ENVIRONMENTAL ASSESSMENT:

MUTE SWAN DAMAGE MANAGEMENT IN MICHIGAN

Prepared By:

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Animal and Plant Health Inspection Service
Wildlife Services

In Cooperation With:

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SUMMARY

Mute Swans (*Cygnus olor*) have many positive values but outside their native range they can cause damage to property, agricultural and natural resources; and pose risks to human health and safety. This environmental assessment (EA) analyzes the potential environmental impacts of alternatives for U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (WS) involvement in the reduction of conflicts with and damage by Mute Swans in Michigan. The proposed Mute Swan damage management (MSDM) activities could be conducted on public and private property in Michigan when the property owner or manager requests assistance and/or when assistance is requested by an appropriate state, federal, tribal, or local government agency, a need is confirmed, and authorization is granted by the landowner/manager. Federal lands where MSDM is under consideration include USDA Forest Service, Huron-Manistee National Forests; U.S. Department of the Interior (USDI), Fish and Wildlife Service, Shiawassee National Wildlife Refuge and Detroit River International Wildlife Refuge. In addition to these federal agencies, this analysis was prepared in consultation with the Michigan Department of Natural Resources (MDNR) Wildlife Division and Parks and Recreation Division, Grand Traverse Band of Ottawa and Chippewa Indians, Little Traverse Bay Bands of Odawa Indians, Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians, and the Great Lakes Indian Fish and Wildlife Commission. This analysis is consistent with the MDNR Wildlife Division Mute Swan Management and Control Program Policy and Procedures (MDNR 2012*a*).

Alternatives examined in the EA include an alternative in which WS does not become involved in MSDM, an alternative in which WS is restricted to the use and recommendation of only non-lethal MSDM methods and egg treatments, and an alternative in which WS provides technical assistance (advice/recommendations) but does not provide operational assistance with implementing the recommendations. A fourth (preferred) alternative, allows WS to continue using an Integrated MSDM strategy including technical assistance on and operational use of the full range of legal non-lethal and lethal MSDM techniques. The WS Decision Model would be used to develop appropriate site-specific strategies using permitted techniques, singly or in combination, to meet project objectives. Non-lethal methods recommended and used by WS may include resource management, physical exclusion, human behavior modification, frightening devices, and other deterrents (Appendix B). Lethal methods recommended and used by WS may include nest/egg destruction; egg oiling/addling/puncturing; live capture and euthanasia; and shooting (Appendix B). All WS activities would be conducted in accordance with applicable state, federal and local laws and regulations.

The EA provides a detailed analysis of the impacts of each alternative on Mute Swan populations; non-target species including state and federally-listed threatened and endangered species; and sociological concerns including aesthetic values and humaneness. The analysis also provides information on the relative efficacy of each alternative.

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ACRONYMS

AC	Alpha-chloralose
AFC	Atlantic Flyway Council
APHIS	Animal and Plant Health Inspection Service
BCC	Biological Carrying Capacity
BO	Biological Opinion
CDCP	Center for Disease Control and Prevention
CEQ	Council on Environmental Quality
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	U.S. Department of Transportation, Federal Aviation Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
GLIFWC	Great Lakes Indian Fish and Wildlife Commission
GLRI	Great Lakes Restoration Initiative
INAD	Investigational New Animal Drug
IWDM	Integrated Wildlife Damage Management
MA	Methyl Anthranilate
MBTA	Migratory Bird Treaty Act
MDNR	Michigan Department of Natural Resources
MFC	Mississippi Flyway Council
MIS	Management Information System
MOU	Memorandum of Understanding
MSDM	Mute Swan Damage Management
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
SAV	Submerged Aquatic Vegetation
SOP	Standard Operating Procedures
T & E	Threatened and Endangered
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Department of Agriculture Forest Service
USFWS	U.S. Department of the Interior, Fish and Wildlife Service
VITF	Voigt Intertribal Task Force
WAC	Wildlife Acceptance Capacity
WDM	Wildlife Damage Management
WS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Mute Swans (*Cygnus olor*) are appreciated by many people for their beauty, social behavior (e.g., long-term pair bonds) and intrinsic value as living beings (Gelston and Wood 1982, Swans of Stanley Park 2012, Wisconsin Swan Lovers 2009). Unfortunately, Mute Swans can also damage property, agriculture, and natural resources (Atlantic Flyway Council 2003, MDNR 2003, 2012*a*, Craves and Suskow 2010). Mute Swans can also be a hazard to human health and safety because of aggressive behavior by territorial or food-habituated birds, and fecal contamination of water sources and areas with high recreational use. Their large size also makes them hazardous to aircraft. Resolution of conflicts with and damage by Mute Swans requires skill in wildlife management and sensitivity to their many positive values. This environmental assessment (EA) evaluates alternatives for U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) involvement in the management of damage by and conflicts with Mute Swans in Michigan.

Wildlife damage management (WDM) is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife, and it is an integral component of wildlife management (Leopold 1933, The Wildlife Society 1990, Berryman 1991). The USDA has been authorized by congress (the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c)) to protect American agriculture and other resources from damage associated with wildlife. The Secretary of Agriculture has delegated his authority to the APHIS. Within that agency, the authority resides with the WS program. Wildlife Services activities are conducted in cooperation with other federal, state, and local agencies, and private organizations and individuals. Federal agencies, including the United States Department of the Interior (USDI), Fish and Wildlife Service (USFWS) and the U.S. Department of Transportation, Federal Aviation Administration (FAA) recognize the expertise of WS in addressing wildlife damage issues.

Wildlife Services strives to reach and maintain a balance between wildlife needs and welfare and human needs and welfare. Wildlife Services conducts WDM as a means of reducing damage, not in order to punish offending animals. Wildlife Services is a cooperatively funded and service oriented program. Wildlife Services works with private property owners and managers and with agencies, as requested and appropriate, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with applicable federal, state, and local laws and regulations.

Most individual actions of the types encompassed by this analysis could be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR§372.5(c)). The USDA and APHIS NEPA implementing regulations also provide that all technical assistance furnished by WS is categorically excluded. Wildlife Services has chosen to prepare this EA to assist in planning

Mute Swan damage management (MSDM) activities, facilitate interagency coordination with MSDM, and to clearly communicate with the public the analysis of cumulative impacts of issues of concern in relation to alternative means of meeting needs for such management in Michigan. This analysis covers current and future MSDM activities by WS wherever and whenever they might be requested, in Michigan. This analysis was prepared in consultation with the Michigan Department of Natural Resources (MDNR) which has management authority for Mute Swans in Michigan.

1.1 PURPOSE

The purpose of this EA is to analyze the potential environmental impacts of alternatives for WS involvement in efforts to reduce damage by and conflicts with Mute Swans in Michigan. Resources potentially protected by such activities include property, agriculture, natural resources, and human health and safety.

1.2 DECISIONS TO BE MADE

Wildlife Services is the lead agency in the preparation of this EA. The USFWS Shiawassee National Wildlife Refuge and Detroit River International Wildlife Refuge; and the USDA Forest Service (USFS), Huron-Manistee National Forests are cooperating agencies. Each of these federal agencies has responsibility for the management of lands and natural resources in their care in accordance with applicable laws, agency policy, and site specific management plans.

This analysis was prepared in consultation with the MDNR Wildlife Division and Parks and Recreation Division, Grand Traverse Band of Ottawa and Chippewa Indians, Little Traverse Bay Bands of Odawa Indians, Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians, the Hannahville Indian Community, and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC). The MDNR Wildlife Division provides for the control, management, restoration, conservation, and regulation of birds, game and all other wildlife resources in Michigan. The MDNR Parks and Recreation Division is responsible for acquiring, protecting, and preserving the natural and cultural features of Michigan's unique resources; and for providing access to land and water based public recreation and educational opportunities. The tribes have authority for management of natural resources on tribal lands, and, in accordance with applicable treaties, the right to hunt fish and gather in the ceded territories. The GLIFWC is an agency of 11 Ojibwe nations in Minnesota, Wisconsin, and Michigan with off-reservation treaty rights to hunt, fish, and gather in treaty-ceded lands and waters. It exercises powers delegated by its member tribes. GLIFWC assists its member tribes in the implementation of off-reservation treaty seasons and in the protection of treaty rights and natural resources.

The lead and cooperating agencies will work together to address the following questions in the EA.

- How can the lead and cooperating agencies best respond to the need to address Mute Swan damage and conflicts in Michigan?
- What are the environmental impacts of alternatives for dealing with Mute Swan damage and conflicts?
- Will the proposed program have significant effects requiring preparation of an environmental impact statement (EIS)?

Although the lead and cooperating agencies have worked together to produce a joint document and intend to collaborate on MSDM in Michigan, each agency will be making its own decision on the alternative to be selected in accordance with the standard practices and legal requirements applicable to each agency's decision making process.

1.3 BACKGROUND

1.3.1 Michigan Mute Swan Population

Mute Swans are native to Eurasia, and were introduced from Europe into the United States in the late 19th and early 20th centuries for use in ornamental ponds and lakes, zoos, and aviculture collections (Maryland Mute Swan Task Force 2001; Ciaranca et al. 1997). Feral breeding is believed to have first started among escaped birds in the lower Hudson Valley in 1910 and on Long Island in 1912 (Atlantic Flyway Council 2003). Since that time Mute Swans have expanded their range to many Eastern states several Midwestern states and portions of the western U.S. and Canada.

Mute Swans are not native to North America, but some have questioned their status as an introduced species (Alison and Burton 2008). However, multiple subsequent reviews of Alison and Burton (2008) have refuted their assertion that Mute Swans are a native species (Warnock 2009, Askins 2009, Elphick 2009, Seymour and Peck 2009). Review by the USFWS also supports the conclusion that Mute Swans are not native to North America (FR 70(2):372-377 and FR 70(49):12710-12716).

The Michigan Mute Swan population is believed to have started with a pair of birds donated in 1918 by George B. Douglas from his estate in Iowa to the Chicago Club in Charlevoix, Michigan (Gelston and Wood 1982). Ironically, the birds were donated because the male threatened Mr. Douglas' children whenever they came near his pond. Other accidental and intentional additions from private citizens also contributed to the population. By the 1940's the initial population had increased to 47 birds (Gelston and Wood 1982). In 1972, the large flock in Traverse City contained between 450-500 birds (Gelston and Wood 1982). The population continued to expand, and by 1991 the MDNR

estimated there were 4,000 Mute Swans in the state (MDNR 2003, MDNR Unpub. data; Fig. 1).

The MDNR currently uses a spring breeding waterfowl survey to track trends in the status of the state Mute Swan population. Flights are conducted at low elevation, slow speeds, and follow the same transect routes each year. The survey methodology used is scientifically sound and proven and used by other states and Canadian provinces in managing a wide range of waterfowl species (USFWS 1987). These surveys have been used successfully to monitor waterfowl populations, guide establishment of annual hunting regulations, and ensure that licensed harvest does not jeopardize waterfowl populations. Although there has been normal annual variation in estimates the overall trend for the population has been increasing with approximately 5,700 birds in 2000, 8,000 birds in 2005, 15, 500 birds in 2010 and 15,420 birds in 2011 (Fig. 1; MDNR unpublished data). At present, Michigan has the largest population of Mute Swans in North America (MDNR 2012*b*, Nelson 1997, Atlantic Flyway Council 2003). Data from the USDI, Geological Survey, Breeding Bird Survey indicate a statistically significant increasing trend (8% per year) for Mute Swans in Michigan for the period of 1966-2009 (Fig. 2; Sauer et al. 2011). Christmas bird count also show and increasing population trend for Mute Swans in Michigan (Fig. 3; National Audubon Society 2012).

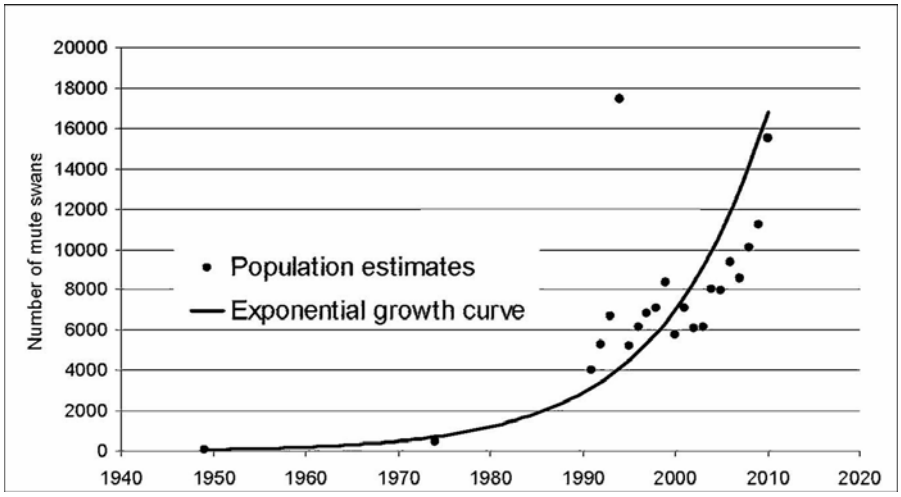

Figure 1. Michigan Department of Natural Resources Mute Swan population estimates (MDNR unpub. data). From 1990 – 2006 the Mute Swan population estimate was derived by taking the count of all swans from the waterfowl census and subtracting the Trumpeter Swan population estimate. Estimates during this period could include Tundra Swans. However, the annual waterfowl census is counducted during the nesting period when Tundra Swans are usually not present or only present in small numbers because they have already migrated through the state. Outlier in 1994 may be attributable to a late spring and the census likely included a large number of migrating Tundra Swans (MDNR pers. comm, D. Luukkonen). From 2007 to present, all swan species were counted separately to provide a more precise estimate of Mute Swan population size.

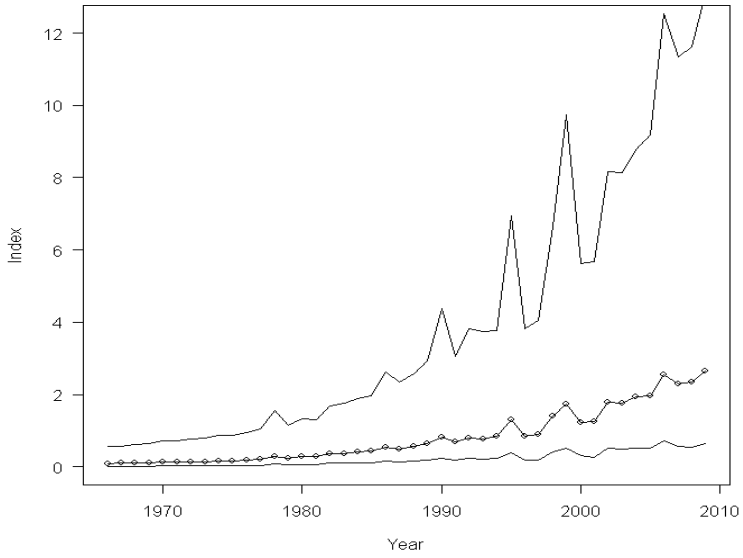

Figure 2. Trend in U.S. Geological Survey Breeding Bird Survey Mute Swan annual population indices with 95% confidence intervals for the period of 1966-2010 (Sauer et al. 2011).

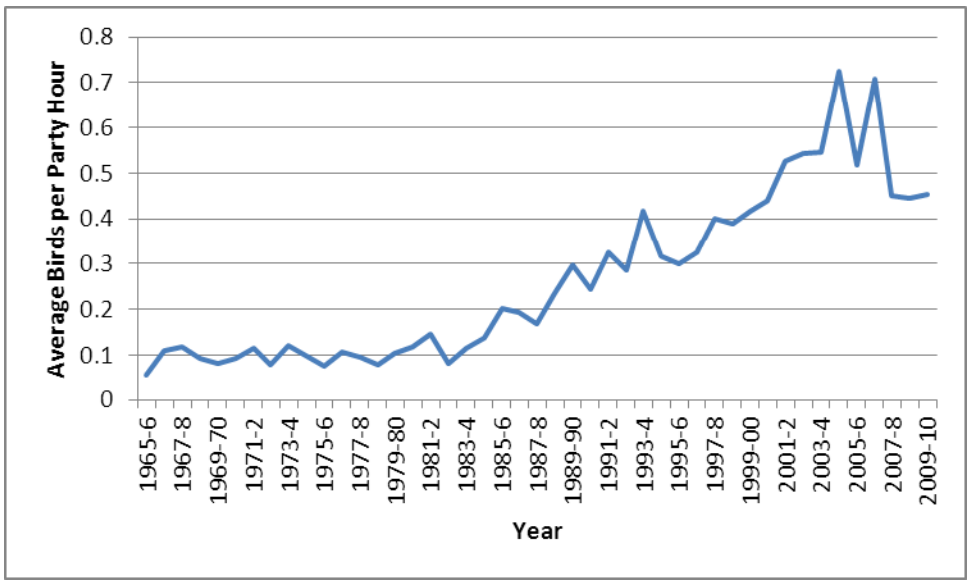

Figure 3. Average number of Mute Swans counted per party hour during Audubon Christmas Bird Count in Michigan for winter 1965/1966 to 2009/2010 (National Audubon Society 2012).

Gelston and Wood (1982) provided data on nesting Mute Swans in Michigan. Age of first breeding was documented at 2-4 years of age. A typical clutch of 4 to 8 eggs (average 4.3 eggs) takes 35 to 41 days to hatch. Re-nesting may occur if a nest is

destroyed but appears to be relatively uncommon (Conover and Kania 1999, Ciaranca et al. 1997, Reese 1980). Gelston and Wood (1982) reported that approximately 2 chicks per nest survive to fledging. In North America, the oldest known wild Mute Swan was at least 26-years old (Ciaranca et al. 1997). In Chesapeake Bay, the oldest known flighted bird was 16-years old and had nested for 13 years. Average lifespan would likely be considerably lower than recorded maximums. For example, average captive life expectancy reported by the London Zoo was 11 years with maximum lifespan of 21 years (Ciaranca et al. 1997).

1.3.2 Benefits of Mute Swans

Many people enjoy watching Mute Swans glide across the water and consider them to be a charismatic and aesthetically valuable component of the environment. Mute Swans have been symbols of romance, beauty, purity, royalty and wealth in many cultures. Their image figures prominently in modern culture including art, advertisements, and greeting cards. Mute Swans are raised by some people for display or sale to other breeders and people who want to keep swans on their ponds for aesthetic reasons. Mute Swans may also be sold to property owners to help control filamentous green algae in ponds and as a means of discouraging Canada Geese from using private ponds (e.g., Knox Swan and Dog 2012; Dickson Farm 2012[1])[2]. Mute Swans have little fear of humans and readily use urban and suburban environments, which results in opportunities for people to come into close contact with wildlife. Some people enjoy feeding the birds and become attached to specific individuals.

1.3.3 Legal Status of Mute Swans

Prior to 2001, the USFWS did not consider the Migratory Bird Treaty Act (MBTA) to apply to Mute Swans because they were not native to North America and authority for Mute Swans was held by the states and tribes. In 1999, the state of Maryland appointed a task force to make recommendations regarding the increasing population of Mute Swans and potential adverse impacts on submerged aquatic vegetation (SAV) in Chesapeake Bay. Lethal removal of Mute Swans was included in the recommendations presented by the task force. In July 1999, a complaint was filed in federal district court in an effort to block the proposed swan removals. The plaintiff asserted the USFWS decision to not include Mute Swans in the list of species protected by the MBTA was arbitrary and capricious and that the USDI had failed to comply with the NEPA because it had not

[1] Examples are provided as a means of illustration. Inclusion in this text does not imply endorsement of the product or service providers.

