopodiella margaritae J. G. Bruce, W. H. Wagner, & Beitel	Clubmoss
(iv)	OPHIOGLOSSACEAE (Adder's-tongue family):	
(A)	*Botrychium campestre* W. H. Wagner	Prairie Moonwort or Dunewort
(B)	*B. hesperium* (Maxon & Clausen) W. H. Wagner & Lellinger	Western moonwort
(C)	*B. mormo* W. H. Wagner	Goblin moonwort
(D)	*Ophioglossum vulgatum* L. [*O. pycnostichum* (Fern.) Löve & Löve]	Southeastern adder's-tongue

(v)	PTERIDACEAE (Maidenhair Fern Family)	
	Pellaea atropurpurea (L.) Link.	Purple cliff brake
(b)	MONOCOTYLEDONS:	
(i)	ALISMATACEAE (Water-plantain family):	
	Sagittaria montevidensis Cham. & Schlecht.	Arrowhead
(ii)	CYPERACEAE (Sedge family):	
(A)	*Carex albolutescens* Schw.	Sedge
(B)	*C. assiniboinensis* W. Boott	Assiniboia sedge
(C)	*C. atratiformis* Britton	Sedge
(D)	*C. conjuncta* F. Boott.	Sedge
(E)	*C. crus-corvi* Kunze	Raven's-foot sedge
(F)	*C. lupuliformis* Dewey	False hop sedge
(G)	*C. media* R. Br.	Sedge
(H)	*C. novae-angliae* Schwein.	New England sedge
(I)	*C. oligocarpa* Willd.	Eastern few-fruited sedge
(J)	*C. platyphylla* Carey	Broad-leaved sedge
(K)	*C. rossii* Boott	Ross's sedge
(L)	*C. scirpoidea* Michaux	Bulrush sedge
(M)	*C. seorsa* Howe	Sedge
(N)	*C. typhina* Michaux	Cattail sedge
(O)	*C. wiegandii* Mackenzie	Wiegand's sedge
(P)	*Eleocharis geniculata (L.) R & S.* [*E.caribaea* (Rottb.) S. F. Blake]	Spike rush
(Q)	*E. compressa* Sulliv.	Flattened spike rush
(R)	*E. parvula* (R. & S.) Link.	Dwarf spike rush
(S)	*E. tricostata* Torrey	Three-ribbed spike rush
(T)	*Fuirena squarrosa* Michaux	Umbrella grass
(U)	*Psilocarya scirpoides* Torrey	Bald rush
(V)	*Scirpus hallii* A. Gray	Hall's bulrush
(W)	*S. americanus* Pers. [*S. olneyi* A. Gray]	Olney's bulrush
(X)	*Scleria reticularis* Michaux	Netted nut rush
(iii)	IRIDACEAE (Iris family):	
(A)	*Iris lacustris* Nutt.	Dwarf lake iris
(B)	*Sisyrinchium atlanticum* Bickn.	Atlantic blue-eyed-grass
(iv)	JUNCACEAE (Rush family):	
(A)	*Juncus brachycarpus* Engelm.	Short-fruited rush
(B)	*J. militaris* Bigelow	Bayonet rush
(C)	*J. scirpoides* Lam.	Scirpus-like rush
(D)	*J. stygius* L.	Moor rush
(E)	*J. vaseyi* Engelm.	Vasey's rush
(F)	*Luzula parviflora* (Ehrh.) Desv.	Small-flowered wood rush
(v)	LEMNACEAE (Duckweed family):	
	Wolffia papulifera Thompson [*W. brasiliensis* Weddell]	Watermeal

(vi) LILIACEAE (Lily family):