[2] Wildlife Services does not recommend using Mute Swans for goose management. Mute swans are not consistent in their impacts on Canada Geese from using or nesting on ponds (Conover and Kania 1994). Additionally, as noted in Section swans can be aggressive towards humans and may have undesirable effects on native aquatic vegetation Furthermore, Executive Order 11987 May 24, 1977, states that federal agencies shall encourage states, local governments, and private citizens to prevent the introduction of exotic species into the environment.

prepared an EIS on the decision (Hill vs. Norton). The U.S. District Court in the District of Columbia decided in favor of the USDI on both counts. The finding of the District court was appealed. The U.S. Court of Appeals for the District of Columbia Circuit reversed the decision of the District Court. The appeals court concluded that there was nothing in the MBTA regarding the native or non-native status of the species and that the treaties only make reference to "swans" and the family Anatidae. Consequently, management authority for Mute Swans was transferred to the USFWS under the MBTA in 2001.

In 2003, several state agencies applied to the USFWS for depredation permits to address conflicts with Mute Swans. In accordance with the NEPA, the USFWS prepared an EA to address potential impacts from the proposed action. Shortly after the Finding of No Significant Impact (FONSI) was issued, the Fund for Animals and two citizen plaintiffs filed suit challenging the FONSI and requesting a preliminary injunction. The preliminary injunction was granted. The Service opted to withdraw the EA and the depredation permits. In 2004, Congress provided clarification of the intent of the MBTA, stipulating that the act only applies to migratory bird species that are native to the U.S. Congress also directed the USFWS to prepare a list of species to which the act does not apply. The list was finalized on March 15, 2005 and Mute Swans were included on the List and management authority returned to the states and tribes.

The Michigan Department of Natural Resources (MDNR), under Public Act 451 of 1994, is empowered to "protect and conserve the natural resource of this state" [MCL 324.503 (1)]. In addition, MCL 324.40105 states, "All animals found in this state, whether resident or migratory and whether native or introduced, are the property of the people of the state, and the taking of all animals shall be regulated by the Department, as provided by law." Further, the MDNR has authority to issue orders determining the kinds of animals that may be taken and determining the animals or kinds of animals that are protected [MCL 324.40107 (1)]. See Section 1.7.3 for specific regulations pertaining to Mute Swans.

1.3.4 Wildlife Acceptance Capacity (WAC) and Biological Carrying Capacity (BCC)

Human dimensions of wildlife management include identifying how people are affected by problems or conflicts with wildlife, attempting to understand people's reactions, and incorporating this information into policy and management decision making processes and programs (Decker and Chase 1997).

Wildlife Acceptance Capacity (WAC), sometimes known as cultural carrying capacity, is the maximum wildlife population level in an area that is acceptable to people who live in and use the affected area (Decker and Purdy 1988). For wildlife damage situations, there will be varying thresholds of tolerance for wildlife conflicts and damage for people directly and indirectly affected by the damage. Thresholds for action and tolerance of

wildlife damage will also vary depending upon individual values and philosophies regarding wildlife and natural resources. This threshold of tolerance is a primary limiting factor in determining the WAC. Once this WAC is met or exceeded, people seek to implement Mute Swan population reduction methods to alleviate property damage, nuisance problems and threats to human health or safety. Given the variability in individual response to wildlife and wildlife damage, it should be understood that the WAC for a group of people is reached when the majority of individuals, or representatives for that group of individuals, has reached the threshold for action. It does not imply that all individuals within the community have come to a universal conclusion that action is warranted.

Biological Carrying Capacity (BCC) is the wildlife population level that the land or habitat can support over an extended period of time without degradation to the population's health, individual animals' health, or wellbeing of associated plant and animal communities and the environment (Decker and Purdy 1988). Considerations of BCC for non-native and invasive species must also be evaluated in context of lost opportunities for native species. Although a habitat may be able to support a non-native species without measureable habitat damage or degradation to the health of the Mute Swan population, the presence of Mute Swans may prevent range expansion or population increases in native species.

1.4 NEED FOR ACTION

As the Mute Swan population has grown, so has the level of conflict with humans (MDNR 2003, 2012*c*; Wisconsin Department of Natural Resources 2007; Maryland Mute Swan Task Force 2001; Nelson 1997). The primary conflicts with and damage by Mute Swans in Michigan include, degradation of natural habitat, competition with and aggressive behavior toward native wildlife, and threats to human safety from aggressive swans. Other less-common concerns include risks to aircraft from collisions with Mute Swans and the potential role for Mute Swans in transmission of diseases significant to agriculture and human health. The need for action is based on requests for assistance received by WS and MDNR, review of the available literature, and evaluation of Mute Swan impacts and the risk of Mute Swan impacts in Michigan by the lead, cooperating, and consulting agencies. The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated.

Wildlife Services maintains a Management Information System (MIS) database to document assistance that the agency provides in addressing wildlife damage conflicts. The MIS data are limited to information that is collected from people who have requested services or information from WS. The database does not include requests received or responded to by local, state, or other federal agencies, and it is not a complete database for all damage occurrences. The number of requests for assistance does not necessarily reflect the extent of need for action, but does provide an indication that needs exists.

In Michigan, the WS program provided assistance in 136 Mute Swan damage-related requests for assistance in 2008 - 2011 (Table 1; USDA MIS). Requests are categorized according to resource category: natural resource protection, threat to human health and safety (aggressive swans), and threat to human safety (aviation). Natural resource protection was the cause of most requests for assistance (n=95) followed by threats to aviation safety (n=36).

Table 1. Number of requests for assistance regarding Mute Swans in Michigan received by USDA APHIS Wildlife Services during 2008 - 2011 (USDA MIS).

	Natural Resource Protection	**Aggressive Behavior Towards Humans**	**Threat to Aviation Safety**	**Total**
2008	7	0	5	12
2009	7	0	12	19
2010	20	3	7	30
2011	61	2	12	75
Total	**95**	**5**	**36**	**136**

The MDNR also works to reduce damage by Mute Swans in Michigan. The majority of Mute Swan damage complaints recorded by the MDNR are concentrated in the southeastern and western portions of Michigan. Most nuisance complaints are associated with suburban areas where Mute Swans are on public or private ponds and are displaying aggressive behavior toward humans, but may also include property damage. In 2011, MDNR staff issued 19 permits for Mute Swan nest/egg destruction and adult removals (MDNR unpublished data). Under those 19 permits: 21 nests and 129 eggs were destroyed, and 56 swans were removed. The MDNR staff conducted MSDM on state lands for natural resources protection: 166 eggs were destroyed and 182 swans were removed (MDNR unpublished data).

1.4.1 Mute Swan Damage to Natural Resources

Mute Swans can impact ecosystems by foraging on native plants and competing with native species for food and habitat (Allin and Husband 2003, Tatu et al. 2007, Bailey et al. 2008). Mute Swans forage primarily on SAV, and each swan can consume approximately 4-8 pounds of vegetation per day (Owen and Cadbury 1975, Allin 1981, Fenwick 1983). Adult Mute Swans in the Lower Great Lakes primarily consumed above ground plant parts, although below ground plant parts, particularly tubers of arrowhead, sago pondweed and wild celery, were also consumed (Bailey et al. 2008). Plants most commonly found in Mute Swan diets included pondweed (*Potamogeton* spp.), muskgrass (*Chara vulgaris*), coontail (*Ceratophyllum demersum*), slender naiad (*Najas flexilis*), common waterweed (*Elodea canadensis*), wild celery (*Vallisneria americana*), and wild

rice (*Zizania palustris*). Within the lower Great Lakes region, Bailey et al. (2008) found that the diet of Mute Swans had considerable overlap with many native waterfowl species which stage in and over-winter in the Lower Great Lakes. Mute Swans also use their feet while feeding; patting, paddling, and raking the substrate to expose plant rhizomes for foraging and to help dislodge food for cygnets (Ciaranca et al. 1997). This behavior results in damage to aquatic substrates and to vegetation surrounding preferred foods. Mathiasson (1973) and Fenwick (1983) estimated that Mute Swans typically consume less than 50% of what they remove.

Records of Mute Swan impacts on SAV have been mixed with reports of adverse impacts (Allin and Husband 2003, O'Hare et al. 2007, Tatu et al. 2007, Eicholz et al. 2009) and situations where Mute Swans did not appear to adversely impact plant communities (Conover and Kania 1994). The difference may depend upon the concentration of birds at the site (Allin and Husband 2003) and the nature of the plants consumed (Craves and Susko 2010). Some plants appear to tolerate a relatively intensive level of swan and other waterfowl foraging and can compensate via density dependent growth rates (Craves and Susko 2010). In Michigan, foraging by Mute Swans appears to have been a factor in the failure of efforts to restore wild rice to Muskegon Lake (McVicar 2010). Wildlife Services has received requests from Michigan Native American Tribes to remove Mute Swans because of damage to wild rice beds used by the community. Additional research on the impact of Mute Swans on freshwater ecosystems is warranted. However, given the volume of food consumed and vegetation damaged by foraging Mute Swans, the overlap between diets of Mute Swans and other native species, and the high Mute Swan population in the state, the lead and cooperating agencies believe there is sufficient reason to act to reduce impacts of non-native Mute Swans on native plant communities.

Mute Swans are known for their highly territorial behavior during breeding season and may compete with native wildlife for space and associated resources. The MDNR is particularly concerned about potential impacts on state-listed threatened and endangered (T & E) species including Trumpeter Swans and Common Loons. Data on the direct impacts of Mute Swans on native swans is limited. Mute Swans have been observed behaving aggressively toward native Tundra Swans, and driving them from protected coves and feeding areas (Maryland Department of Natural Resources 2003). In most instances, Mute Swans establish territories and initiate nesting about 3 weeks earlier than Trumpeter Swans and successfully defend them from Trumpeter Swans and other native wildlife. Although Trumpeter Swans have been occasionally known to prevail in conflicts with Mute Swans (Kellogg Bird Sanctuary, unpub. report.), the high numbers of Mute Swans contribute to increasing conflicts over and pressure for resources used by both species. During the breeding season, Mute Swans have also displaced other native waterfowl from preferred nesting locations (Ciaranca et al. 1997, Petrie 2002), and have reportedly killed adult and juvenile ducks and geese (Kania and Smith 1986, Ciaranca 1990). In one incident in Maryland, a large molting flock of Mute Swans caused a colony of Least Terns (*Sterna antillarum*) and Black Skimmers (*Rynchops niger*) to abandon a nesting colony by trampling nests, eggs, and chicks (Maryland Department of

Natural Resources 2003). The birds also displaced nesting Common Terns (*Sterna hirundo*). In 2011 in Michigan, a Mute Swan nest was found in the middle of a Black Tern (*Chlidonias niger*) colony site which had supported approximately 54 Black Terns in 2009. In 2011, there were only a few Black Tern nests noted roughly 30-40 feet away from the swan nest (MDNR unpublished data).

Human development and associated activities have resulted in substantial loss of wetland habitat in North America, which make the preservation and restoration of remaining areas for native wildlife especially important. Although other native swans, such as Trumpeter Swans, may also compete with native species, this is a natural occurrence which has come into balance over evolutionary time (WDNR 2007). Native swans do not habituate as readily to human altered environments and their populations appear to be limited by biological factors which do not appear to have similar limiting effects on non-native Mute Swans. The additional cumulative impact of concentrations of introduced Mute Swans can be more than can be sustained without adverse impacts on native species and ecosystems.

1.4.2 Risks to Human Health from Mute Swans

While transmission of disease or parasites from waterfowl to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun, et al. 2000). In worst case scenarios, infections may be life threatening for immunocompromised and immunosuppressed people (Roffe 1987, Virginia Department of Health 1995, Graczyk et al. 1998). There are several pathogens involving Mute Swans which may be contracted by humans. However, even though many people are concerned about disease transmission from feces, the risk of infection is believed low (Centers for Disease Control and Prevention ((CDCP) 1998). Financial costs related to human health threats involving Mute Swans may include testing of water for *coliform* bacteria, regularly cleaning feces from beaches and other recreational areas, loss of revenue for businesses associated with recreations sites that are temporarily closed because of fecal contamination, obtaining assistance from public health officials, and implementing non-lethal and lethal methods of MSDM.

Wildlife Services recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health. Wildlife Services' involvement in management of risks to human health from Mute Swans may include sampling animals and the environment for diseases/organisms and/or working with health officials and/or property managers to reduce existing health problems or risks. This section includes a description of a wide variety of diseases associated with Mute Swans. Not all of these diseases are currently known to occur in Michigan. It is also possible that WS may receive a request from state or local human health and wildlife agencies to conduct surveillance for new diseases that are not on this list. In these instances, WS could conduct surveillance for or work with regulatory

agencies to manage disease in birds so long as the methods used and anticipated environmental impacts are within the parameters analyzed in this EA, and the methods are allowed under the selected management alternative. The following list provides examples of some of the types of health issues that may be associated with Mute Swans

Cryptosporidium parvum is a protozoan parasite that commonly causes a diarrheal disease (Cryptosporidiasis) in a wide range of animals. Humans can become infected with Cryptosporidiosis through contact with infected mammals or contaminated water. The presence of *Cryptosporidium parvum* in water supplies (e.g. lakes, reservoirs) used for human consumption is a public health risk and has caused numerous human outbreaks (Karanis et al. 2007). Mute Swans have tested positive for the presence of *Cryptosporidium* (including *C. parvum*) in their fecal droppings (Ketelaars et al. 1999, Majewska et al. 2008, Papazahariadou et al. 2008).

Giardiasis is an illness caused by a microscopic parasite (*Giardia lambia*) that has become recognized as one of the most common causes of waterborne disease in humans in the United States during the last 15 years (CDCP 1999). Giardiasis is contracted by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal or person, and causes diarrhea, cramps and nausea (CDCP 1999). *Giardia* cysts have been documented in Mute Swan fecal droppings (Ketelaars et al. 1999, Majewska et al. 2008, Papazahariadou et al. 2008).

Salmonella *(Salmonella spp.)* may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea. Salmonella has been documented in Mute Swans (WS unpublished data).

Chlamydiosis is caused by *Chlamydia psittaci*, which can be present in diarrhetic feces of infected waterfowl, and can be transmitted if it becomes airborne (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl, herons, and rock doves (pigeons) are the most commonly infected wild birds in North America (Locke 1987).

Cercarial dermatitis ("swimmer's itch") is caused by a parasite that lives in the blood of infected animals such as ducks, geese, gulls, swans, and certain aquatic mammals such as muskrats and beavers. The parasite produces eggs that are passed in the feces of infected birds or mammals. If the eggs land in the water, the water becomes contaminated. The larvae burrow into the swimmer's skin, and may cause an allergic reaction and rash (CDCP 2004). In 2011, a total of 240 Mute Swans were screened for intestinal parasites, including *Schistosomes*, which is the genus of the parasite causing "swimmer's itch". A variety of intestinal parasites were found in 47 swans including flukes, trematodes, tapeworms, and *Schistosomes* (WS unpublished data).

Escherichia coli (*E. coli*) bacteria are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of E. coli and the majority are harmless (Sterritt and Lester 1988). Probably the best known serological type of *E. coli* is *E. coli* O157:H7, which is a harmful *E. coli* usually associated with cattle (Gallien and Hartung 1994). Concerns about E. coli contamination and associated illness were the primary reason the U.S. and Europe developed requirements for testing public water supplies at the turn of the century.

Regardless of whether the serological types of *E. coli* disseminated into watersheds by Mute Swans are proven to be harmful to humans, it has been demonstrated that waterfowl can disseminate *E. coli* into the environment and result in elevated fecal coliform densities in the water column (Hussong et al. 1979). Unfortunately, linking the elevated bacterial counts to frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link these animal sources of coliform bacteria to fecal contamination (Jamieson 1998, Simmons et al. 1995). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. More recently, microbiologists were able to implicate waterfowl and gulls as the primary source of *E.* coli contamination along the Minnesota shoreline of Lake Superior (Winfried et al. 2007). Many communities monitor water quality at swimming beaches, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards the beaches are temporarily closed, adversely affecting recreational use of the site, even though they may not have the type of *E. coli* known to cause illness in humans.

Avian Influenza (AI) is primarily a disease of birds caused by influenza A viruses. Wild waterfowl (particularly ducks, geese, and swans) are considered to be the natural reservoirs for AI (Webster 1992). Avian influenza viruses (AIVs) vary in the intensity of illness they may cause (virulence). Most AIV strains rarely cause severe illness or death in birds; however two strains (H5 and H7) are known to cause highly virulent and very contagious infections in humans and other animal species (Olsen 2006). In addition, even the strains which do not cause severe illness in birds are a concern for human and animal health because the viruses have the potential to become virulent and transmissible to other species through mutation and reassortment (Clark 2003).

The occurrence of highly pathogenic avian influenza virus (HPAIV) H5N1 has raised concern regarding its potential impact on wild birds, domestic poultry, and human health should it be introduced into the U.S. HPAIV H5N1 has been circulating in Asian poultry and fowl resulting in death to these species. More recently, this virus moved back into wild birds resulting in significant mortality of some species of waterfowl, gulls, and cormorants (Olsen 2006). Numerous potential routes for introduction of the virus into the U.S. exist including: illegal movement of domestic or wild birds, contaminated products,

infected travelers, and the migration of infected wild birds.

Mute Swans have been of particular concern in the spread of HPAIV H5N1 in Europe. Recent AIV surveillance reports from several European countries (Germany, France, Poland, Croatia, Austria, Italy, Slovenia, Hungary, Czech Republic, Hungary) show that of all the waterfowl species, the Mute Swan population was predominantly affected, and this suggests an increasing role of Mute Swans in the epidemiology of HPAIV H5N1 (Nagy et al. 2007). Because of their susceptibility to HPAIV infection, and swan mortality is relatively easy to detect, Mute Swans make an ideal sentinel for early HPAIV outbreak detection (Hars et al. 2008).

Eastern Equine Encephalitis (EEE) is an arbovirus that is spread by mosquitoes and is important because it can affect the central nervous system of humans and cause severe complications and death (CDCP 2006). Birds are the source of infection for mosquitoes, which can sometimes transmit the infection to horses, other animals, and people. Historically, Mute Swans have never been examined for EEE, but 100 serum samples from Michigan Mute Swans were tested in 2011 and 10 of those were positive for EEE (WS unpublished data). It is unclear at this point what role, if any, Mute Swans are playing in the maintenance or transmission of the disease, but continued research is underway.

Toxoplasmosis is a disease caused by the parasite *Toxoplasma gondii* which is known to affect humans (Dubey 2008). In most people, toxoplasmosis may cause flu-like symptoms, although some people never develop signs or symptoms. Toxoplasmosis can cause more serious complications in infants born to infected mothers and individuals with compromised immune systems (MayoClinic 2011). The parasite can be found in a variety of birds and mammals, and can be spread to humans through fecal contamination. In 2011, serum from 62 Mute Swans in Michigan was tested for evidence of toxoplasmosis infection, with four testing positive (WS unpublished data). Because the parasite can be shed in feces from infected birds, there is a risk of infection to people swimming in waters contaminated with Mute Swan feces. The degree of risk is currently being evaluated.

1.4.3 Risks to Human Safety from Mute Swans

Bird strikes usually kill birds and can damage aircraft, disrupt airport operations, and erode public confidence in the safety of air travel (Dolbeer et al. 2012, Conover et al. 1995, Linnell et al. 1996). Damage to aircraft from bird strikes poses a substantial risk to human safety. Federal Aviation Administration regulations require aircraft engines to be designed to withstand the ingestion of a 4-lb. bird into the engine without an uncontained fire or engine failure. The size of Mute Swans (approximately 20-24 lbs.; Madge and Burn 1988) makes them particularly hazardous to aircraft (Dolbeer and Eschenfelder 2003). With the increasingly large number of Mute Swans in the Great Lakes region, airports in Michigan are more likely to incur Mute Swan strikes compared to other states.

In the United States from 1994 to 2011 there were eight reported Mute Swan strikes, with three of these being in Michigan (FAA 2012). There were no data recorded on the specific costs for damages incurred for any of the Mute Swan strikes. However, one strike report from New York noted a flap skin was punctured and the plane was taken out of service for replacement of flap. Another strike report from New York includes comments that a flock of 5 Mute Swans crossed the flight path immediately after takeoff and the pilot used evasive maneuvers to avoid collision. The pilot reported situation to the tower and the tower later reported finding bird remains on the runway.

Mute Swans aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Conover and Kania 1994). In Michigan, reported attacks on humans in boats and on shore have become more frequent (MDNR 2003, 2012*c*). Birds which have learned to expect food from people may become aggressive in seeking food. Mute Swans are also very territorial and will defending their nest site and chicks from all perceived threats including people. Most of the aggressive behavior is bluffing, but Mute Swans are capable of inflicting bruises, sprains, bone fractures, and in at least two cases on the East Coast, human fatalities (WDNR 2007). In 2012, aggressive behavior by a Mute Swan contributed to the death of a man in Illinois (Steckling 2012).

1.4.4 Mute Swan Damage to Property

The majority of individuals who contact WS for assistance describe a general decline in their enjoyment of sites or recreational activities due to a local overabundance of Mute Swans. In many cases, people are unable to use and enjoy their own property, public parks, and other areas because of aggressive swans or the presence of swan feces. Costs associated with property damage include labor and disinfectants to clean and sanitize the areas, loss of property use and resale value, loss of aesthetic value of aquatic vegetation, and lawns where Mute Swans nest, loss of customers or visitors irritated by having to walk on feces or fear being attacked by aggressive swans, loss of time contacting wildlife management agencies on health and safety issues and damage management advice, and implementation of wildlife management methods.

Mute Swan collisions with aircraft are not only a risk to human safety, they can also result in expensive damage to aircraft, loss of aircraft use during repairs, and losses due to cancellation and delays of flights because of damage to aircraft.

1.4.5 Impacts on Agriculture

In some portions of the world, Mute Swans cause damage to agricultural crops such as wheat and oilseed rape (Parrott and Watola 2008). However in Michigan, incidents of swan damage to crops are unlikely. However, animal health professionals are concerned about the potential for Mute Swans to serve as a vector or reservoir for diseases of significance to agriculture. Some of these diseases may also impact human health and have been described above.

Newcastle's Disease Virus (NDV) has been detected in over 200 bird species. In most cases the birds showed no clinical signs of disease (Kaleta and Baldauf 1988). Three pathotypes of NDV are recognized, lentogenic (low-virulence), mesogenic (moderate-virulence) and velogenic (high-virulence), based on disease produced by the virus isolate in poultry (Alexander 1997). Newcastle Disease Virus is shed via feces, body fluids, and eggs, and is transmitted by the fecal-oral route as well as aerosolized bodily secretions (Leighton and Heckert 2007). The virus is able to persist in the environment over wide temperature ranges. Newcastle's Disease epidemics have occurred with irregular frequency throughout the Great Lakes basin, primarily in cormorants. Despite several outbreaks of NDV in the past two decades in Canada and the U.S., little is known about how the disease is maintained in wild bird populations. Given the demonstrated ability of wild birds to transmit NDV to commercial poultry flocks (Heckert et al 1996) and the high mortality experienced by poultry infected with NDV (Alexander 1997), it is important to fill the current information gaps in this disease system. In 2011, WS collected serum samples from 242 Mute Swans from Michigan, and found 138 (57%) to be positive for NDV (WS unpublished data). Further research is warranted to evaluate the role Mute Swans may be playing in the maintenance and transmission of the disease.

Wildlife Services works with state and federal agencies and researchers from universities in conducting surveillance for diseases and may assist with projects investigating disease transmission and management so long as the methods used and anticipated environmental impacts are within the parameters analyzed in this EA, and the methods are allowed under the selected management alternative.

1.4.6 Michigan Department of Natural Resources Mute Swan Management and Control Program

The MDNR first started expressing concerns about the expanding Mute Swan population in the 1960s (MDNR 2012*b*). In January, 2012, the MDNR completed the most recent set of Mute Swan Management and Control Program Policy and Procedures (MDNR 2012*a*). The MDNR management objectives set in the Policy and Procedures were based on the need to reduce ecological impacts of the increasing population of Mute Swans in the state including disturbance and destruction of submerged vegetation, and competition with native breeding waterfowl such as Trumpeter Swans and Common Loons. The MDNR Policy and Mrocedures are also intended to provide a mechanism for reducing incidents of aggressive behavior by Mute Swans toward people. The Policy and Procedures set short-term (2011-1016) management objectives of eliminating all Mute Swans from state administered lands and reducing Mute Swan population growth in the state to zero on all other lands. The long-term objective is to reduce the statewide population of Mute Swans to less than 2,000 birds by 2030.

The MDNR Mute Swan Management and Control Program Policy and Procedures specify which methods can be used for Mute Swan removal, approved methods of carcass

disposal, and the method for monitoring the Mute Swan population. Approved methods for removal include shooting; live-capture followed by euthanasia (inhalation of carbon dioxide, cervical dislocation, injection of approved anesthesia drugs, single shot to the head); egg and nest destruction; and egg addling, oiling and chilling. The Mute Swan Policy and Procedures also establish requirements for public/landowner notification and consent prior to the issuance of permits for Mute Swan take in areas with multiple lakeshore and riparian landowners, and in areas with single bottomland ownership but multiple landowners adjacent to the bottomland.

From 2006-2010, WS removed Mute Swans in Michigan for damage management and disease surveillance (Fig. 4). Scope of removals was limited relative to the statewide population estimates and distribution, largely because of financial constraints, until 2011. Throughout this period, the Mute Swan population in Michigan continued to increase (Fig. 1). In 2011, a grant from the Great Lakes Restoration Initiative (GLRI) was available to fund Mute Swan removals for the recovery of native species and ecosystems in the Great Lakes. Wildlife Services removed 1,518 Mute Swans from 40 sites throughout Michigan in 2011 as part of the Great Lakes Restoration Initiative (Figure 5).

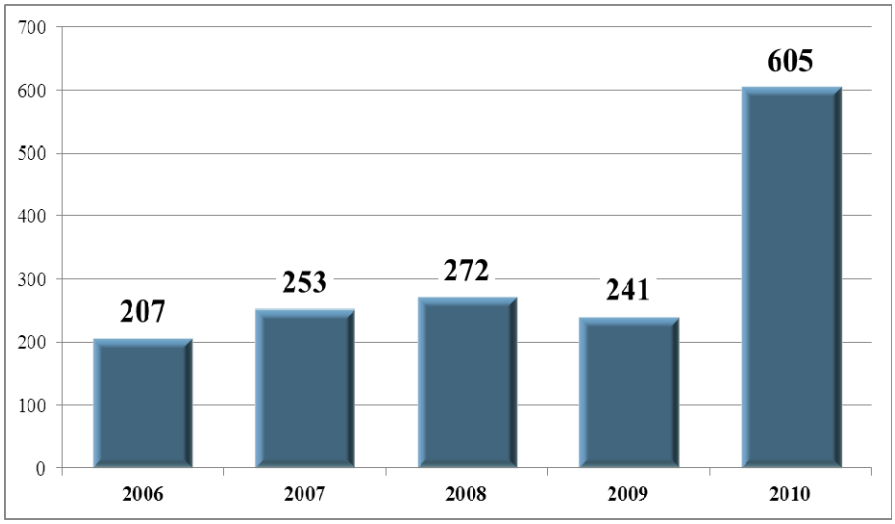

Figure 4. Mute Swans removed by WS from state-managed natural areas prior to GLRI funding in 2011.

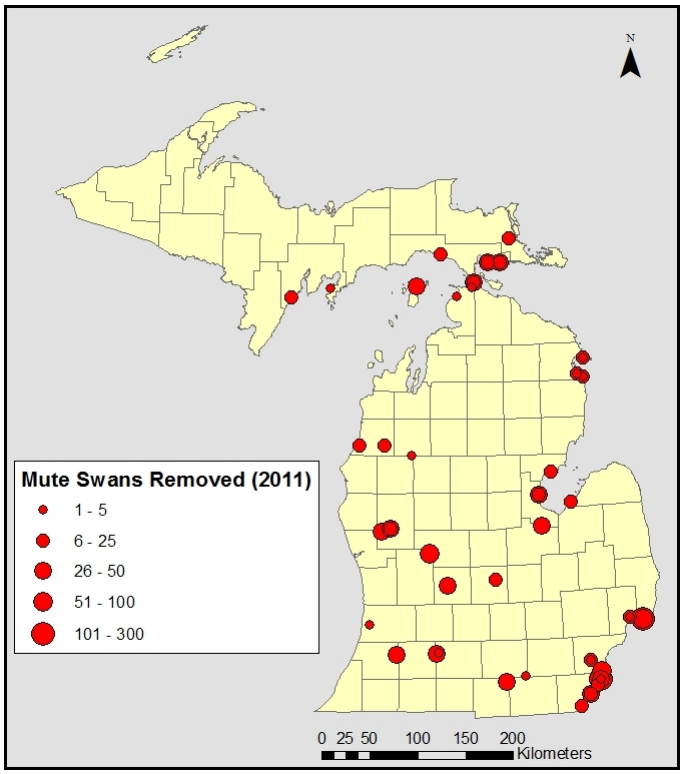

Figure 5. Locations where Mute Swans were removed by WS in 2011.

1.5 RELATIONSHIP OF THIS ENVIRONMENTAL ASSESSMENT TO OTHER ENVIRONMENTAL DOCUMENTS

Animal Damage Control [WS] Programmatic Environmental Impact Statement. Wildlife Services has issued a Final EIS on the national APHIS/WS program (USDA 1997 Revised). Pertinent and current information available in the EIS has been incorporated by reference into this EA.

2012 MDNR Mute Swan Management and Control Program Policy and Procedures. In 2006, the MDNR completed the Mute Swan Management and Control Program Policy and Procedures (MDNR 2006). The document established the management objectives, policies and procedures used by the MDNR to addressed damage by and conflicts with Mute Swans in Michigan. The MDNR Wildlife Division has worked with the Mute Swan Forum to update the policy and procedures and a revised version was approved in January 2012. The forum included a diverse group of organizations and agencies such as Ducks Unlimited, Michigan Audubon Society, Friends of the Detroit River, Kellogg Biological Station of Michigan State University, Rouge River Bird Observatory of the University of Michigan, Michigan Lake and Stream Association, Michigan Humane Society, and the Detroit Zoological Society. The Mute Swan

Forum agreed that increased actions needed to be taken to address the exponential growth of the mute swan population to protect the natural resources of this state. See Section 1.4.6.

2012 Mississippi Flyway Council Policy – Management of Mute Swans (MFC 2012). The Mississippi Flyway Council was established in 1952 to coordinate the management of migratory game and non-game birds in the Flyway and promote activities of its members that serve the long-term benefit to the resources and the Flyway as a whole. Administratively, the Mississippi Flyway includes the states of Alabama, Arkansas, Indiana, Illinois, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin and the Canadian provinces of Saskatchewan, Manitoba and Ontario. The policy briefly reviews the history, status, and management concerns pertaining to Mute Swans in the Mississippi Flyway and provides direction for the cooperative management of Mute Swans by natural resource agencies within the flyway. The management goal for the Flyway is to maintain Mute Swan populations at levels that will minimize or eliminate their harmful ecological impacts to native waterfowl species and habitats. Primary objectives of the plan include reducing the Flyway population of Mute Swans to 4,000 birds or fewer by 2030 and preventing Mute Swans from establishing new breeding populations in areas where they do not currently exist. The plan notes that the two largest populations of Mute Swans in the Flyway are Michigan (> 15,000 birds in 2011) and Ontario (>3,000 birds in 2011).

1.6 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.6.1 Actions Analyzed

This EA evaluates MSDM by WS to protect human health and safety, property, natural resources, and agriculture on private, public or tribal lands whenever or wherever such management is requested from the WS program in Michigan.

1.6.2 American Indian Lands and Tribes

The scope of this EA is limited to the MSDM actions of WS and federal agencies working cooperatively with WS. Although the EA provides estimates of the anticipated activities of other entities (e.g., tribes) for the purpose of analyzing cumulative impacts, these estimates do not represent a commitment by tribal entities to work within the parameters analyzed by WS. Wildlife Services, with assistance from the MDNR and cooperating agencies, will monitor MSDM actions to determine if cumulative impacts are within parameters predicted and analyzed in the EA. The EA will be updated as needed pursuant to the NEPA.

Native American tribes may conduct MSDM on their own or choose to work with all or some of the cooperating agencies. At the time this analysis was completed, WS had received requests for assistance with MSDM from the Little Traverse Bay Bands of

Odawa Indians and the Little River Band of Ottawa Indians. All WS MSDM actions are conducted in accordance with written agreements between WS and the tribes.

Tribes make their own decision regarding the management alternative they wish to implement on tribal lands. Memoranda of Understanding or agreements would be completed before WS would conduct MSDM on any tribal lands in Michigan. In the 1836 ceded territory, Mute Swan management decisions by tribes are made in accordance with the provisions of the 2007 Consent Decree (Setion 1.7.1).

1.6.3 Period for which this EA is Valid

If it is determined that an EIS is not needed, this EA will remain valid until the lead or cooperating agencies determine that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that the analysis and alternatives adequately reflect program activities and impacts.

1.6.4 Site Specificity

This EA analyzes potential impacts of WS's MSDM activities that will occur or could occur on private, public, and tribal lands in all 83 counties in Michigan. Because the proposed action is to implement an integrated MSDM program, and because Michigan WS program goals and responsibilities are to provide service when requested within the constraints of available funding and personnel, it is conceivable that MSDM activities by WS could occur anywhere in state. WS activities are only conducted after appropriate agreements for control or similar documents outlining the type and extent of the actions to be conducted are completed with the appropriate landowner/manager. The EA emphasizes issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of Mute Swan damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 is employed for determining methods and strategies to use or recommend for individual actions conducted by WS (See USDA 1997 Revised, and Chapter 3 for a more complete description of the WS Decision Model). Decisions made using this process will be in accordance with any mitigation measures and standard operating procedures (SOP) described herein and adopted or established as part of the decision.

Planning for the management of swan damage is 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 (e.g., airports), all specific locations or times where such damage will occur in any given year cannot be predicted. The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within the State of Michigan. In this way, WS believes the EA 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 meet needs for assistance with MSDM in a timely fashion. In addition, in terms of considering cumulative impacts, one EA analyzing affects in Michigan will provide a better analysis than multiple EA's covering smaller zones.

The EA also addresses the impacts of MSDM on areas where additional agreements may be signed in the future. Because the proposed action is to reduce or prevent 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 MSDM efforts could occur. Thus, the EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

1.6.5 Public Involvement/Notification

The EA will be made available for public review and comment for 30-day period, in accordance with Council on Environmental Quality (CEQ) and APHIS NEPA implementing regulations and WS public notification practices published in the federal register FR 72(54):13237-13238. Notices include a Legal Notice of Availability placed in the *Lansing State Journal*, posting on the WS NEPA web site, and notices of availability and/or copies of the EA mailed directly to individuals and organizations that the lead and cooperating agencies believe may have an interest in the EA. This EA will be available for public comment from June 1 – July 2, 2012.

1.7 AUTHORITY AND COMPLIANCE

1.7.1 Authority of Federal and State Agencies and Tribes in Mute Swan Damage Management in Michigan

WS Legislative Authority. The USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). The Secretary of Agriculture has delegated his authority under both the statutes listed below to the APHIS. Within that agency, the authority resides with the WS program.

WS is a cooperatively funded, service-oriented program. Before any operational WDM is conducted, an Agreement for Control or similar document must be completed by WS and the landowner/administrator. WS cooperates with other federal, state, tribal, and

local government entities, educational institutions, private property owners and managers, and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws.

WS's mission is to "provide federal leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety." This is accomplished by:

A) training WDM professionals;
B) developing and improving strategies to reduce economic losses and threats to humans from wildlife;
C) collecting, evaluating, and disseminating management information;
D) establishing cooperative WDM programs;
E) informing and educating the public on how to reduce wildlife damage and;
F) providing data on and a source for limited use management materials and equipment, including pesticides (USDA 1989).

U.S. Department of the Interior, Fish and Wildlife Service (USFWS).
The primary responsibility of the USFWS is conserving fish, wildlife, plants, and their habitats. While some of the USFWS's responsibilities are shared with other federal, state, tribal, and local entities, the USFWS has special authorities in managing the National Wildlife Refuge System; conserving migratory birds, endangered species, certain marine mammals, and nationally significant fisheries; and enforcing federal wildlife laws. The MBTA gives the USFWS primary statutory authority to manage migratory bird populations in the United States. The USFWS is also charged with implementation and enforcement of the Endangered Species Act (ESA) of 1973, as amended, and with developing recovery plans for listed species and the Bald and Golden Eagle Protection Act.

The Migratory Bird Treaty Reform Act of 2004 clarifies the purpose of the MBTA as only pertaining to the conservation and protection of migratory birds *native* to North America. Congress directed the USFWS to establish a list of bird species found in the United States which are non-native, human-introduced species and therefore not federally protected under the MBTA. On March 15, 2005, the Secretary of Interior published a final list in the Federal Register of the non-native bird species that have been introduced by humans into the United States or its territories and to which the MBTA does not apply. Mute Swans are included on that list.

The mission of the National Wildlife Refuge System is to, "administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans". The Shiawassee National

Wildlife Refuge and the Detroit River International Wildlife Refuge have requested assistance with MSDM. Both requests for assistance were due to the damage to the natural habitats within the refuge and direct competition with native waterfowl species.

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

Great Lakes Indian Fish and Wildlife Commission (GLIFWC). The Great Lakes Indian Fish and Wildlife Commission is an agency of eleven Ojibwe nations in Minnesota, Wisconsin, and Michigan, with off-reservation treaty rights to hunt, fish, and gather in treaty-ceded lands and waters. It exercises powers delegated by its member tribes. The GLIFWC assists its member tribes in the implementation of off-reservation treaty seasons and in the protection of treaty rights and natural resources. The GLIFWC provides natural resource management expertise, conservation enforcement, legal and policy analysis, and public information services. The GLIFWC's member tribes include: the Bay Mills Indian Community, Keweenaw Bay Indian Community and the Lac Vieux Desert Band in Michigan; the Bad River, Red Cliff, Lac du Flambeau, Lac Courte Oreilles, Sokaogon and St. Croix Bands in Wisconsin; and the Fond du Lac and Mille Lacs tribes in Minnesota. All member tribes retained hunting, fishing and gathering rights in one or more treaties with the U.S. government, including the 1836, 1837, 1842, and 1854 Treaties.

The GLIFWC's Board of Commissioners, comprised of a representative from each member tribe, provides the direction and policy for the organization. Recommendations are made to the Board of Commissioners from several standing committees, including the Voigt Intertribal Task Force (VITF). The VITF was formed following the 1983 Voigt decision and makes recommendations regarding the management of the fishery in inland lakes and wild game and wild plants in treaty-ceded lands.

Federally Recognized Native American Tribes in Michigan. Michigan Native American tribes have authority for MSDM on tribal lands. The federally recognized Native American tribes in Michigan at the time this EA was completed include the Bay Mills Indian Community, Grand Traverse Band of Ottawa & Chippewa Indians, Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians, Hannahville Indian Community, Keweenaw Bay Indian Community, Lac Vieux Desert Band of Lake Superior Chippewa

Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, Nottawaseppi Huron Band of Potawatomi Indians, Pokagon Band of Potawatomi Indians, Saginaw Chippewa Indian Tribe, and Sault Ste. Marie Tribe of Chippewa Indians.