(A)	*Allium schoenoprasum* L. (native variety)	Chives
(B)	*Camassia scilloides* (Raf.) Cory	Wild hyacinth
(C)	*Disporum trachycarpum* (Wats) B. & H.	Northern fairy bells
(D)	*Tofieldia pusilla* (Michaux) Pers.	False asphodel
(E)	*Trillium nivale* Riddell	Snow trillium
(F)	*T. recurvatum* Beck	Prairie trillium
(G)	*T. sessile* L.	Toadshade

(vii) ORCHIDACEAE (Orchid family):

(A)	*Calypso bulbosa* (L.) Oakes	Calypso or fairy-slipper
(B)	*Cypripedium candidum* Willd.	White lady slipper
(C)	*Galearis spectabilis* (L.) Raf.	Showy orchis
(D)	*Isotria verticillata* (Willd.) Raf.	Whorled pogonia
(E)	*Platanthera ciliaris* (L.) Lindley [*Habenaria ciliaris* (L.) R. Br.]	Orange- or yellow-fringed orchis
(F)	*Spiranthes ovalis* Lindley	Lesser ladies'-tresses
(G)	*Tipularia discolor* (Pursh) Nutt.	Cranefly orchid
(H)	*Triphora trianthophora* (Sw.) Rydb.	Nodding pogonia or three birds orchid

(viii) POACEAE (Grass family):

(A)	*Aristida longespica* Poiret	Three-awned grass
(B)	*A. tuberculosa* Nutt.	Beach three-awned grass
(C)	*Beckmannia syzigachne* (Steudel) Fern.	Slough grass
(D)	*Bouteloua curtipendula* (Michaux) Torrey	Side oats grama
(E)	*Bromus pumpellianus* Scribner	Pumpelly's bromegrass
(F)	*Calamagrostis lacustris* (Kearney) Nash	Northern reedgrass
(G)	*C. stricta* (Timm) Koeler	Narrow-leaved reedgrass
(H)	*Chasmanthium latifolium* (Michx.) Yates [*Uniola latifolia* Michaux]	Wild oats
(I)	*Diarrhena americana* Beauv.	Beak grass
(J)	*Festuca scabrella* Torrey [*F. altaica* Trin.]	Rough fescue
(K)	*Muhlenbergia richardsonis* (Trin.) Rydb.	Mat muhly
(L)	*Oryzopsis canadensis* (Poiret) Torrey	Canada rice grass
(M)	*Panicum leibergii* (Vasey) Scribner	Leiberg's panic grass
(N)	*P. longifolium* Torrey	Panic grass
(O)	*P. verrucosum* Muhl.	Warty panic grass
(P)	*Poa alpina* L.	Alpine bluegrass
(Q)	*P. paludigena* Fern. & Wieg.	Bog bluegrass
(R)	*Zizania aquatica* var. *aquatica* L.	Wild rice

(ix) POTAMOGETONACEAE (Pondweed family):

(A)	*Potamogeton bicupulatus* Fern. [*P. capillaceus* Poiret]	Waterthread pondweed
(B)	*P. hillii* Morong	Hill's pondweed
(C)	*P. pulcher* Tuckerman	Spotted pondweed
(D)	*P. vaseyi* Robins	Vasey's pondweed