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

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

Given that Mute Swans can negatively impact native species and ecosystems, the tribes may choose to become involved in Mute Swan management within the ceded territory.

1.7.2 Compliance with Federal Laws

Several other federal laws authorize, regulate, or otherwise affect WS WDM. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act (NEPA). WS prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. 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.

Endangered Species Act (ESA). It is federal policy, under the ESA, that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS 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 USFWS (USDI 1992) describing potential effects of the national WS program on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997 Revised). WS completed an informal Section 7 consultation regarding the impacts of the MSDM methods proposed in this EA on federally-listed threatened, endangered and candidate species.

Migratory Bird Treaty Act of 1918 (U.S.C. 703711: 40 Stat. 755), as amended (MBTA). The Migratory Bird Treaty Act 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 or authorized by the USFWS. The Migratory Bird Treaty Reform Act of 2004 clarifies the original purpose of the MBTA as pertaining to the conservation and protection of migratory birds native to North America and directs the USFWS to establish a list of bird species found in the United States which are non-native, human-introduced species and therefore not federally protected under the MBTA. On March 15, 2005, the Secretary of Interior published a final list in the Federal Register of the non-native bird species that have been introduced by humans into the United States or its territories and to which the MBTA does not apply. Mute Swans were included on that list; therefore the MBTA does not apply to Mute Swans.

Bald and Golden Eagle Protection Act (16 USC 668). Congress enacted the Eagle Protection Act (16 U.S.C. 668) in 1940, thereby making it a criminal offense for any person to "take" or possess any bald eagle or any part, egg, or nest. The Act contained several exceptions which permitted take under select circumstances. Since its original enactment, the Act has been amended several times to increase protections for eagles and/or provide exemptions for specific types of activities. For example, the amendment in 1962 was designed to give greater protection to immature bald eagles, and to include golden eagles. The 1962 amendment also created two exceptions to the Act: first, it allowed the taking and possession of eagles for the religious purposes of Indian tribes and second, it provided that the Secretary of the Interior, on request of the governor of any state, could authorize the taking of golden eagles to seasonally protect domesticated flocks and herds in that state.

While Bald Eagles were federally listed as a threatened species, the Endangered Species Act was the primary regulation governing the management of Bald Eagles in the lower 48 states. Now that Bald Eagles have been removed from the Federal list of T & E species, the Bald and Golden Eagle Protection Act is the primary regulation governing Bald Eagle management. For purposes of this Act, "take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb." If an APHIS action could potentially affect either bald or golden eagles in any of these ways, APHIS must consult with USFWS. If these species are found in a location where a proposed action

will be carried out, APHIS must ensure that its actions do not impact eagles in a way that fits the definition of "take". When there is the potential to affect eagles, it is advisable to coordinate with USFWS to assure actions avoid "take." WS is consulting with the USFWS regarding potential risks to Bald Eagles from the proposed actions and methods to reduce impacts on eagles.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The U. S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All pesticides used by the WS program in Michigan are registered with and regulated by the EPA and the Michigan Department of Agriculture and Rural Development, and are used by WS in compliance with label procedures and requirements. No toxicants are currently used or registered for use in Mute Swans or reducing Mute Swan damage, but some nonlethal repellents are available.

Investigational New Animal Drug (INAD). The drug alpha-chloralose 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 method to capture birds.

National Historic Preservation Act (NHPA) of 1966, as amended. The National Historic Preservation Act 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 invited all the tribes in Michigan and the Chippewa Ottawa Resource Authority to participate in the preparation of this EA and has provided copies of this EA to each of the federally recognized tribes in Michigan and to the GLIFWC. Wildlife Services also offered the tribes the opportunity for formal consultation on this issue. Wildlife Services actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. The GLIFWC and the Chippewa Ottawa Resource Authority which assist with tribal interests in natural resource management in the ceded territories were also invited to participate in the preparation of the EA.

The MSDM methods described in Chapter 3 and Appendix B that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, does not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any

property. With the potential exception of noise-making devices, the proposed methods generally do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. There is potential for audible effects on the use and enjoyment of a historic property when methods such as propane exploders, pyrotechnics, firearms, or other noise-making methods are used at or in close proximity to such sites for purposes of hazing or removing nuisance birds or other wildlife. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280). This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity.

WS has determined that the Preferred Alternative would be consistent with the state's Coastal Zone Management Program. Wildlife Services has sent a request for a consistency determination to the Michigan Coastal Zone Management Program.

Environmental Justice and Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.
Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" 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 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. The USDA 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. Wildlife Services personnel use only legal, effective, and environmentally safe WDM methods, tools, and approaches. 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.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045). Children may suffer disproportionately from environmental health and safety risks for many reasons, including the development of their physical and mental status. Wildlife Services makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and has considered the impacts that this proposal might have on children. The proposed MSDM program would only use legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action. Additionally, since the proposed MSDM program may include actions to reduce accumulations of feces and Mute Swan aggression at public parks, private properties, and other locations where children are sometimes present, it should help reduce health and safety risks to children.

Executive Order 13112 – Invasive Species. This order directs federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. To comply with Executive Order 13112, WS may cooperate with other federal, state, or local government agencies, or with industry or private individuals to reduce damage to the environment or threats to human health and safety.

1.7.3 Compliance with State Laws

The MDNR, under Public Act 451 of 1994, is empowered to "protect and conserve the natural resources of this state" [MCL 324.503 (1)]. In addition, MCL 324.40105 states, "All animals found in this state, whether resident or migratory and whether native or introduced, are the property of the people of the state, and the taking of all animals shall be regulated by the Department, as provided by law." Further, the Department has authority to issue orders determining the kinds of animals that may be taken and determining the animals or kinds of animals that are protected [MCL 324.40107 (1)].

Permitted acts; certain species.

Section 9.3 (2) (Protected Animal; Unlawful Acts) lists Mute Swans as a protected species that can be taken only by means identified in Section 9.1 (Permitted Acts, Certain Species).

Section 9.1. (2) stipulates that Mute Swans and their eggs and nests may be taken by department personnel, and persons authorized in writing by the department to control Mute Swans under one or more of the following situations: (a) To stabilize or reduce Mute Swan population levels or to prevent new populations of feral Mute Swans from being established in this state; (b) To prevent Mute Swans interference with the establishment, reestablishment, or reproductive success of native wildlife and with the establishment or reestablishment of native vegetation; (c) To prevent Mute Swans interference with the establishment, reestablishment, or reproductive success of endangered or threatened species; (d) To protect public health, safety, or welfare. Mute Swans taken as provided in Section 9.1 shall not be released back into the wild in Michigan.

Other, related, regulatory authority for mute swans is provided in Section 5.51 (Damage and nuisance animal control permit, issuance) and Section 5.74a (Animals of special concern, possession, transportation and disposal) of the Wildlife Conservation Order.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

2.0 INTRODUCTION

Chapter 2 contains a discussion of issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences). It also provides a review of issues that were considered by not analyzed independently for each of the alternatives, with rationale for not including the issue in the detailed analysis. Additional information on the affected environment is incorporated into the discussion of the environmental impacts in Chapter 4, and the description of the current program in Chapter 3.

2.1 AFFECTED ENVIRONMENT

The affected environment includes any site in Michigan where there is damage by or a conflict with Mute Swans including but not limited to, property on or adjacent to airports, golf courses, recreational areas, swimming beaches, parks, agricultural areas, wetlands, state or federal natural and game areas, and habitat restoration sites. The proposed action may be conducted on properties held in private, local, state, tribal, or federal ownership including Shiawassee National Wildlife Refuge, Detroit River International Wildlife Refuge, and Huron-Manistee National Forests. Wildlife Services would not conduct MSDM at any site without the consent of the appropriate landowner/manager. Work on tribal lands would only be conducted after the completion of all appropriate agreements between WS and the tribe(s).

2.2 ISSUES

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

I. Effects on Mute Swan Populations;
II. Effectiveness of Mute Swan Damage Management Methods;
III. Effects on Aesthetic Values;
IV. Humaneness and Animal Welfare Concerns of Methods Used by WS; and
V. Effects on Non-target Wildlife Species Populations, Including T&E Species

2.3 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

2.3.1 Effects on Mute Swan Populations

Mute Swans are a non-native invasive species (Section 1.3.1). Presidential Executive Order 13112 - Invasive Species directs federal agencies to use their programs and

authorities to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. In Michigan, the MDNR and tribes have authority for Mute Swan management. The MDNR has established a long-term population goal for the management of Mute Swans of 2,000 birds by 2030 (MDNR 2012*a*). This section analyzes the potential impacts of each alternative in context of the state management objectives for Mute Swans.

2.3.2 Effectiveness of Mute Swan Damage Management Methods

Another common concern among members of the public, tribes, and agencies is whether the methods of reducing Mute Swan damage will be effective in reducing or alleviating the damage/conflict. The effectiveness of each alternative can be defined in terms of decreased health risks, decreased human safety hazards, reduced damage to property and natural resources, and a reduction in nuisance complaints.

2.3.3 Effects on Aesthetic Values

Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetic values are subjective and depend on what an observer regards as beautiful. Generally, wildlife is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit for many people. However, as discussed in Chapter 1, Mute Swans may also have adverse impacts on people and on other environmental components with aesthetic value (e.g., native Tumpeter Swans).

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 is a part of the stability of natural ecosystems (e.g., ecological, existence, bequest values; Bishop 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest benefits involve providing for future generations, and pure existence benefits are the knowledge that the animals exist (Decker and Goff 1987). Positive values of wildlife would also include having enough wildlife to view. However, the same wildlife populations that are generally appreciated may also create conflicts with land uses, natural resources, and human health and safety. Some wildlife species can be regarded as a nuisance in certain settings. Large numbers of Mute Swans can reduce the aesthetic appearance and enjoyment of some activities and locations because of excessive feces, aggression behavior and risk of human injury, denuded vegetation, eroded stream banks, and negative impacts on native wildlife. In context of this EA, consideration of aesthetics includes those values people place on Mute Swans, knowledge of their existence and

occurrence in their area, ability to enjoy and use properties for their intended purpose, and ability to enjoy native ecosystems.

Public reaction to damage management methods is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife. Many people directly affected by damage to property and threats to human safety caused by Mute Swans desire lethal removal of the birds from the property when the WAC has been exceeded. Other people believe that Mute Swans should be captured and relocated to another area to alleviate damage or threats to human safety. Some people directly affected by the damage from Mute Swans oppose removal of the birds regardless of the amount of damage. Individuals who are totally opposed to bird removal want WS to teach tolerance for Mute Swan damage and threats to human health and safety, and to only apply nonlethal methods or egg treatments.

Some of the people who oppose removal of Mute Swans do so because of human affectionate bonds with individual birds. Mute Swans readily become accustomed to people (habituate) and can live in close proximity to humans. It is not uncommon for people in these situations to feed the birds and/or otherwise derive aesthetic enjoyment from the presence of the animals. Some people consider individual wild birds as "pets", or exhibit affection toward individual animals. Examples would be people who visit a city park to feed waterfowl and homeowners who enjoy the birds that make regular use of their property.

Some property owners that have populations of Mute Swans above their personal WAC are concerned about the negative aesthetic appearance of feces and property damage to landscaping. Others may be concerned about the behavior of territorial or food-habituated swans that solicit handouts from people. Managers of golf courses, swimming beaches, and parks may be particularly concerned because negative aesthetics can result in reduced public use.

2.3.4 Humaneness and Animal Welfare Concerns of Methods used by WS

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently.

Research indicates that the public may be willing to accept lethal wildlife management methods if they are humane (i.e., minimize pain and suffering of the target animal) (Kellert 1993, Schwartz et al. 1997). The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife, is an important and complex concept. Wildlife 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"* (Schmidt 1989). 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, suffering is considered to be minimized where death is immediate (CDFG 1991) such as occurs with proper shooting.

Defining pain as a component in humaneness of WS methods is a greater challenge than that of suffering. Altered physiology and behavior can be indicators of pain, and the causes that elicit pain responses in humans would *" . . . probably be causes for pain in other animals . . . "* (AVMA 1987). Pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). One challenge with coping with this issue is how to achieve the least amount of animal suffering while still effectively addressing wildlife damage problems within the constraints of current technology and resources.

Wildlife Services 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 MSDM methods are used.

Wildlife Services personnel in Michigan 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 and SOP used to maximize humaneness are listed in Chapter 3.

2.3.5 Effects on Non-target Wildlife Species Populations, Including T&E Species

Wildlife Services and the public are concerned about the potential impact of WDM methods and activities on non-target species, particularly T&E species. Wildlife Services SOP include measures intended to mitigate or reduce the effects on non-target and T&E species populations and are presented in Chapter 3. Since Mute Swans have been shown to eat similar plants as native waterfowl (Bailey et al. 2008) and because their territorial behavior may exclude nesting of other species such as Trumpeter Swans and Common Loons, implementation of MSDM is expected to benefit native T & E species.

2.4 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

2.4.1 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. Wildlife damage management falls within the category of federal or other agency actions in which

the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. The WS program is analogous to other agencies or entities with damage management missions such as fire and police departments, emergency cleanup organizations, insurance companies, etc. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage will occur, the program cannot predict the specific locations or times at which affected resource owners will request WDM assistance from WS. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever bird conflicts 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 State of Michigan. In this way, WS believes the EA 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 meet needs for assistance with MSDM in a timely fashion. In addition, one EA analyzing the cumulative impacts throughout Michigan will provide a better analysis than multiple EA's covering smaller zones. However, if a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared.

2.4.2 Reliability of Population Estimates Using Aerial Surveys

Some individuals may question the reliability of the Michigan statewide Mute Swan population estimates. These population estimates are derived each year using data from the MDNR Michigan Spring Breeding Waterfowl Survey. Since 1991, the state of Michigan has cooperated with other states, the USFWS, Canadian provinces, and the Canadian Wildlife Service in conducting aerial surveys of breeding waterfowl. Surveys are conducted following the SOP established by the USFWS (USFWS 1987). The Michigan portion of the continental breeding duck and goose survey encompasses most of the state. There are 2,500 miles of east-west transects that are flown by two qualified observers (not including the pilot) in a fixed-wing aircraft between mid-April and early May, prior to leaf out. Approximately two-thirds of the transects are located in the southern Lower Peninsula, and the remainder are split between the northern Lower Peninsula and the eastern Upper Peninsula. Flights are conducted at low elevation, slow speeds, and follow the same transect routes each year. Waterfowl estimates are derived by expanding densities corrected for visibility bias from transects to entire strata. Swan estimates differ from other waterfowl species in that the densities are not corrected for visibility bias (i.e., assume all swans are observed). Therefore, any bias in swan population estimates would underestimate the true population size and could be considered as the minimum population. The survey methodology used is scientifically sound and proven and used by other states and Canadian provinces.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the potential management alternatives, including those analyzed in detail in Chapter 4 (Environmental Consequences), alternatives considered but not analyzed in detail, and SOP for WDM techniques.

3.1 MUTE SWAN DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES USED BY WILDILFE SERVICES

This section contains a description of the general damage management strategies and individual damage management techniques that could be applied by WS to address Mute Swan damage and conflicts in Michigan. Appendix B is a more thorough description of the methods that could be used or recommended by WS. These strategies and techniques are combined to form management alternatives discussed in Section 3.2.

3.1.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially (USDA 1997 Revised). The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[1] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. Integrated Wildlife Damage Management may incorporate cultural practices (e.g., no feeding policies), habitat modification (e.g., exclusion), animal behavior modification (e.g., frightening devices), nonlethal or lethal removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem. Wildlife Services considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions that could be implemented by the requester, WS, or others, as appropriate. Methods may be applied using one of two general strategies:

> **Preventive Damage Management** is applying WDM strategies before damage occurs, based on historical problems and data. Most preventive management techniques are non-lethal methodologies, and are most commonly applied by the resource owners/manager. When requested, WS personnel provide information, conduct demonstrations, or take actions to prevent losses from occurring. An example would be a cooperator installing and maintaining a fence and/ or overhead wire grid system to reduce access of Mute Swans to a retention pond.

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

Corrective Damage Management Corrective damage management is applying WDM to stop or reduce current losses. Both nonlethal and lethal methods may be used for corrective damage management. As requested and appropriate, WS personnel provide information, conduct demonstrations, or take action to prevent additional losses from recurring. Examples include using pyrotechnics or border collies to chase away birds, removing breeding pairs of Mute Swans, or oiling eggs.

3.1.2 Wildlife Services Decision Model

Wildlife Services personnel use a thought process referred to as the WS Decision Model for evaluating and responding to damage complaints that is described by Slate et al. (1992) (Fig. 6). Wildlife Services personnel assess the problem; evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations, and the damage management history of the site. Wildlife Services personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. Following this evaluation, the methods deemed to be appropriate for the situation are developed into a management strategy. After the management 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 necessarily a documented process, but is a mental problem-solving process common to most if not all professions.

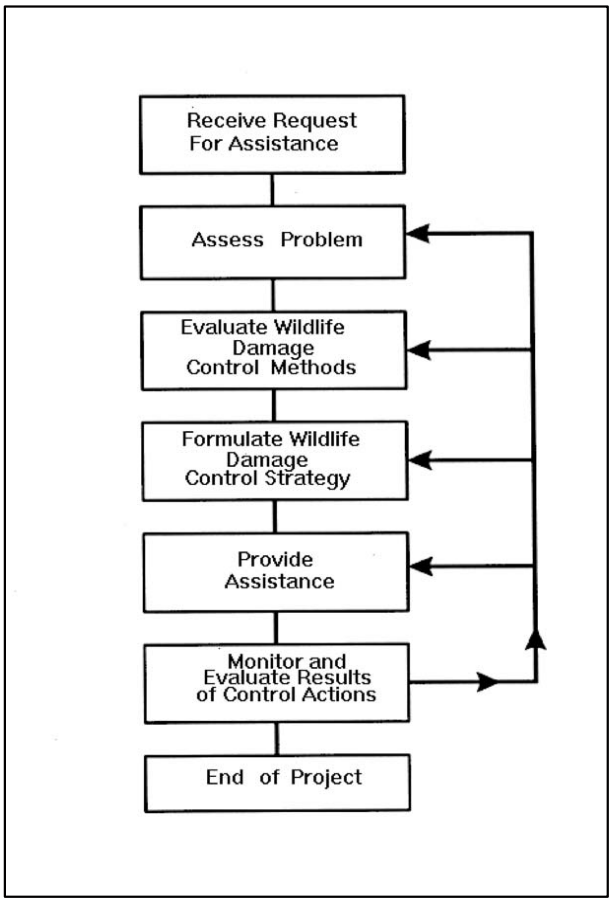

Figure 6. Wildlife Services Decision Model

3.1.3 General Types of Assistance Which May Be Provided by WS

Technical Assistance Recommendations (implementation is the responsibility of the requestor): Technical assistance is information, demonstrations, and advice on available and appropriate WDM methods. Technical assistance may require substantial involvement by WS personnel in the decision making process, but 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 following 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.

Direct Damage Management Assistance (implementation is 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 provide for WS involvement in implementing the damage management techniques. The initial investigation defines the nature, history, extent of the problem, species or property directly and indirectly damaged, 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 problem is complex.

Educational Efforts: Education is an important element of WS program activities because WDM is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature is not static, 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. Wildlife Services 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.

Research and Development: The National Wildlife Research Center (NWRC) functions as the research division of WS by providing scientific information and development of methods for WDM that are effective and environmentally responsible. The NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate WDM techniques. As one example, research by the NWRC was instrumental in the development of the repellent methyl anthranilate (MA)

(See Appendix B). Scientists at the NWRC have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in WDM.

3.1.4 Community Based Decision Making

Technical assistance provided by Wildlife Services to resource owners for decision making. The WS program in Michigan follows the "co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of Mute Swans and effective, practical, and reasonable methods available to the local decision maker(s) to reduce wildlife damage. This may include non-lethal and lethal methods depending upon the overall management alternative selected by WS (Section 3.2). Wildlife Services and other state and federal wildlife or WDM agencies may facilitate discussions at local community meetings when resources are available. Resource owners and others directly affected by Mute Swan damage or conflicts in Michigan have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local decision makers decide which effective methods should be used to solve wildlife-related conflicts. These decision makers include community leaders, private property owners/managers, and public property owners/managers. The process for involving local communities and local stakeholders in the decisions for MSDM assures that local concerns are considered before individual damage management actions are taken.

> **Community decision makers**: The decision maker for the local community with a homeowner, civic, or lake association would be the President or Board's appointee. The President and Board are popularly elected residents of the local community who oversee the interests and business of the local community. This person would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Identifying the decision maker for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. Wildlife Services would provide technical assistance to the local community or local business community decision maker(s) and recommendations to reduce damage. The MDNR has established a standard protocol for passing a resolution to obtain a permit to either conduct MSDM activities themselves or if they are requesting direct control provided by WS (MDNR 2012*a*). Direct control would be provided by WS if requested, funding was available or provided, and the local community decision maker's request for direct control was compatible with WS recommendations.

Private property decision makers: The decision maker for private property owned by one person is him or herself. Wildlife Services would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding was available or provided, and the requested direct control was in line with WS recommendations.

Affected resource owners who disagree with the direct control action may request that WS not conduct this action on their property and WS will honor this request.

If the affected resource has multiple owners (e.g., lakeshore), the MDNR has established a standard protocol for filling a petition to obtain a permit to either conduct MSDM themselves, or if they are requesting direct control provided by WS (MDNR 2012). Conditions of the petition are as follows:

i. The lakeshore landowners, or lake association representing lakeshore landowners, must document the extent of the problem and must concur through a petition or association resolution offered to the MDNR Management Unit Supervisor that population control is desirable.
ii. Petitions must be approved by 70 percent of the lakeshore landowners.
iii. It shall be the responsibility of the lake association, or other petition circulators, to certify that the list of names on the petition has been verified by the township or other local unit of government, and that the governmental unit has a list of all eligible property owners.
v. It shall be the responsibility of the lake association, or other petition circulators, to certify that they made a reasonable attempt to contact all lakeshore landowners, and must indicate when/where the petition is available for public review.
v. The petition document(s) presented to the lakeshore landowners for signature, and available for public review, must specify what activities are proposed for population management.

Public property decision makers: The decision maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. Wildlife Services would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding is available or provided, and the requested direct control was in line with WS recommendations.

3.1.5 Wildlife Damage Management Methods Available For Use or Recommendation by WS

Depending upon the management alternative selected, the following methods may be available to WS for use in managing Mute Swan damage and conflicts. Appendix B contains more detailed descriptions of MSDM methods.

Non-lethal Methods

Resource Management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. In most instances, WS involvement in resource management would be limited to recommendations. Implementation of resource management techniques would usually be the responsibility of the landowner/manager. Resource management methods include habitat alteration, modifying human behavior (e.g., feeding bans), and removal of domestic waterfowl which may attract (decoy) other waterfowl to sites with damage problems.

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

- Exclusion such as fencing/overhead wires
- Harassment tactics including frightening devices (e.g. propane cannons and pyrotechnics), visual repellents (e.g. lasers), and physical harassment by people and/or dogs
- Chemical repellents
- Nest destruction (does not include destruction of eggs)

Lethal Methods

Live capture and Euthanasia involves using various types of nets/traps designed to capture waterfowl. Some examples are panel nets and drive traps used for capturing waterfowl during the summer molt, rocket nets, hoop nets, net guns, and hand capture. Michigan Wildlife Conservation Order Section 9.1 prohibits release of Mute Swans captured for damage management into the wild. Captured Mute Swans would be euthanized using methods approved by the American Veterinary Medical Association (AVMA 2007):

a. Live capture and euthanized by a veterinarian at the MDNR Wildlife Division's Wildlife Disease Lab,

b. Live capture and inhalation of carbon dioxide,

c. Live capture and injection of approved euthanasia drugs,

d. Live capture and cervical dislocation, or

e. Live capture and single shot to the head with approved firearm.

Capture with Alpha-chloralose and Euthanasia. Alpha-chloralose is a central nervous system depressant which is used as an immobilizing agent to capture waterfowl or other birds. It is generally used in recreational and residential areas where birds are accustomed to accepting food from humans. Alpha-chloralose is typically delivered as hand-delivered bait in small quantities with minimal hazards to pets and humans. Single bread or corn baits are fed directly to the target birds. Any Mute Swans that may be captured in Michigan using alpha-chloralose must be subsequently euthanized because Sec. 9.1 of the Michigan Wildlife Conservation Order prohibits releasing Mute Swans captured for damage management back into the wild.

Shooting is the selective removal of target species by shooting with a pistol, shotgun, or rifle. Shooting can be used to reduce local Mute Swan populations or to remove a few individuals from a larger flock, which can reinforce birds' fear of harassment techniques.

Sport hunting is sometimes recommended when target species can be legally hunted. At present, Mute Swans in Michigan cannot be legally hunted.

Egg treatment/destruction is the practice of ceasing the development of the egg prior to hatching (egg oiling, chilling, shaking, puncturing), physically breaking eggs, or directly removing eggs from a nest and destroying them.

Carcass Disposal: Carcasses would be disposed of via incineration, burial on site or disposal in a landfill in accordance with applicable state, local and federal regulations and the Michigan Mute Swan policy and procedures (MDNR 2012*a*). In most instances WS disposes of carcasses off-site via incineration or disposal in a landfill. Carcasses would only be buried on site with the consent of the landowner/manager.

3.1.6 Examples of Past Mute Swan Damage Management Methods Conducted by the Michigan WS Program

Pyrotechnics are used to scare Mute Swans away from an area. This method is often used by WS to discourage Mute Swans from using areas on and near airports and reduce the risk that an aircraft may strike a Mute Swan. From 2006 to 2011, WS personnel used pyrotechnics to disperse 48 Mute Swans away from airports in Michigan.

Alpha-chloralose is a waterfowl-immobilizing agent that is used by Michigan WS personnel to capture Mute Swans from areas where they are habituated to hand feeding. Typically these areas include public recreational and residential areas, such as shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as 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. In 2004 and 2005 Michigan WS used alpha-chloralose to capture 3 Mute Swans.

Shooting is the selective removal of target species by shooting with a pistol, shotgun, or rifle. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques as well as reduce the local population of Mute Swans. In recent years, Michigan WS has used shooting to reduce Mute Swans populations at state managed natural areas, to remove individual aggressive birds at private lakes, and to remove birds from airports.

3.2 ALTERNATIVES ANALYZED IN DETAIL IN CHAPTER 4

This section contains a description of four different alternatives available for use by the lead and cooperating federal agencies. Although the agencies and tribes have worked together to produce a joint document and intend to collaborate on MSDM in Michigan, each of the agencies will be making its own decision on the alternative to be selected in accordance with the standard practices and legal requirements pertaining to each agency's decision making process. The tribes and MDNR are only consulting agencies and will not be issuing formal decisions based on this analysis. These entities also retain full authority to make independent Mute Swan management decisions even though they have aided in the preparation and review of this analysis.

Although the agencies and tribes make independent decisions, the decisions made by one agency/tribe can restrict the actions taken by the other agencies. For example, if WS and the MDNR select an alternative that allowed for nonlethal and lethal MSDM techniques, but the USFWS or FS choose an alternative that allows for only nonlethal MSDM techniques, only nonlethal methods would be used on lands under their jurisdiction. Conversely, although the MDNR may choose to make lethal methods legal for use in managing Mute Swan conflicts in Michigan, WS can choose to limit its involvement in MSDM to the use of nonlethal methods. For simplicity and clarity of analysis, each of the alternatives below is described and its potential impacts are analyzed as if the lead and cooperating federal agencies had selected the same alternative.

3.2.1 Alternative 1: Integrated Wildlife Damage Management (Proposed Action/No Action)

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and 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 guidance from the CEQ (CEQ 1981). In this guidance, the No Action alternative for situations where there is an ongoing management program may be interpreted as "no change" from current management direction or level of management intensity.

Under this alternative, the WS program would continue the current IWDM program that responds to requests for MSDM to protect property, natural resources, and human health and safety in Michigan. The continued implementation of the IWDM approach would allow the use and recommendation of legal nonlethal and lethal techniques and methods singly or in combination, to meet requestor needs for reducing conflicts with Mute Swans. Non-lethal methods used by WS may include resource management, physical exclusion, and harassment tactics. Lethal methods used by WS may include nest and egg treatment/destruction, live capture and euthanasia, and/or shooting. In many situations, the implementation of non-lethal methods such as habitat alteration, repellents, and exclusion type barriers would be the responsibility of the requestor to implement. Requests for assistance may occur anywhere and anytime in Michigan. The proposed MSDM activities could be conducted on public and private property in Michigan when the property owner or manager requests assistance and/or when assistance is requested by an authorized state, federal, tribal, or local government agency, a need is confirmed, and authorization is granted by the landowner/manager. A combination of nonlethal or lethal methods for MSDM would be available for use on lands under USFWS and FS management. All management actions would comply with applicable federal, tribal, state, and local laws.

3.2.2 Alternative 2: Technical Assistance Only by WS

This alternative would not allow for WS operational MSDM in Michigan. Wildlife Services would only provide technical assistance when requested. Property owners/managers, other agency personnel, or others could conduct MSDM on their own using any legal lethal or non-lethal method. Landowners/managers would be able to seek operational assistance with MSDM from other federal, state, or local agencies, or private businesses and organizations. This alternative is limited to impacts by WS. Actions by cooperating agencies would be identical to Alternative 1.

Currently, the sedative alpha-chloralose is only available for use by WS employees. Therefore, this chemical would be unavailable for use by private individuals. Appendix B describes a number of methods that could be employed by private individuals or other agencies after receiving technical assistance under this alternative.

3.2.3 Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

This alternative would require federal agencies to only use and recommend non-lethal methods and egg treatments (destruction, oiling, addling, puncturing, chilling) to resolve Mute Swan damage problems (Appendix B). Individuals, agencies, and organizations with Mute Swan conflicts could still employ other lethal methods (e.g., shooting, capture and euthanasia) that were available to them or seek assistance from other businesses, agencies, and organizations in implementing lethal MSDM methods. Individuals seeking

information on other lethal MSDM methods would be referred to other sources such as the MDNR or pest control organizations.

Currently, the sedative alpha-chloralose is only available for use by WS employees. Under this alternative, WS could not use alpha-chloralose to capture Mute Swans because all swans captured by WS would have to be euthanized, per MDNR regulation.

3.2.4 Alternative 4: No Federal Mute Swan Damage Management

This alternative would eliminate federal involvement in MSDM in Michigan. Wildlife Services would not provide direct operational or technical assistance, and requesters of WS services would conduct MSDM without WS input. No MSDM would be conducted on USFWS or FS lands. Information on MSDM methods may be available to producers and property owners through other sources such as the MDNR, universities, or pest control organizations. The sedative alpha-chloralose is only available for use by WS employees. Therefore, this chemical would not be available for use by private individuals.

3.3 ALTERNATIVES AND METHODS ELIMINATED FROM FURTHER ANALYSIS WITH RATIONALE

3.3.1 Non-lethal Methods Implemented Before Lethal Methods

This alternative is similar to Alternative 1 except that the federal agencies would be required to always recommend or use non-lethal methods prior to recommending or using lethal methods to reduce Mute Swan damage. Both technical assistance and direct damage management would be provided in the context of a modified IWDM approach. Alternative 1, the Proposed Action, is similar to this alternative in that it recognizes non-lethal methods as an important dimension of IWDM, gives them first consideration in the formulation of each management strategy, and recommends or uses them when practical and effective before recommending or using lethal methods. However, in many cases, when WS is requested to provide assistance with a Mute Swan damage problem, the property owner/manager(s) have already tried nonlethal alternatives for resolving their problem. The important distinction between the Non-lethal Methods First Alternative and the Proposed Alternative is that the former alternative would require that all non-lethal methods be used before any lethal methods are recommended or used.

While the humaneness of the non-lethal management methods under this alternative would be comparable to the Proposed Program Alternative 1, the extra harassment caused by the required use of methods that may be ineffective could be considered less humane. As local Mute Swan populations increase, the number of areas negatively affected by these birds would increase, and greater numbers of birds would be expected to congregate at sites where non-lethal management efforts were not effective. This may ultimately

result in a greater number of Mute Swans being killed to achieve the local WAC than if lethal management were immediately implemented at problem locations (Manuwal 1989). Once lethal measures were implemented, Mute Swan damage would be expected to drop relative to the reduction in localized population of Mute Swans causing damage.

In many situations, the Non-lethal Methods First Alternative would increase the risk of relocating a damage problem instead of resolving the problem. Consequently, this could result in greater numbers of Mute Swans being killed to achieve the local WAC at a greater cost to the requester, and could result in a delay in reaching the local WAC in comparison to the Proposed Alternative. The Non-lethal Methods Implemented before Lethal Methods Alternative is removed from further discussion in this document.

3.3.2 Federal Agencies Only Use Nonlethal Methods to Address Conflicts with Mute Swans

Under this proposal, the WS and the federal cooperating agencies would only use nonlethal methods to resolve conflicts with Mute Swans. Available methods would include resource management, exclusion, harassment, and chemical repellents (Appendix B). None of the available options would have any impact on the size of the Mute Swan population. The nonlethal methods would usually be implemented by landowners and managers. Consequently, the impacts of this alternative would be similar to those analyzed under Alternative 4 (No Federal Mute Swan Damage Management). Given the relative inability of this alternative to address damage and conflicts resulting from the high number of Mute Swans in Michigan and the similarity between the impacts of this alternative and Alternative 4, this alternative will not be analyzed in detail.

3.3.3 Nicarbazin

A chemical method of reproductive control, nicarbazin, has been developed for use in urban Canada Geese and domestic ducks. The NWRC has been instrumental in the development and registration of nicarbazin (OvoControl-G^{TM}; CAS 330-95-0/4,4'-dinitrocarbanilide (DNC, CAS 587-90-6)/ 2-hydroxy-4,6-dimethylpyrimidine (HDP, CAS 108-79-2) (1:1)), which is an infertility agent for Canada geese in urban areas (Bynum et al. 2005). Nicarbazin is thought to induce infertility in birds by two main mechanisms. Nicarbazin may disrupt the membrane surrounding the egg yolk, resulting in intermixing of egg yolk and white (albumin) components, creating conditions in which the embryo cannot develop. Nicarbazin may also inhibit incorporation of cholesterol into the yolk, a step that is necessary for yolk formation, thereby limiting energy for the developing embryo. If the yolk does not provide enough energy, the embryo will not completely form and the egg will never hatch. Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming. Nicarbazin is undetectable in the plasma of Canada geese, mallards, and chickens by 4-6 days after consumption of nicarbazin bait has stopped. The levels of active ingredient in the blood are reduced by half within one day after bait consumption stops. If the level of

active ingredient falls by approximately one half its peak levels, no effects on egg formation can be seen. By two days after bait consumption has stopped, no effects on the egg being formed are seen. Consequently, the bait must be offered to the birds each day of the nesting period for best impact on reproduction.

In a field study conducted in Oregon (Bynum et al. 2005), use of nicarbazin reduced hatchability of eggs 35.6% ($P = 0.062$). When considering the success of individual nests at sites rather than flocks as a whole, percent hatchability was significantly reduced 50.7% ($P < 0.001$). The high degree of variability among Canada geese in their movement patterns, nesting and habitat use complicates use of this product (Vercauteren and Marks 2004). The variability in goose behavior can make it difficult to get the required doses to the geese.

In theory, nicarbazin should also be effective for use with Mute Swans, particularly in urban/suburban areas which are consistently used by a limited number of pairs. However, at present, nicarbazin is only registered for use in resident Canada Geese and domestic ducks in urban areas. Federal and state authorization/labeling would be required before this method could be used for Mute Swans. Biologists would also have to test bait feeding strategies on Mute Swans to ensure that bait would be accepted by the swans and an adequate amount could be delivered on a daily basis.

If this product becomes available, the lead and cooperating agencies will review and update this EA as needed to include the use of this method.

3.3.4 The EA should consider use of live capture and relocation

Live capture and relocation of Mute Swans is not legal in the state of Michigan. Consequently, this method does not receive further consideration in the analysis.

3.3.5 The EA should consider use of Surgical Sterilization

Surgical sterilization involves live-capturing swans, and having them surgically sterilized by a veterinarian or other trained and authorized professional. This method is not an option in Michigan as according to State order, “under no conditions will a captured mute swan be released back into the wild”.

3.4 STANDARD OPERATING PROCEDURES (SOP) FOR WILDLIFE DAMAGE MANAGEMENT

The WS program, nationwide and in Michigan, has developed SOP for its activities that reduce the potential impacts of these actions on the environment. These procedures are discussed in detail in Chapter 5 of the Animal Damage Control Final EIS (USDA 1997 Revised). Some key SOP pertinent to the proposed action and alternatives of this EA are listed below.

- The WS Decision Model would be used to identify effective WDM strategies and their impacts (Slate et al. 1992).
- Reasonable and prudent measures or alternatives would be identified through consultation with the USFWS and are implemented to avoid impacts to T&E species.
- Wildlife Services uses MSDM devices and conducts activities for which the risk of hazards to public safety and hazard to the environment has been determined to be low according to a formal risk assessment (USDA 1997 Revised, Appendix P). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazard to the public is even further reduced.
- WS will conduct all MSDM on USFS lands in accordance with applicable MOUs between the USFS and WS.

3.4.1 Additional SOP Specific to the Issues

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

Effects on Mute Swan Populations

- Mute Swan damage management is directed to resolve Mute Swan damage problems by taking action against individual problem birds, or local populations or groups. All actions would be consistent with MDNR management objectives for Mute Swans.
- To ensure that methods of live-capturing Mute Swans result in minimal pain and discomfort, which could be measured as factors like physical injury (e.g., bleeding, broken wing), dehydration, and over-heating; captured birds would be made as comfortable as possible by watering the birds as necessary, not overcrowding the birds if they are put in holding cages for transportation, and seeking shade for caged birds as necessary.
- Wildlife Services take would be monitored by comparing numbers of birds killed with overall populations or trends in populations.

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

- Wildlife Services personnel are trained and experienced in selecting the most appropriate method for taking problem animals and excluding non-target wildlife.
- Observations are made to determine if non-target or T&E species would be at significant risk from MSDM activities prior to conducting MSDM actions.

- Wildlife Services consulted with the USFWS and MDNR regarding potential impacts of MSDM methods on state and federally-listed T&E species. Wildlife Services abides by reasonable and prudent alternatives and other agency recommendations for the protection of listed species that were established as a result of these consultations.
- Wildlife Services personnel who conduct MSDM are trained in differentiating Mute Swans from native swan species.
- Wildlife Services personnel only use nontoxic shot to remove Mute Swans.
- Wildlife Services will consult with the USFS prior to conducing MSDM on USFS lands. Wildlife Service will implement USFS recommendations for protection of species on the Regional Foresters Sensitive Species list (Appendix C).

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed to make informed decisions when selecting an appropriate alternative to meet the needs for action identified in Chapter 1. This chapter analyzes the potential environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. The environmental consequences of each alternative are analyzed in comparison with the No Action (ongoing program) alternative to determine if the real or potential effects would be greater, lesser, or the same as current conditions.