(x)	RUPPIACEAE (Widgeon grass family):	
	Ruppia maritima L.	Widgeon grass
(c)	DICOTYLEDONS:	
(i)	ACANTHACEAE (Acanthus family):	
(A)	*Justicia americana* (L.) Vahl	Water willow
(B)	*Ruellia humilis* Nutt.	Hairy wild petunia
(C)	*R. strepens* L.	Smooth wild petunia
(ii)	APIACEAE (Parsley family):	
(A)	*Berula erecta* (Nutt.) Fern.	Cut-leaved water parsnip
	[*B. pusilla* (Nutt.) Fern.]	
(B)	*Eryngium yuccifolium* Michaux	Rattlesnake-master or button snakeroot
(C)	Os*morhiza depauperata* Phil.	Sweet Cicely
(D)	*Zizia aptera* (A. Gray) Fern.	Prairie golden alexanders
(iii)	ARALIACEAE (Ginseng family):	
(A)	*Oplopanax horridus* (Smith) Miq.	Devil's club
(B)	*Panax quinquefolius* L.	Ginseng
(iv)	ARISTOLOCHIACEAE (Birthwort family):	
	Aristolochia serpentaria L.	Virginia snakeroot
(v)	ASCLEPIADACEAE (Milkweed family):	
(A)	*Asclepias hirtella* (Pennell) Woodson	Tall green milkweed
(B)	*A. sullivantii* Engelm.	Sullivant's milkweed
(vi)	ASTERACEAE (Composite family):	
(A)	*Agoseris glauca* (Pursh) Raf.	Prairie or pale agoseris
(B)	*Antennaria rosea* Greene	Rosy pussytoes
(C)	*Artemisia ludoviciana* Nutt.	Western mugwort
(D)	*Aster furcatus* Burgess	Forked aster
(E)	*A. modestus* Lindley	Great northern aster
(F)	*A. sericeus* Vent.	Western silvery aster
(G)	*Cirsium pitcheri* (Eaton) Torrey & A. Gray	Pitcher's thistle
(H)	*Coreopsis palmata* Nutt.	Prairie coreopsis
(I)	*Erigeron hyssopifolius* Michaux	Hyssop-leaved fleabane
(J)	*Eupatorium fistulosum* Barratt	Hollow-stemmed Joe-pye weed
(K)	*E. sessilifolium* L.	Upland boneset
(L)	*Gnaphalium sylvaticum* L.	Woodland everlasting
(M)	*Helianthus mollis* Lam.	Downy sunflower
(N)	*Lactuca floridana* (L.) Gaertner	Woodland lettuce
(O)	*L. pulchella* (Pursh) DC.	Wild blue lettuce
(P)	*Petasites sagittatus* (Pursh) A. Gray	Sweet coltsfoot
(Q)	*Polymnia uvedalia* L.	Yellow-flowered leafcup
(R)	*Senecio indecorus* Greene	Northern ragwort
(S)	*Silphium integrifolium* Michaux	Rosinweed
(T)	*S. laciniatum* L.	Compass plant

(U)	*S. perfoliatum* L.	Cup plant
(V)	*Solidago houghtonii* A. Gray	Houghton's goldenrod
(W)	*S. missouriensis* Nutt.	Missouri goldenrod
(X)	*Tanacetum huronense* Nutt.	Lake Huron tansy
(vii)	BORAGINACEAE (Borage family):	
	Mertensia virginica Pers. (L.)	Virginia bluebells
(viii)	BRASSICACEAE (Mustard family):	
(A)	*Arabis perstellata* E. L. Braun	Rock cress
(B)	*Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates [*A. aquatica* (Eaton Wiegand)]	Lake cress
(C)	*Braya humilis* (C. A. Meyer) Robinson	Low northern rock cress
(D)	*Dentaria maxima* Nutt.	Large toothwort
(F)	*Draba cana* Rydb.	Ashy whitlow grass
(G)	*D. incana* L.	Twisted whitlow grass
(H)	*D. reptans* (Lam.) Fern.	Creeping whitlow grass
(ix)	CALLITRICHACEAE (Water-starwort family):	
	Callitriche heterophylla Pursh	Large water starwort
(x)	CAPRIFOLIACEAE (Honeysuckle family):	
(A)	*Lonicera involucrata* (Richardson) Banks	Black twinberry
(B)	*Viburnum edule* (Michx.) Raf.	Squashberry or mooseberry
(xi)	CARYOPHYLLACEAE (Pink family):	
(A)	*Arenaria macrophylla* Hooker	Large-leaved sandwort
(B)	*Sagina nodosa* (L.) Fenzl	Pearlwort
(C)	*Silene stellata* (L.) Aiton f.	Starry campion
(D)	*S. virginica* L.	Fire pink
(E)	*Stellaria crassifolia* Ehrh.	Fleshy stitchwort
(xii)	CISTACEAE (Rockrose family):	
	Lechea pulchella Raf. [*L. leggettii* Britton & Hollick]	Leggett's pinweed
(xiii)	CONVOLVULACEAE (Morning-glory family):	
	Ipomoea pandurata (L.) G. F. W. Meyer	Wild potato vine or man-of-the-earth
(xiv)	EMPETRACEAE (Crowberry family):	
	Empetrum nigrum L.	Black crowberry
(xv)	ERICACEAE (Heath family):	
(A)	*Pterospora andromedea* Nutt.	Pine-drops
(B)	*Vaccinium cespitosum* Michaux	Dwarf bilberry
(C)	*V. uliginosum* L.	Alpine blueberry
(xvi)	EUPHORBIACEAE (Spurge family):	