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

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

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: Wildlife Services MSDM actions are not undertakings that could adversely affect historic resources (See Section 1.6.2).

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

As noted in Section 3.2, the lead and cooperating agencies have worked together on this analysis but each agency retains authority to make independent decisions. For simplicity and clarity of analysis, each of the alternatives below is described and its potential impacts are analyzed as if the lead and cooperating federal agencies had selected the same alternative. Differences in agency decisions will result in impacts intermediate to those analyzed below.

4.1.1 Effects on Mute Swan Populations

The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997 Revised). Magnitude is described in USDA (1997 Revised) 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.

Cumulative impacts are assessed in context of WS' proposed take and anticipated take by other entities including the MDNR, tribes, and individuals authorized to take swans under MDNR permits. Wildlife Services' actions would occur simultaneously with natural processes and human-generated environmental changes that also impact wildlife populations including but not limited to: natural mortality, human and naturally induced changes in wildlife habitat, and annual and perennial cycles in wildlife populations. The analysis below assesses the cumulative impacts of all factors affecting Mute Swan populations by monitoring population trends for the species.

4.1.1.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under this alternative, the lead and cooperating agencies would use the full range of legally available nonlethal and lethal methods to reduce damage by and conflicts with Mute Swans in accordance with applicable state, federal and local regulations, policy and management plans. Wildlife Services would provide technical and operational assistance with nonlethal and lethal MSDM. No MSDM would be conducted on private property without the consent of the landowner/manager. For areas with multiple landowners and public property, consent for lethal removal of Mute Swans would have to be obtained in accordance with MDNR requirements for landowner and community notification and consultation (MDNR 2012*a*). Local governments, private individuals, and organizations working under permits from the MDNR could also conduct MSDM, however, the extent of this type of activity would be lower than under Alternatives 2-4.

Michigan had an estimated 15,500 Mute Swans in the state in 2010. The MDNR estimates that from 2000 to 2010 the state Mute Swan population increased at an average rate of approximately 9-10% per year although there were some years when the population decreased or was similar to previous years' estimates (Figure 1). The Mississippi Flyway Council also reports increasing Mute Swan population in the Flyway (MFC 2012)[3]. At the present rate of increase, natural factors and habitat changes do not appear to be adversely affecting the Michigan Mute Swan population. Mute Swan removals conducted from 2000-2010 also did not appear to have an adverse cumulative impact on the Mute Swan population. In 2011 the Michigan Mute Swan population was estimated at 15,420 swans. Although Mute Swan removals in 2010 were higher than previous years (605 swans, Figure 4) based on Mute Swan population models, the level of removal (4% of the 2010 population estimate) was not of sufficient magnitude to cause a reduction in the statewide population, although short-term site-specific reductions

[3] Adminstratively, the Mississippi Flyway includes the states of Alabama, Arkansas, Indiana, Illinois, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Ohio, Tennessee and Wisconsin and the Canadian provinces of Saskatchewan, Manitoba and Ontario. (See Section 1.5)

would have occurred. A Mute Swan population model by Ellis and Elphick (2007) indicated that at least 17% of the population must be removed per year to be reasonably certain of a reduction in the Mute Swan population. A similar population model from the MDNR using state-specific data indicated that approximately 9.5% of the population would need to be taken per year just to stabilize the population at current levels (MDNR, unpublished data).

Mute Swans are a non-native species with the potential to have negative impacts on native birds and their habitat. As a result, the MDNR has established two short-term (2011-2016) goals which involve 1) reducing the Mute Swan population to zero on DNR administered lands, and 2) reducing the statewide Mute Swan population growth to zero on all other lands. The MDNR's long-term goal (2030) is to maintain a spring population of less than 2,000 Mute Swans throughout Michigan (MDNR 2012*a*). It is not the goal of the MDNR to eliminate all Mute Swans in Michigan. The Mississippi Flyway Council is also concerned about the impacts of Mute Swans on native waterfowl and ecosystems and has established a management objective of 4,000 or fewer Mute Swans in the flyway by 2030. The state of Michigan and Mississippi Flyway management objectives for Mute Swans are consistent with Executive Order 13112 which directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health.

A Mute Swan population model by Ellis and Elphick (2007) indicated that at least 17% of a Mute Swan population would need to be taken per year in order to be 90% certain of a decline in the Mute Swan population. The Ellis and Elphick (2007) model used a higher estimate of Mute Swan population growth than that observed in Michigan and may over-estimate the level of control needed to meet MDNR objectives. The MDNR has modified the model parameters to better approximate observed Mute Swan population growth rates and uses the revised model to guide management decisions. (MDNR, unpublished data). The maximum annual number of Mute Swans that could be taken by WS, the tribes, other federal agencies, the MDNR, and other entities working under permits from the MDNR is not anticipated to exceed 3,500 Mute Swans per year. Wildlife Services does not anticipate taking more than 2,500 of the maximum statewide take of 3,500 Mute Swans per year, but the WS portion of total take may vary among years depending upon agreements with the agencies, tribes, and landowners/managers. This level of cumulative Mute Swan take would be approximately 23% of the 2011 Mute Swan population in Michigan.

The maximum level of annual take set for the project was based on model predictions regarding the level of take needed to achieve state long-term population management objective; the expectation that additional swans may need to be taken from state-administered lands to achieve the MDNR objective of no Mute Swans on state-administered land by 2016; and an allowance to accommodate the limitations inherent in population models and Mute Swan surveys, annual variation in productivity of the swan population, and changes in resources available for Mute Swan damage management.

Mute Swan take levels will be adjusted as needed during the project using the MDNR Mute Swan population model, data on swans taken, and current population estimates. Mute Swan take by WS would be coordinated with the MDNR and tribes as appropriate to ensure consistency with state and tribal Mute Swan management objectives and the provisions of this analysis (e.g., anticipated cumulative annual Mute Swan take will not exceed 3,500 swans per year). Personnel from the MDNR and individuals working under MDNR Mute Swan permits are also required to report Mute Swan take to the MDNR waterfowl biologist (MDNR 2012*a*). The MDNR will monitor the Mute Swan population and swan take levels to ensure that the state Mute Swan population remains within parameters specified in their management plan.

Nest destruction and egg treatments (destruction, oiling, addling, puncturing, chilling) could also be used to reduce the Mute Swan population. However, because of the cost and logistical limits on these methods, use of egg treatments is likely to be limited to small privately-held areas where the goal is to prevent increase of a small group of swans. The Mute Swan population model by Ellis and Elphick (2007) indicated that reproductive rates for the population would need to be reduced more than 72% to be 90% certain of reducing the Mute Swan population. The MDNR Mute Swan model suggests that 13 times as many eggs would have to be destroyed as adults to achieve a comparable reduction in mute swan population growth. Consequently, these actions may be beneficial at a limited number of individual sites, but are unlikely to contribute substantially to statewide Mute Swan population reduction efforts.

Based on the analysis above, the cumulative impact of the proposed WS actions would result in a reduction of the state Mute Swan population in accordance with established management objectives of the MDNR. However, given annual monitoring of the Mute Swan population and MDNR oversight of swan removals, the proposed action would not eliminate or jeopardize the viability of the Mute Swan population in Michigan.

4.1.1.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would have no impact on Mute Swan populations in Michigan because the WS program would only provide advice on the management of the target species and would not conduct any MSDM activities. The cooperating agencies, tribes, and other entities would be free to continue to conduct MSDM in Michigan in accordance with MDNR permits and policy. The only exception is that the sedative alpha-chloralose would not be available for use because it is only available for use by WS employees.

Private efforts to reduce or prevent Mute Swan damage and conflicts could increase. The MDNR would be able to apply for the same GLRI grant obtained by WS to assist with Mute Swan management in 2011. Implementation of this alternative could result in an increase in Mute Swan take by private individuals under MDNR permits. It is hypothetically possible that attempts to address Mute Swan damage and conflicts by inexperienced individuals could result in the inappropriate or even illegal use of damage

management methods. Instances of this type of problem would be very rare. Effects on Mute Swans under this alternative would probably be about the same or slightly lower than under Alternative 1 depending upon the skills and training of the individuals conducting MSDM. Effects and hypothetical risks of uniformed use of damage management methods would probably be less than Alternative 4 because individuals would have access to WS technical assistance.

4.1.1.3 Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

Under this alternative, WS and the cooperating federal agencies would be limited to use of nonlethal methods and egg treatments (destruction, oiling, addling, puncturing, chilling) to address conflicts with Mute Swans (Appendix B). Wildlife Services would not use alpha-chloralose under this alternative because MDNR regulations prohibit the release of captured Mute Swans. As with Alternatives 2 and 4, the tribes, the MDNR, and individuals and other agencies working under MDNR permits would continue to take Mutes Swans using all legally available methods including shooting and live-capture and euthanasia. Selection of this alternative would likely result in an increase in lethal Mute Swan removal by the MDNR, tribes, and permittees. Cumulative annual take of Mute Swans on federal lands would be similar to or less than the preferred alternative because no swans would be lethally taken on federal lands.

In areas where Mute Swan removals are conducted by the MDNR, tribes or non-federal entities working under MDNR permits, impacts of this alternative are likely to be similar to Alternative 1. The MDNR would be able to apply for the same GLRI grant obtained by WS to assist with Mute Swan management in 2011 and could use the funding to support lethal removal of swans. In areas where MSDM is conducted by WS and on lands managed by federal cooperating agencies, the impact of this alternative on the state Mute Swan population would depend on the efficacy of egg treatments. The population model by Ellis and Elphick (2007) indicates that reproductive rates would have to be reduced at least 72% to reduce the Mute Swan population. The MDNR model indicates that reproductive rates would have to be reduced by about 55-56% just to stabilize the mute swan population; in contrast, adult survival would have to be reduced by 11-12% to achieve the same result. Given the amount of land managed by federal cooperators in Michigan, achieving this population control through egg treatments alone would be expensive and difficult. If the desired level of control is not achieved, these areas may have stable or increasing Mute Swan populations. Some swans from these areas would likely move to surrounding sites with lower swan densities and complicate MSDM efforts in other sections of the state.

In general, the statewide Mute Swan population would decrease under this alternative in accordance with MDNR management objectives. However, the rate of decrease would likely be lower than under Alternative 1. The ability of the MDNR to achieve its long-

term management objective for the species in the state will depend on the efficacy of efforts conducted on lands managed by the federal agencies.

4.1.1.4 Alternative 4: No Federal Mute Swan Damage Management

Under this alternative, WS and the cooperating federal agencies would not conduct MSDM and, with the possible exception of actions by tribes in the ceded territories[4], MSDM would not be permitted on lands managed by the cooperating federal agencies. The tranquilizer alpha-chloralose is currently only available for use by WS employees and would not be available for use under this alternative. As with Alternatives 2 and 3, the tribes, the MDNR, and individuals and other agencies working under MDNR permits would continue to take Mutes Swans using all legally available methods including shooting, and live-capture and euthanasia. The MDNR would be able to apply for the same GLRI grant obtained by WS in 2011 to assist with Mute Swan management.

Implementation of this alternative could result in an increase in Mute Swan take by private individuals under MDNR permits. It is hypothetically possible that attempts to address Mute Swan damage and conflicts by inexperienced individuals could result in the less effective or even illegal use of damage management methods. Instances of this type of problem would be very rare. Effects and hypothetical risks of uniformed use of damage management methods would probably be slightly greater than Alternative 2 because individuals would not have access to WS technical assistance.

In general, the statewide Mute Swan population might decrease under this alternative in accordance with MDNR management objectives. However, the likelihood of achieving population decrease and the rate of decrease would likely be lower than under Alternative 1. The ability of the MDNR to achieve its long-term management objective for the species in the state would likely be impaired by the lack of MSDM on lands managed by federal cooperating agencies. Based on the MDNR mute swan population model, a complete cessation of population control activities by federal, state, and tribal agencies could result in a population of Mute Swans in the range of 19,000-24,000 Mute Swans by 2015.

4.1.2 Effectiveness of Mute Swan Damage Management

4.1.2.1 Alternative 1: Integrated Wildlife Damage Management Program (ProposedAction/No Action)

Wildlife Services' extensive experience with WDM has shown that each damage management situation has its own unique challenges and needs. There are no MSDM

[4] Where regulations and policy of the managing federal agency allow, some tribal Mute Swan management may be possible on federal lands in the ceded territories.

techniques that are effective or appropriate for every situation. Wildlife Services and cooperating agencies would be best able to develop effective site-specific damage management strategies if they have access to the full range of legal damage management techniques including lethal and nonlethal methods. Consequently, this alternative would be more effective than any of the other alternatives in reducing or minimizing damage caused by Mute Swans because it allows access to the widest range of damage management techniques.

Methods of frightening or discouraging waterfowl have been effective at specific sites, such as airports. However, in many instances, these methods simply shift the problem elsewhere. If WS is providing direct operational assistance in dispersing Mute Swans, 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. Issues of relocating Mute Swans are particularly problematical in the instance of natural resource damage caused by a non-native species. Relocating the species from one natural area to another will not prevent it from engaging in behaviors which negatively impact native species and ecosystems. For optimal efficacy, some frightening strategies require long-term commitment of staff and/or financial resources that many not be available to everyone with a Mute Swan damage problem.

Habitat modifications, while potentially effective for developed areas, can impact the aesthetics and use of a property and are often not accepted by landowners/managers. Many habitat modifications that would discourage Mute Swan activity may also have unacceptable impacts on native wildlife and ecosystems. In general, habitat modification and frightening devices are not acceptable for use in areas managed to support native wildlife.

In a long-lived species, reducing survival of adults is usually more effective in reducing population growth to target levels than reproductive control methods (Cooper and Keefe 1997, Walter 1999, Ellis and Elphick 2007). Where logistically feasible (e.g., relatively small readily accessible populations), reproductive control can be used to reduce populations, but the time required to achieve results is generally longer than with removal of adults. Results from the Mute Swan population model developed by Ellis and Elphick (2007) indicated that reducing a Mute Swan population of 2,000 birds by egg/nest destruction and egg oiling/addling/puncturing would take 3-4 times as many person-days within the first year as achieving the same reduction through removing adults. The model also indicated that projects which removed a larger proportion of individuals per year to achieve program goals in a shorter time (e.g., 5 years) took fewer birds by the end of the project than projects intended to achieve similar goals over a longer time frame (e.g., 20 years). Repopulation of sites where lethal management methods were used would undoubtedly take place as long as suitable habitat exists in that area. However, reducing the number of damaging waterfowl can facilitate the use of nonlethal methods thereby enhancing the effectiveness of non-lethal methods (Smith et al. 1999). For example, because Mute Swans are relatively long-lived, exclusive use of non-lethal

methods to suppress reproduction may take years to reduce a local population and associated damage problems. In contrast, lethal methods could be used to initially reduce the Mute Swan populations and then non-lethal methods could be used to maintain the population at the reduced level. Although removal of adults and reproductive control can be effective, they are not acceptable to all landowners/ managers and members of the public because of humaneness, ethical and aesthetic concerns (Sections 4.1.3 and 4.1.4).

4.1.2.2 Alternative 2: Technical Assistance Only by WS

With WS technical advice but no direct management assistance, entities requesting MSDM would take no action, implement WS recommendations for non-lethal and lethal control methods, or seek other sources of assistance with MSDM. If the individual/organization with the damage problem decides to not take action, conflicts and damage would likely continue or increase as bird numbers are maintained or increased. The efficacy of the alternative sources for assistance with MSDM will vary depending upon the training and skills of the individual(s) involved. The tranquilizer drug alpha-chloralose is only available to WS and would not be available under this alternative.

In general, this alternative is likely to be similar to or slightly less effective than Alternative 1. It would be more effective than Alternative 3 because lethal removal of adults would still be available to landowners/managers. It also would likely be more effective than Alternative 4, because the full range of MSDM methods would still be available for use on federal property, and because WS would be available to provide guidance for individuals, organizations, agencies, and tribes working to resolve damage by and conflicts with Mute Swans

4.1.2.3 Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

Under this alternative, WS would be restricted to implementing and recommending only non-lethal methods, nest destruction and egg treatments when providing assistance with Mute Swan damage problems. Only non-lethal methods, nest destruction, and egg treatments would be available for use on federal lands. Where the regulations and policy of the managing federal agency allow, some tribal take of Mute Swans may be possible on federal lands within the ceded territories. However, only a portion of the federal lands in the state are included in the ceded territories.

Efficacy of nonlethal methods would remain as discussed for Alternative 1. The efficacy of actions taken on federal lands will depend on tribal involvement (within the ceded territories) and the ability of federal agencies to reduce Mute Swan numbers using egg treatments. The Mute Swan population model by Ellis and Elphick (2007) indicated that reproductive rates for the population would need to be reduced more than 72% to be 90% certain of reducing the Mute Swan population. Given the amount of land in Michigan under federal management, limits on resources available for MSDM and that the ceded

territories only include a portion of the federal lands, it would be very difficult, time and labor intensive to achieve state Mute Swan management objectives under this alternative.

4.1.2.4 Alternative 4: No Federal Mute Swan Damage Management

Under this alternative, federal land management agencies would not act or authorize others to address damage by and conflict with Mute Swans on their property. Damage in these areas would continue. Mute Swans in these areas would likely serve as source populations, which would complicate state efforts to achieve management objectives for the species. The ability of the state to achieve its management objectives for the species would depend on the number of swans living on federal lands. Where the regulations and policy of the managing federal agency allow, some tribal MSDM may be possible on federal lands within the ceded territories. However, only a portion of the federal lands in the state are included in the ceded territories.

With no WS assistance, the MDNR, tribes, private individuals, and local community government officials would either take no action or implement their own non-lethal and lethal control methods. The efficacy of the alternative sources for assistance with MSDM will vary depending upon the training and skills of the individual(s) involved. The tranquilizer drug alpha-chloralose is only available to WS and would not be available under this alternative. Completely eliminating WS involvement in MSDM would eliminate a source of readily available professional assistance with MSDM.

Based on the above information, this alternative is likely to be the least effective of the 4 alternatives.

4.1.3 Effects on Aesthetic Values

4.1.3.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Impacts of this alternative will depend on the values of the individuals involved. Some people who routinely view or feed individual Mute Swans would likely be disturbed by removal of such birds under the proposed program. Some people derive aesthetic enjoyment from watching Mute Swans. For these individuals, watching swans can provide an opportunity for peace, relaxation and entertainment. These people may feel sadness and anger if the birds were removed, especially if the birds are removed using lethal methods. State requirements for landowner/manager notification and consent were established, in part, to address these concerns. Wildlife Services is aware of such concerns and works to mitigate these impacts. In some situations, especially with landowner/manager or visitor cooperation, it may be possible to resolve conflicts using nonlethal methods. In other situations the management goal may be to reduce but not eliminate the local population or to remove only particularly aggressive individuals. In

these situations, WS may sometimes be able to mitigate such concerns by working to leave birds which have particular importance to individuals.

Individuals who place greater emphasis on enjoying native species and native species protection and restoration may feel that this alternative has the greatest potential for aesthetic benefits because the purpose of the MDNR's proposed Mute Swan population reduction is to protect native wildlife and ecosystems. Removal of Mute Swans is intended to aid native Trumpeter Swan restoration efforts and may eventually result in increased opportunities to view and enjoy Trumpeter Swans.

As noted in Section 4.1.2.1, this alternative would give the agencies the greatest ability to effectively resolve Mute Swan damage. Consequently, this alternative would be most effective in reducing the adverse aesthetic impacts of Mute Swans and their feces on property. Individuals whose aesthetic enjoyment of other birds and the environment is diminished by the presence of Mute Swans and swan feces will be positively affected by programs which result in reductions in the presence of Mute Swans.