	Euphorbia commutata Engelm.	Tinted spurge
(xvii)	FABACEAE (Pea family):	
(A)	*Astragalus canadensis* L.	Canadian milk vetch
(B)	*Wisteria frutescens* (L.) Poiret	Wisteria
(xviii)	FUMARIACEAE (Fumitory family):	
	Corydalis flavula (Raf.) DC.	Yellow fumewort
(xix)	GENTIANACEAE (Gentian family):	
(A)	*Bartonia paniculata* (Michaux) Muhl.	Panicled screwstem
(A)	*Gentiana linearis* Froel.	Narrow-leaved gentian
(B)	*Gentianella quinquefolia* (L.) Small	Stiff gentian
(C)	*Sabatia angularis* (L.) Pursh	Rosepink
(xx)	HALORAGACEAE (Water-milfoil family):	
	Myriophyllium farwellii Morong	Farwell's water milfoil
(xxi)	HYDROPHYLLACEAE (Waterleaf family):	
	Phacelia franklinii (R. Br.) A. Gray	Franklin's phacelia
(xxii)	HYPERICACEAE (St. John's-wort family):	
	Hypericum sphaerocarpum Michaux	Round-fruited St. John's-wort
(xxiii)	LAMIACEAE (Mint family):	
(A)	*Lycopus virginicus* L.	Virginia water-horehound
(B)	*Pycnanthemum muticum* (Michx.) Pers.	Mountain mint
(C)	*P. pilosum* Nutt.	Hairy mountain mint
(D)	*Scutellaria nervosa* Pursh	Skullcap
(E)	*S. parvula* Michaux [sensu lato]	Small skullcap
(F)	*Trichostema brachiatum* L. [*Isanthus brachiatus* (L.) BSP.]	False pennyroyal
(G)	*T. dichotomum* L.	Bastard pennyroyal
(xxiv)	LENTIBULARIACEAE (Bladderwort family):	
	Utricularia subulata L.	Bladderwort
(xxv)	LINACEAE (Flax family):	
	Linum virginianum L.	Virginia flax
(xxvi)	MELASTOMATACEAE (Melastome family):	
	Rhexia mariana L.	Maryland meadow beauty
(xxvii)	MORACEAE (Mulberry Family):	
	Morus rubra L.	Red mulberry
(xxviii)	NYMPHAEACEAE (Water-lily family):	
	Nelumbo lutea (Willd.) Pers. [*N. pentapetala* (Walter) Fern.]	American lotus

(xxix)	OLEACEAE (Olive family):	
	Fraxinus profunda (Bush) Bush [*F. tomentosa* F. Michaux]	Pumpkin ash
(xxx)	ONAGRACEAE (Evening-primrose family):	
	Ludwigia sphaerocarpa Ell.	Globe-fruited seedbox
(xxxi)	OROBANCHACEAE (Broom-rape family):	
	Orobanche fasciculata Nutt.	Broomrape
(xxxii)	OXALIDACEAE (Wood-sorrel family):	
	Oxalis violacea L.	Violet wood sorrel
(xxxiii)	POLEMONIACEAE (Phlox family):	
(A)	*Phlox bifida* Beck.	Cleft phlox
(B)	*P. maculata* L.	Wild sweet William
(C)	*Polemonium reptans* L.	Jacob's ladder
(xxxiv)	POLYGONACEAE (Smartweed family):	
(A)	*Polygonum careyi* Olney	Carey's smartweed
(B)	*P. viviparum* L.	Alpine bistort
(xxxv)	RANUNCULACEAE (Crowfoot family):	
(A)	*Hydrastis canadensis* L.	Goldenseal
(B)	*Ranunculus ambigens* Watson	Spearwort
(C)	*R. cymbalaria* Pursh	Seaside crowfoot
(D)	*R. lapponicus* L.	Lapland buttercup
(E)	*R. macounii* Britton	Macoun's buttercup
(F)	*R. rhomboideus* Goldie	Prairie buttercup
(xxxvi)	RHAMNACEAE (Buckthorn family):	
	Ceanothus sanguineus Pursh	Wild lilac
(xxxvii)	RUBIACEAE (Madder family):	
	Galium kamtschaticum Schultes & J. H. Schultes	Bedstraw
(xxxviii)	ROSACEAE (Rose family):	
(A)	*Dalibarda repens* L.	False violet
(B)	*Filipendula rubra* (Hill) Robinson	Queen-of-the-prairie
(C)	*Geum triflorum* Pursh	Prairie smoke
(D)	*Porteranthus trifoliatus* (L.) Britton [*Gillenia trifoliata* (L.) Moench.]	Bowman's root
(E)	*Potentilla paradoxa* Nutt.	Sand cinquefoil
(F)	*P. pensylvanica* L.	Prairie cinquefoil
(G)	*Sanguisorba canadensis* L.	Canadian burnet
(xxix)	SALICACEAE (Willow family):	
	Salix planifolia Pursh	Tea-leaved willow

(xl)	SARRACENIACEAE (Pitcher-plant family):	
	Sarracenia purpurea f. *heterophylla* (Eaton) Fern.	Yellow pitcher plant
(xli)	SAXIFRAGACEAE (Saxifrage family):	
(A)	*Parnassia palustris* L.	Marsh grass-of-parnassus
(B)	*Saxifraga paniculata* Miller [S. aizoön Jacq.]	Encrusted saxifrage
(C)	*S. tricuspidata* Rottb.	Prickly saxifrage
(xliii)	SCROPHULARIACEAE (Figwort family):	
(A)	*Besseya bullii* (Eaton) Rydb.	Kitten-tails
(B)	*Castilleja septentrionalis* Lindley	Pale Indian paintbrush
(C)	*Collinsia parviflora* Lindley	Small blue-eyed Mary
(D)	*Dasystoma macrophylla* (Nutt.) Raf.	Mullein foxglove
(E)	*Euphrasia hudsoniana* Fernald & Weigand	Eyebright
(F)	*E. nemorosa* (Pers.) Wallr.	Eyebright
(G)	*Gratiola aurea* Pursh)[*G. lutea* Raf.]	Hedge-hyssop
(H)	*G. virginiana* L.	Annual hedge hyssop
(I)	*Penstemon calycosus* Small	Beard tongue
(xliii)	VALERIANACEAE (Valerian family):	
(A)	*Valeriana edulis* var. *ciliata (T. & G.) Cronquest*	Edible valerian
(B)	*Valerianella chenopodiifolia* (Pursh) DC.	Goosefoot corn salad
(C)	*V. umbilicata* (Sull.) A. W. Wood	Corn salad
(xliv)	VIOLACEAE (Violet family):	
(A)	*Viola epipsila* Ledeb.	Northern marsh violet
(B)	*V. novae-angliae* House	New England violet
(C)	*V. pedatifida* G. Don	Prairie birdfoot violet
(xlv)	VITACEAE (Grape family)	
	Vitis vulpina L.	Frost grape

(3) This rule does not apply to cultivated plants.