It is the MDNR goal to reduce the number of free-ranging Mute Swans in the state and WS could assist the state with that effort. The MDNR will work to achieve this goal with or without the assistance of WS. Removal of any Mute Swans would likely be distressing to any individuals with attachments to the birds. However, given that there were approximately 15,500 Mute Swans in the state in spring of 2010, and the goals of MDNR are to reduce not eliminate the statewide population, opportunities to view the birds will remain.

4.1.3.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would not conduct any MSDM activities, but could provide advice on damage management alternatives. Consequently, WS would not have a direct impact on stakeholder aesthetic enjoyment of Mute Swans. However, the MDNR, tribes, local governments and individuals and organizations working under MDNR permits could still conduct MSDM activities including lethal removal of swans. Persons who have developed affectionate bonds with individual birds would not be affected by WS's activities under this alternative, but may not still experience adverse impact on their aesthetic enjoyment of Mute Swans because of actions of entities other than WS. Consequently, the aesthetic impacts of this alternative are likely to be similar to the proposed alternative.

As noted in Section 4.1.2.2, overall efficacy of this alternative in reducing adverse impacts by Mute Swans will vary depending upon the training, experience and methods available to the individuals conducting the damage management activities. In general, this alternative is likely to be similar to or have slightly less beneficial impacts on the aesthetic value of property damaged by Mute Swans. However, potential beneficial

impacts on aesthetic value of property damaged by Mute Swans would be greater than for Alternative 4, because WS would be providing technical assistance.

The dispersal of Mute Swans by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. If WS is limited to providing technical assistance, coordination with local authorities to monitor the birds' movements may not be conducted. This could increase the risk of moving the adverse aesthetic impacts to nearby property owners.

4.1.3.3 Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

Under this alternative, WS would not use lethal methods to remove adult Mute Swans and lethal methods would not be used to remove adult Mute Swans from federal property, with the possible exception of actions by tribes in the ceded territories[5]. Some people who oppose lethal removal of birds but are tolerant or supportive of egg treatments would likely consider this alternative an improvement over the preferred alternative. Mute Swan population reductions on federal lands, if they occur, would be more gradual and may be less disruptive to those who derive aesthetic enjoyment from Mute Swans. Persons who have developed affectionate bonds with individual birds would not be affected by the death of individual birds under this alternative, but might oppose nonlethal dispersal of certain birds.

The restrictions on WS and federal land manager access to some damage management techniques may make it harder to effectively resolve damage problems. Additionally, exclusive use of nonlethal methods and egg treatments has greater potential to result in Mute Swans relocating to other sites where they would likely create or worsen similar problems for other property owners. If WS is providing direct operational assistance in dispersing such birds, WS may coordinate damage management activities with local officials in order to minimize incidence of Mute Swans relocating to other undesirable locations.

The MDNR, tribes, and entities working under permits from the MDNR would still have access to the full range of MSDM techniques and/or they could obtain WS assistance with nonlethal methods and egg treatments. If the MDNR and/or property owners and managers chose to use lethal WDM methods without assistance from WS, the impacts on aesthetic values would be similar to the proposed action alternative.

4.1.3.4 Alternative 4: No Federal Mute Swan Damage Management

Under this alternative, WS would not conduct any lethal removal of Mute Swans. With the possible exception of tribal activities within the ceded territories[5], no MSDM would be conducted on properties managed by the federal cooperators. Federal landowners/ managers would be unable to act to address aesthetic damage caused by Mute Swans.

Individuals who feel their aesthetic enjoyment of Mute Swans would be impaired by swan removal or the knowledge that swans are being lethally removed from federal property or by federal agencies may prefer this alternative. Persons who have developed affectionate bonds with individual birds would not be affected by WS activities under this alternative. Individuals who value native species and ecosystems over the presence of non-native Mute Swans, especially on federal lands, would experience the most adverse impacts on their aesthetic values under this alternative.

However, on non-federal lands, the tribes, MDNR, or other entities working under MDNR permits would likely conduct MSDM activities similar to those that would have been provided by WS under the preferred alternative. The effects on aesthetic values would vary depending on the choices and experience of the individuals conducting the MSDM but would probably be similar to the proposed action alternative. Ability of alternative sources to reduce adverse aesthetic impacts on property from Mute Swans will vary depending upon the training, skills, and equipment available to the entity conducting the WDM.

The dispersal of Mute Swans by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. Coordination with local authorities to monitor Mute Swan movements to determine if birds become established in other undesirable locations might not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.4 Humaneness and Animal Welfare Concerns of Methods Used by WS

4.1.4.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under this alternative, methods viewed by some persons as inhumane would be used by WS. These methods would include capture and euthanasia, immobilization with the use of alpha-chloralose, and shooting. Some individuals also consider egg treatments to be inhumane and ethically unacceptable.

Many stakeholders would want Mute Swans captured in a way that results in no pain or a minimization of pain, which they could measure as physical injury (e.g., bleeding, broken wing). There would likely also be concern that the captured birds should be killed quickly and humanely. Birds that would be captured and euthanized, would only be euthanized using humane methods approved by the AVMA (AVMA 2007). Captured birds would be made as comfortable as possible by watering the birds as necessary, not overcrowding the birds if they are put in holding crates for transportation, and seeking shade for caged birds as necessary. Most people would view AVMA-approved methods of euthanizing animals as humane.

There may be concern among stakeholders that birds sedated with alpha-chloralose should not be allowed to drown, even if the birds are to be euthanized. Wildlife Services alpha-chloralose SOP includes maintaining visual contact of birds once the drug has been administered to ensure sedated animals are not subject to harm. If Mute Swans are removed by shooting, stakeholders would likely want quick clean kills of shot birds. Some persons would view shooting as inhumane. WS personnel are experienced, professional, and humane in their use of management methods. All WS personnel who use firearms have been trained and have experience in safe and effective use of firearms. Use of trained WS personnel reduces risk of a nonlethal wounding of birds through use of firearms.

Some people have concerns over the potential for separation of Mute Swan family groups through management actions. This could occur through harassment (e.g., pyrotechnics, dogs) and lethal control methods. Wildlife Services would not use or recommend harassment and exclusion methods during periods when juveniles and adults are flightless (e.g., molt for adults) unless there are readily accessible areas the birds can use where their presence is acceptable. For example, if only one or a limited number of landowners on a lake property object to impacts of Mute Swans, WS might recommend repellents, barriers or harassment for those specific properties. Wildlife Services would not recommend harassment for birds using a pond with a single landowner who objects to the presence of swans until such time as all birds were physically able to depart the site.

4.1.4.2. Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would not conduct any lethal or non-lethal management actions, and would only provide advice on MSDM. Thus, lethal methods viewed as inhumane by some persons would not be used by WS. However, tribes, the MDNR and agencies, individuals and organizations working under permits from the MDNR could use most damage management techniques on their own or contract for the assistance of entities other than WS. If the individual(s) conducting the damage management actions are inexperienced and/or use the methods improperly, risk of injury, pain and distress for the birds would be higher than with a WS program. Risks of these types of problems would be lower for this alternative than for Alternative 4 because WS would be able to provide technical assistance, including training, on the safe and effective use of damage management techniques. Use of the tranquilizer drug alpha-chloralose, which may facilitate calm capture of Mute Swans, is available only to WS personnel and would not be available under this alternative. Overall, impacts on humaneness and animal welfare concerns associated with MSDM under this alternative would likely be similar to or, potentially, less humane than Alternative 1.

4.1.4.3. Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

Perceptions of the humaneness of this alternative will vary depending upon the land class where the action is conducted and individual values. Under this alternative, lethal methods (i.e., shooting and capture followed by euthanasia) viewed as inhumane by some persons would not be used by WS. With the possible exception of tribal actions in the ceded territories[5], these methods would also not be used on lands managed by the federal cooperators. Individuals who perceive use of egg treatments, or any form of human manipulation of wildlife as inhumane and ethically unacceptable will still perceive actions on federal lands as inhumane. Individuals concerned about the welfare of native species negatively impacted by Mute Swans may perceive this alternative as less humane than Alternative 1 because it would limit actions to reducing impacts from Mute Swans on federal lands.

On other land classes in Michigan, the tribes, MDNR, and individuals, agencies and organizations working under MDNR permits could still conduct MSDM using lethal methods. Wildlife Services would be able use nonlethal methods and egg treatments which some individuals may consider inhumane or unethical. If the individual(s) using MSDM techniques, which are not available to WS under this alternative, are inexperienced and/or use the methods improperly, risk of injury, pain and distress for the birds would be higher than with a WS program. Overall, for individuals opposed to lethal management of Mute Swans and/or management of free-ranging animals, perceptions of the humaneness of this alternative on non-federal lands would likely be similar to or, potentially, less humane than Alternative 1.

4.1.4.4. Alternative 4: No Federal Mute Swan Damage Management

As with Alternative 3, perceptions of the humaneness of this alternative will vary depending upon the land class where the action is conducted and individual values. With the possible exception of tribal actions in the ceded territories[5], no MSDM would be conducted on federal lands. Individuals opposed to lethal MSDM methods or to any form of management of free-ranging animals would likely consider actions on federal lands to be to be the most humane of all the alternatives. In contrast, individuals primarily concerned about the impacts of non-native species on native wildlife and ecosystems may consider this alternative to be the least ethical and humane.

As with Alternative 3, on other land classes in Michigan, the tribes, MDNR, and individuals, agencies and organizations working under MDNR permits could still conduct MSDM using all legally available methods. If the individual(s) conducting the damage management actions are inexperienced and/or use the methods improperly, risk of injury, pain and distress for the birds would be higher than with a WS program. Overall, for individuals opposed to lethal management of Mute Swans and/or management of free-

ranging animals, perceptions of the humaneness of this alternative on non-federal lands would likely be similar to or, potentially, less humane than Alternative 1.

4.1.5 Effects on Non-target Wildlife Species Populations, Including Threatened and Endangered Species

4.1.5.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Wildlife Services, other wildlife professionals, and the public are concerned about the potential impacts of MSDM methods and activities on non-target species, especially threatened and endangered (T&E) species. WS personnel are experienced and trained in wildlife identification and in selecting the most appropriate methods for taking targeted animals and excluding nontarget species. Wildlife Services SOP include measures intended to mitigate or reduce the effects on non-target species populations and are presented in Chapter 3. Wildlife Services has not killed any non-target wildlife species while conducting MSDM activities in Michigan and does not anticipate this number to substantially increase. As noted in Chapter 1, much of the MSDM proposed for Michigan by the MDNR is intended to reduce the adverse impacts of high concentrations of non-native Mute Swans on native species and ecosystems. In general, these projects will have beneficial impacts on state populations of native species.

The WS activities proposed under this alternative would not result in the destruction or alteration of wildlife habitat and will not impact critical habitat for any species. In the event that WS recommends habitat modification as a damage management practice for the landowner/manager, WS will advise the landowner/manager that they are responsible for checking with state and federal authorities regarding regulations and endangered species protections that may be applicable to the proposed project. In general, WS would not recommend exclusion or habitat modification for projects with the goal of reducing Mute Swan impacts on native species and ecosystems because of the risk of impacts on habitat and activities of nontarget species. Non-target species are usually not affected by WS non-lethal management methods, except for the occasional scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action.

Wildlife Services' use of shooting is virtually 100% selective for target species and WS personnel receive additional training to aid in distinguishing between Mute Swans and native swans. The sedative alpha-chloralose is hand fed in baits administered to Mute Swans to avoid access by nontarget species. Sedated birds are immediately removed from the treatment area, thereby minimizing secondary hazards to predators.
Risks to nontarget species from WS use of alpha-chloralose are negligible. Nontarget species can generally be excluded from live capture devices/programs. However, in the

event that a nontarget species was captured, WS would be able to release the animal on-site.

WS could also recommend repellents such as methyl or di-methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption). Methyl anthranilate has undergone rigorous testing and research to prove safety, effectiveness, and low environmental risks before being registered by EPA. 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 wildlife populations.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. Lists of state and federal T&E species were obtained from the MDNR and the USFWS (Appendix C & D). The Michigan WS program conducted an informal Section 7 consultation with the USFWS regarding potential risks to federally-listed species (Appendix C) from the actions proposed in this EA. Wildlife Services has determined that the proposed action will have no effect on the majority of federally-listed species; however, it may affect but is unlikely to adversely affect Piping Plover and Whooping Crane. In addition, WS has concluded that the proposed action may affect but is unlikely to adversely affect federally-listed plant species including: Dwarf Lake Iris (*Iris lacustris*), Eastern Prairie Fringed Orchid (*Platanthera leucophaea*), Houghton's Goldenrod (*Solidago houghtonii*), Michigan Monkey-flower (*Mimulus glabratus var. michiganensis*), or Pitcher's Thistle (*Cirsium pitcheri*). Wildlife Services has received USFWS concurrence with these determinations. Reasoning for the determinations is provided below.

Mute Swans and Piping Plovers generally do not use similar habitats. The territorial behavior of Mute Swans also makes it unlikely that Mute Swans and Piping Plovers would be in the same area. None of the methods or products proposed for use in MSDM would result in the direct take of Piping Plovers. Alpha-chloralose baits are fed directly to target Mute Swans and would not be available to Piping Plovers, nor would Piping Plovers eat the corn or bread baits. Shooting is highly selective for the target species. Live capture devices, harassment devices and shooting would not be used within 1,000 feet of active Piping Plover colonies or nesting sites to prevent disturbing nesting and feeding birds. Rocket nets and net launchers would not be activated if a Piping Plover is near the capture area for the device. Fences and barriers would not be used or recommended in areas used by Piping Plovers. Given the above protective measures, the proposed action may affect but is unlikely to adversely affect Piping Plovers. Wildlife Services personnel will abide by all postings regarding entry into Piping Plover critical habitat and will limit use of vehicles in un-occupied critical habitat to the water's edge.

Whooping Cranes from the Experimental Non-essential Eastern Whooping Crane population have occasionally been found in Michigan. Wildlife Services personnel are trained to differentiate Mute Swans from other native swans and Whooping Cranes, so risk of unintentional take via shooting is extremely low. Whooping Cranes are highly unlikely to use developed habitats where methods such as habitat modification, alpha-chloralose, live capture and euthanasia, repellents or barriers would be used and these methods are not expected to have any impact on Whooping Cranes. Frightening devices and visual barriers are also primarily anticipated to be used in and near developed areas which are not used by Whooping Cranes. Use of frightening devices in more remote locations, could, theoretically result in Cranes discontinuing use of a location. However, given the highly localized use of frightening devices, and the fact that Whooping Cranes are not know to nest in Michigan, risk of disturbance is low and any disturbance would be temporary and unlikely to adversely impact the cranes.

The Dwarf Lake Iris, Eastern Prairie Fringed Orchid, Houghton's Goldenrod, Michigan Monkey-flower, and Pitcher's Thistle could potentially be found in some of the remote sites where WS could conduct MSDM. Management actions such as habitat modification and barriers, discussed above, would only be implemented/recommended in developed areas and would not be used or recommended in locations where these species occur. There is a remote risk that WS personnel walking to nests for nest and egg treatments or walking into a site to retrieve a carcass from shooting could inadvertently step on a listed plant. However, this risk is minimal because WS personnel are almost always able to oil eggs and retrieve carcasses from boats (e.g., birds are usually shot while on the water and not over land). WS personnel will also familiarize themselves with the appearance and biology of the plants to assure no accidental trampling or similar direct harm results.

Bald Eagles are no longer federally-listed as a threatened species but retain special protections under the federal Bald and Golden Eagle Protection Act. Wildlife Services uses non-toxic shot and retrieves carcasses of swans taken with all methods, so the proposed action is not anticipated to pose any risk of secondary toxicity to scavenging eagles. Barriers, fences and habitat management actions proposed for Mute Swan management would primarily be recommended for developed areas where they are unlikely to impact Bald Eagles. Additionally, WS involvement in these methods is limited to technical advice. Barriers, fences and habitat management would be implemented/installed by the landowner/manager.

Frightening devices and shooting do have the potential to disturb nesting eagles. Wildlife Services will not use or recommend shooting or frightening devices for damage management within 750 feet of active Bald Eagle nests. Shooting and frightening devices may be used in these areas after nestlings have fledged and prior to the subsequent year's nesting season. In the unlikely event of a Mute Swan threat to human health and safety involving Mute Swans within 750 feet of an active Bald Eagle nest, WS will consult with the USFWS to develop site-specific strategies for addressing the

conflict. Based on the above analysis and protective measures, the proposed action will not adversely impact Bald Eagles.

Wildlife Services is also consulting with the MDNR regarding potential impacts of the methods proposed in this EA on state-listed threatened and endangered species (Appendix D). Wildlife Services has determined that the proposed action will have no effect on state-listed mammals, reptiles, amphibians, fishes, mollusks, or insects or their habitats. Henslow's sparrow (*Ammodramus henslowii*), Prairie Warbler (*Dendroica discolor*), Kirtland's Warbler (*Dendroica kirtlandii*), Peregrine Falcon (*Falco peregrinus*), Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*), Merlin (*Falco columbarius*), Barn Owl (*Tyto alba*), Long-eared Owl (*Asio otis*), Red-shouldered Hawk (*Buteo lineatus*), Louisiana Waterthrush (*Parkesia motacilla*), Cerulean Warbler (*Dendroica cerulea*), and Yellow-throated Warbler (*Dendroica dominica*) are unlikely to occur in the areas where WS would conduct MSDM activities and will not be adversely impacted by the proposed action. The proposed action may affect but is unlikely to adversely affect state-listed Trumpeter Swans, Piping Plover, Caspian Tern (*Hydroprogne caspia*), Common Tern (*S. hirundo*), Forster's Tern (*S. forsteri*), King Rail (*Rallus elegans*), Yellow Rail (*Corturnicops noveboracensis*), Least Bittern (*Ixobrychus exilis*), Common Loon (*Gavia immer*), Common Moorhen (*Gallinula galeata*), or Short-eared Owls (*Asio flammeus*). Reasoning for these determinations, except for Piping Plovers noted above is provided below.

Trumpeter Swans use the same habitat as Mute Swans and are visually similar to Mute Swans. Mute Swans initiate nesting prior to Trumpeter Swans and, due to their aggressive behavior, exclude Trumpeter Swans from nesting and feeding areas. Adverse impacts of Mute Swans on Trumpeter Swans and swan habitat are among the primary reasons for the proposed action. Prior to any MSDM actions, WS consults with the local MDNR biologist about the presence of Trumpeter Swans. Wildlife Services also conducts a survey of the entire area prior to MSDM actions to determine the number of Mute Swans at the site and the presence or absence of Trumpeter Swans. If Trumpeter Swans are present, WS will consult with the local MDNR biologist on strategies to implement the MSDM actions with minimal risk to the Trumpeter Swans, which may include limiting actions to specific areas or no action at all.

Wildlife Services personnel involved in shooting to remove Mute Swans are trained in differentiating Mute Swans from Trumpeter Swans and only shoot when they are certain their target is a Mute Swan. The bright orange bill of the Mute Swan makes an easy identification tool, even from long distances. When using firearms to remove Mute Swans, WS personnel are training to "check the bill 3 times" before pulling the trigger. Noise disturbance from shooting is likely to be brief and minimal and is not anticipated to adversely impact nest use or nesting success of Trumpeter Swans. However, if Trumpeter Swans are known to be near areas where WS will be using shooting, preference will be given to the use of suppressed firearms. Although it is theoretically possible to unintentionally shoot a Trumpeter swan, given the above information and

protective measures, the actual risk is extremely low. Wildlife Services does not anticipate unintentionally taking more than one bird per year and in most years no birds would be taken.