(4) The following species of plants are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

(a) *Agropyron spicatum* (Pursh) Scribner & J. G. Smith	Bluebunch wheatgrass
(b) *Aristida dichotoma* Michaux	Three-awned grass
(c) *Asplenium montanum* Willd.	Mountain spleenwort
(d) *Buchnera americana* L.	Bluehearts
(e) *Carex decomposita* Muhl.	Log sedge
(f) *C gravida* Bailey	Sedge
(g) *C. haydenii* Dewey	Hayden's sedge
(h) *Commelina erecta* L.	Slender dayflower
(i) *Cyperus acuminatus* Torrey & Hooker	Cyperus, Nut grass
(j) *Dalea purpurea* Vent. *Petalostemon purpurem* (Vent.) Rydb.]	Purple prairie clover
(k) *Dennstaedtia punctiloba* (Michx.) T. Moore	Hay-scented fern
(l) *Digitaria filiformis* (L.) Koeler	Slender finger grass

(m)	*Disporum maculatum* (Buckley) Britton	Nodding madarin
(n)	*Draba nemorosa* L.	Whitlow grass
(o)	*Eleocharis radicans* (Poiret) Kunth	Spike rush
(p)	*Echinacea purpurea* (L.) Moench.	Purple coneflower
(q)	*Equisetum telmateia* Ehrh.	Giant horsetail
(r)	*Fimbristylis puberula* (Michaux) Vahl	Chestnut sedge
(s)	*Gentiana saponaria* L.	Soapwort gentian
(t)	*Glyceria acutiflora* Torrey	Manna grass
(u)	*Hedyotis nigricans* (Lam.) Fosb.	Hedyotis
(v)	*Helianthus microcephalus* Torrey & Gray	Small wood sunflower
(w)	*Lemna valdiviana* Phil.	Pale duckweed
(x)	*Lespedeza procumbens* Michaux	Trailing bush clover
(y)	*Liatris punctata* Hooker	Dotted blazing star
(z)	*L. squarrosa* (L.) Michx.	Plains blazing star
(aa)	*Lithospermum incisum* Lehm.	Narrow-leaved puccoon
(bb)	*Mikania scandens* (L.) Willd.	Mikania
(cc)	*Mimulus alatus* Aiton	Winged monkey flower
(dd)	*Monarda didyma* L.	Bee balm, Oswego tea
(ee)	*Muhlenbergia cuspidata* (Hooker) Rydb.	Plains muhly
(ff)	*Onosmodium molle* Michx.	Marbleweed
(gg)	*Phleum alpinum* L.	Mountain timothy
(hh)	*Polygala incarnata* L.	Pink milkwort
(ii)	*Polygonatum biflorum* var. *melleum* (Farw.) Ownbey	Honey-flowered solomon seal
(jj)	*Polytaenia nuttallii* DC.	Prairie parsley
(kk)	*Rudbeckia subtomentosa* Pursh	Sweet coneflower
(ll)	*Scutellaria incana* Biehler	Skullcap
(mm)	*S. ovata* Hill	Forest skullcap
(nn)	*Senecio congestus* (R. Br.) DC.	Marsh fleabane
(oo)	*Sisyrinchium farwellii* Bickn.	Farwell's blue-eyed grass
(pp)	*S. hastile* Bickn.	Blue-eyed grass
(qq)	*Tomanthera auriculata* (Michaux) Raf. [*Agalinas auriculata* (Michaux) S. F. Blake]	Eared foxglove
(rr)	*Tradescantia bracteata* Small.	Long-bracted spiderwort
(ss)	*Trillium viride* Beck	Green trillium
(tt)	*Woodwardia areolata* (L.) T. Moore	Netted chain fern