Given that Trumpeter Swans are highly unlikely to nest near Mute Swans, nest and egg destruction and egg addling, oiling and puncturing are unlikely to adversely impact Trumpeter Swans. Habitat modification, visual deterrents, repellents, frightening devices and barriers would not be recommended in areas used by Trumpeter Swans. Alpha-chloralose baits are fed directly to target Mute Swans and would not be available to Trumpeter Swans. Based on the above information, the proposed action will not adversely affect and is likely to have a beneficial effect on Trumpeter Swans.

As with Piping Plovers, Caspian Terns and Common Terns generally prefer nesting in open environments, usually on sandy or gravel substrates with limited vegetation (Nisbet 2002, Cuthbert and Wires 1999). These areas are not commonly used by Mute Swans. However, in one incident in Maryland, a large molting flock of Mute Swans cause a colony of Least Terns (*Sterna antillarum*) and Black Skimmers (*Rynchops niger*) to abandon a nesting colony by trampling nests, eggs and chicks (MDNR 2003). The birds also displaced nesting Common Terns. The territorial behavior of Mute Swans also makes it unlikely that Mute Swans and nesting Caspian Terns and Common Terns would be in the same area. Caspian and Common Terns forage over water and could be in areas near Mute Swans and MSDM.

None of the methods or products proposed for MSDM would result in the direct take of Caspian Terns or Common Terns. Alpha-chloralose baits are fed directly to target Mute Swans and would not be available to terns, nor would these species accept the bread or corn baits. Live capture devices, harassment devices and shooting would not be used within 1,000 feet of active Common Tern or Caspian Tern colonies to prevent disturbing nesting birds. Fences, barriers and habitat modification would not be used or recommended in areas used by Common Terns or Caspian Terns. Shooting is highly selective for the target species. Disturbance to feeding terns from swan shooting is likely to be short-term and minimal and will not adversely impact the tern population. However, WS will work with the MDNR and landowner/manager to determine if these species occur at proposed management sites. If Caspian Terns or Common Terns are known to be near areas where WS will be using shooting, preference will be given to the use of suppressed firearms.

Forster's Terns, King Rails, Yellow Rails, Least Bitterns, Common Loons and Common Moorhens use similar habitat as Mute Swans or may use areas adjacent to those used by Mute Swans (Bookhout 1995, Ciaranca et al. 1997, Mcnicholl et al. 2001, Bannor and Kiviat 2002, Poole et al. 2005, Poole et al. 2009, Evers et al. 2010). The territorial behavior of Mute Swans may have a negative impact on some of these species. In 2011, a Mute Swan nest was found in the middle of a Black Tern colony site which had supported approximately 54 Black Terns in 2009. In 2011, there were only a few Black

Tern nests noted roughly 30-40 feet away from the swan nest. The swans used the same nesting materials as the terns. As noted above, in Maryland, a large molting flock of Mute Swans displaced nesting Forser's Terns (MDNR 2003). It seems likely that nesting swans could also have adverse impacts on other birds with similar habitat requirements including state-listed T&E species. Efforts to reduce Mute Swan populations may have beneficial impacts on Forster's Terns, King Rails, Yellow Rails, Least Bitterns, Common Loons, and Common Moorhens.

None of the methods proposed in the EA is anticipated to result in the death of individual of Forster's Terns, King Rails, Yellow Rails, Least Bitterns, Common Loons, and Common Moorhens. The primary risk would be disturbance of nesting or feeding birds. Species listed in this section are unlikely to be in developed or agricultural areas where WS would recommend repellents, barriers, habitat modification, visual frightening devices and harassment, and WS would not recommend these methods near areas where these species are known to nest so these methods are not anticipated to have an adverse impact. Alpha-chloralose baits are fed directly to target Mute Swans and would not be available to state-listed birds. Nest destruction and egg treatments could occur near nests of these species. However, given the territorial behavior of Mute Swans, the distance between the swan nests and nests of the other species in this section is likely to be such that any disturbance from the brief trips (generally 2-4 per year) would be minimal and unlikely to adversely impact nest success. Most Mute Swan nests would be reached by watercraft which would further reduce potential for disturbance. Disturbance to feeding and nesting birds from swan shooting is likely to be short-term and minimal and will not adversely impact the population. Most Mute Swans are shot while on the water, so there will be little movement through nesting habitat to recover carcasses. WS will work with the MDNR and landowner/manager to determine if these species occur at proposed management sites. If Forster's Terns, King Rails, Yellow Rails, Least Bitterns, Common Loons, and Common Moorhens are known to be near areas where WS will be using shooting, preference will be given to the use of suppressed firearms.

Short-eared Owls usually nest in prairie and coastal grasslands, usually in dry sites, but wet areas may occasionally be used (Wiggins et al. 2006). As such, they are unlikely to nest near Mute Swans. However, Short-eared Owls do forage in marshes and coastal grasslands and may be near areas where MSDM actions are conducted. The only potential impact on foraging birds would be disturbance from damage management activities, specifically shooting. Alpha-chloralose baits are fed directly to target Mute Swans and would not be available to Short-eared Owls, nor would these species accept the bread or corn baits. Harassment and frightening devices would not be recommended in areas used by short-eared Owls. Most Mute Swans are shot while on the water or at the shoreline and disturbance from shooting would be of short duration so total exposure to shooting is likely to be minimal.

Several state -listed threatened and endangered plant species occur in areas where MSDM could be conducted. In consultation with the MDNR, the following plant species were

identified as being of primary concern relative to MSDM: Lake Cress (*Armoracia lacustris*), Water-willow (*Justicia americana*), American Lotus (*Nelumbo lutea*), Arrowhead (*Sagittaria montevidensis*), and Wild Rice (*Zizania aquatca var. aquatic*). These species are all emergent or floating plant species. None of the habitat management measures, repellents, or barriers proposed in this EA would be used where these species occur. The primary risk to these species would be the potential for plants to be damaged or uprooted by watercraft used during MSDM.

Mute Swans commonly forage on submerged aquatic vegetation and an adult swan can eat approximately 4-8 pounds of food a day. In a study of 108 Mute Swans collected from marshes associated with the lower Great Lakes, 20% of adult female and 50% of adult male samples contained northern wild rice (*Zizania palustris*; Bailey et al. 2008). Mute Swan foraging has been a significant impediment to wild rice restoration efforts in Muskegon Lake (McVicar 2010). Wildlife Services has received requests from Michigan Native American Tribes to remove concentrations of Mute Swans, which were damaging wild rice beds. Arrowhead (*Sagittaria* spp.), although less common, was also found in Mute Swan diets (2% samples from females, 9% males). The foraging behavior of Mute Swans includes uprooting aquatic plants and may damage adjacent plants in addition to those directly consumed. Michigan has areas recognized of continental significance to migrating waterfowl (e.g., Saginaw Bay and Lake St. Clair) and there is concern that availability of SAV important to migrating diving ducks (e.g., Canvasback, Lesser and Greater Scaup) will be reduced by Mute Swan foraging. Foraging by concentrations of Mute Swans also has the potential to adversely impact state-listed plant species such as lake cress, water willow, American lotus, arrowhead and wild rice. Consequently, efforts to reduce the state Mute Swan population may have beneficial impacts on state-listed plant species. Although there is some potential for damaging state-listed plants with watercraft, the benefits of reducing long-term Mute Swan foraging and damage outweigh the potential risks. Therefore the proposed action may affect but is not likely to adversely affect state threatened and endangered plant populations.

In conclusion, based on the above information and protective measures, we conclude the proposed action will not adversely impact nontarget species populations including state and federally-listed threatened and endangered species.

4.1.5.2 Alternative 2: Technical Assistance Only by WS

Alternative 2 would not allow any WS direct operational MSDM in Michigan. There would be no impact on non-target or T&E species from WS activities under this alternative. Technical assistance or self-help information would be provided upon request. All WS technical assistance would be consistent with protective measures and SOP that would be used operationally by the WS program under Alternative 1 and in accordance with provisions of the state and federal T&E species consultations. Although technical support might lead to more selective use of control methods by private individuals than that which might occur under Alternative 4, private efforts to reduce or

prevent depredations could still result in less experienced persons implementing control methods. These individuals may make errors in the application of damage management methods which may lead to greater take of non-target wildlife than under the Proposed Action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds. Overall risks to nontarget species from this alternative are likely to be similar to or slightly greater than those of Alternative 1. If entities implementing MSDM are not as effective as a WS program, potential benefits to nontarget species and ecosystems from MSDM may be lower than Alternative 1.

4.1.5.3 Alternative 3: Only Nonlethal Methods and Egg Treatment for Mute Swan Damage Management

Under this alternative, on federal lands and in other areas where WS conducts MSDM, use of egg treatments and nonlethal methods is likely to be higher than under Alternative 1. These methods require more time and activity in the field that use of lethal methods to achieve similar rates of population reduction. Consequently risk of disturbance, although still low, would be greater under this alternative than under Alternative 1.

On nonfederal lands, the tribes, MDNR and other entities working under permits from the MDNR could use the same methods as WS under alternative one. Risks to nontarget species will depend on the skills of the individuals conducting MSDM and whether they choose to implement similar protective measures. If the entity conducting the MSDM lacks the experience of WS or fails to take adequate protective measures, risks of adverse impacts on nontarget species could be higher than under Alternative 1.

Potential benefits of MSDM would depend on the efficacy of the actions implemented on federal lands and the actions by non-WS entities. If the cooperating federal agencies are able to commit sufficient resources to nonlethal methods and egg treatments, it may be possible to adequately address Mute Swan damage and conflicts on their property. However, federal resources are limited. Overall efficacy of MSDM and associated benefits to nontarget species are likely to be less than with Alternative 1.

In summary, overall risks to nontarget species from this alternative would be low but greater than risks under Alternative 1 and potential benefits to native species and ecosystems may be similar to or lower than with Alternative 1.

4.1.5.4 Alternative 4: No Federal Mute Swan Damage Management

Alternative 4 would not allow any WS MSDM in Michigan. There would be no impact on non-target or threatened and endangered species by WS activities from this alternative. With the possible exception of tribal actions in the ceded territories[5], no MSDM would be conducted on lands managed by federal cooperating agencies. In situations where Mute Swans are adversely impacting native species and ecosystems on

lands managed by the federal cooperating agencies, adverse impacts on nontarget species will be greatest for this alternative.

The tribes, MDNR and individuals, agencies and organizations working under MDNR permits will continue to conduct MSDM on other land classes in the state using the methods available under Alternative 1. Impacts on nontarget species from these actions will be similar to or slightly greater than Alternative 1 depending upon the experience of the individuals conducting the MSDM and whether or not they choose to adhere to the same measures for the protection of nontarget species as the WS program.

In general risks of adverse impacts on nontarget species will be similar to or slightly greater than Alternative 1. Potential benefits to native species and ecosystems will likely be lower than with Alternative 1 because of prohibition of MSDM actions on land managed by federal cooperators.

4.2 CUMULATIVE IMPACTS

Cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts of public actions to reduce Mute Swan damage in the absence of WS assistance (Alternative 4) can only be speculated. Similarly, cumulative impacts of public actions to reduce Mute Swan damage in the absence of WS direct damage management assistance (Alternative 2) can only be speculated. However, it is reasonable to expect that as governmental assistance in resolving wildlife conflicts decreases, independent actions will increase. The environmental desirability of these actions would be dependent upon the individuals who implement them. For these reasons, cumulative impacts to the environment may be expected to increase as the extent of WS assistance decreases.

No significant cumulative environmental impacts are expected from any of the 4 alternatives. All take of Mute Swans would be coordinated through the MDNR. This agency is charged with stabilizing or reducing Mute Swan population levels. Given that the MDNR does not intend to eliminate Mute Swans and historical evidence indicating that Mute Swan populations can increase and thrive from levels lower than the 2,000 bird goal in the state plan, the proposed action will not jeopardize the existence of Mute Swans in Michigan. Proposed protective measures are sufficient to ensure that the proposed action may affect but will not have a cumulative adverse impact on nontarget species. Protection of native species and habitats from adverse impacts by non-native Mute Swans may counteract some cumulative adverse impacts from all sources on native species and ecosystems. Working closely with MDNR and in accordance with all applicable regulations and permits, helps WS ensure that the proposed action will not have adverse cumulative impacts on the environment.

Although some persons will likely be opposed to WS participation in MSDM activities, the analysis in this EA indicates that the proposed WS Integrated MSDM program will not result in

substantial cumulative adverse impacts on the quality of the human environment. Table 2 summarizes the expected impacts of the alternatives on each of the issues.

Table 2. Summary of the expected impacts of each of the alternatives on each of the issues related to Mute Swan damage management in Michigan.

Issues	**Alternative 1 Current Program/No Action- Integrated Wildlife Damage Management Program**	**Alternative 2 Technical Assistance Only by WS**	**Alternative 3 Nonlethal and Egg Treatment Only by Federal Agencies**	**Alternative 4 No Federal WS Mute Swan Damage Management Program**
Effects on Mute Swan Populations	Reductions in local Mute Swan numbers will occur. MDNR population goals can be met.	No effect on Mute Swan populations by WS. Reductions in local Mute Swan numbers by non-WS personnel likely. Ability to meet MDNR management objectives similar to Alternative 1.	Impacts by WS and cooperating federal agencies dependent upon resources available but likely lower than with Alternative 1. Reductions in local Mute Swan numbers by non-federal personnel likely. Ability to meet MDNR management objectives dependent upon efficacy of federal efforts.	No effect on Mute Swan populations by WS and federal cooperating agencies. Reductions in local Mute Swan numbers by non-WS personnel likely. MDNR will be least likely to achieve management objectives because of birds remaining and reproducing on federal lands.
Effectiveness of WDM	The proposed action has the greatest potential of successfully reducing Mute Swan conflicts and damage because all agencies would be able to access the full range of available methods for site-specific management.	Wildlife Services would not have any direct impact on Mute Swans. Overall effectiveness would be similar to or less than the proposed action dependent upon actions taken by non-WS personnel.	Efficacy of Wildlife Services and cooperating federal agencies would depend on available resources but would likely to be less than under Alternative 1. Overall effectiveness would be similar or less than the proposed action dependent upon actions taken by non-federal personnel.	Wildlife Services and cooperating federal agencies would have no impact on Mute Swan damage. Damage on federal properties would not be addressed. Efficacy in other parts of state would be similar to or less than the proposed action dependent upon actions taken by non-federal entities. Efforts off federal lands could be complicated by swans on federal lands.

Impact on Aesthetic Values	Low to moderate effect. Mute Swan damage management activities would not eliminate overall regional or state Mute Swan populations. Perceptions of impact will vary depending on individual values concerning Mute Swans and the native species, property, and other factors which may be negatively impacted by Mute Swans. This alternative would likely have the greatest negative impact on individuals who value Mute Swans and the greatest positive impact for individuals who place greater value on native species.	Impacts likely to be similar to Alternative 1 depending on actions taken by non-WS entities.	Potential population reductions on federal lands would be less abrupt and likely lower in magnitude than Alternative 1. Depending on efficacy of federal actions, this alternative may have a lower adverse impact on aesthetic values of individuals who wish to view Mute Swans on federal lands. For individuals who enjoy native species which may be adversely impacted by Mute Swans, this alternative may have lower aesthetic benefits than Alternative 1. Impacts of this alternative on aesthetic values on non-federal lands will depend on the actions taken at those locations but are likely to be similar to Alternative 1.	No effect by WS or federal land management agencies. Mute Swan populations on federal lands would likely not change or increase which would be a benefit for those who enjoy Mute Swans, but a negative impact for individuals who value native species which may be negatively impacted by Mute Swans. Impacts of this alternative on aesthetic values on non-federal lands will depend on the actions taken at those locations. Lack of management on federal lands may complicate management at other locations. This alternative may have lower beneficial impacts for individuals who are adversely impacted by Mute Swans than the other alternatives.
Humaneness Concerns of Methods Used by WS	Low to moderate effect. This alternative includes use of methods viewed by some people as inhumane.	No effect by WS. Non-WS personnel could still use methods viewed as inhumane by some individuals. Overall impacts similar to Alternative 1.	Individuals opposed to lethal management of Mute Swans would consider WS actions and actions by cooperating federal agencies more humane than in Alternative 1. Some individuals will consider nest destruction and egg treatments as inhumane. Perceptions of humaneness of actions of non-federal entities will be the same as for Alternatives 1, 2 and 4.	Individuals opposed to lethal management of Mute Swans would consider WS actions and actions by cooperating federal agencies more humane than the other alternatives. However, Mute Swan damage management actions by non-federal entities would be the same as for Alternatives 1, 2, and 3.

Effects on Other Wildlife Species, Including T&E Species	Low to positive effect. Methods used by WS would be highly selective with very little risk to non-target species. Impacts by non-WS personnel would be variable depending upon experience and training. Potential benefits to nontarget species from Mute Swan management greatest for this alternative.	No effect by WS. Impacts by non-WS personnel would be variable depending upon experience and training. Potential benefits to nontarget species from Mute Swan management similar to Alternative 1.	Low effect. Risks of disturbing nontarget species on federal lands may be slightly higher because of increased visits needed for nest destruction and egg treatments. Impacts by non-WS personnel would be similar to Alternative 1. Potential benefits to nontarget species from Mute Swan management would depend on efficacy of actions on federal lands, but would likely be lower than for Alternative 1.	No risks to nontarget species from WS actions and actions by cooperating federal agencies, but also no potential benefits from these actions. Impacts by non-WS personnel would be similar to Alternative 1.

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APPENDIX A

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APPENDIX B

MUTE SWAN DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDED BY THE MICHIGAN WS PROGRAM

In general, the most effective approach to resolving wildlife damage problems is to integrate the use of several methods, either simultaneously or sequentially (USDA 1997 Revised). Integrated Wildlife Damage Management (IWDM) combines practical and effective methods of preventing and reducing wildlife damage by wildlife while minimizing harmful effects of damage reduction measures on humans, other species, and the environment. An IWDM approach may incorporate resource management, physical exclusion and deterrents, and local population management, or any combination of these, depending on the characteristics of specific damage problems and the management alternative selected by WS and the cooperating federal agencies.

In selecting damage management techniques for specific damage situations, consideration is given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of wildlife damage. Consideration is also given to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. These factors are evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods are potentially available to the WS program in Michigan relative to the management or reduction of damage from Mute Swans. In addition to the management decisions that will be based on this EA, various federal, state, and local statutes and regulations and WS directives govern WS use of damage management tools and substances. The following methods and materials may be recommended or used in technical assistance and direct damage management efforts of the Michigan WS program.

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. In most instances, WS involvement in resource management would be limited to recommendations. Implementation of resource management techniques would usually be the responsibility of the landowner/manager.

Habitat Alteration: Habitat alteration can be the planting of vegetation unpalatable to wildlife or altering the physical habitat (Conover and Kania 1991, Conover 1992). Fences, hedges, shrubs, boulders, etc. can be placed at shorelines to impede Mute Swan movements. Restricting a bird's ability to move between water and land will deter them

from an area, especially during molts (Gosser et al. 1997).

Modify Human Behavior: Mute Swans are attracted by and readily habituate to artificial feeding by humans (Chasko 1986). Seeking handouts is particularly prevalent behavior in winter, after dieback of aquatic vegetation (Birkhead and Perrins 1986). Artificial feeding of waterfowl by people attracts and sustains more birds in an area than can be supported by natural food supplies. For example, populations such as the one in Traverse City, MI, were maintained by artificial feeding (Gelston and Wood 1982). The elimination of Mute Swan feeding is a primary recommendation made by WS, and many local municipalities and homeowners associations have adopted policies and ordinances prohibiting feeding of swans (and other waterfowl). Some parks have posted signs, and there have been efforts made to educate the public on the negative aspects of feeding Mute Swans. Use and efficacy of this recommendation is complicated by the fact that swan feeding is a popular pastime for many people.

Removal of Domestic Waterfowl: Flocks of urban waterfowl are known to act as decoys and attract other waterfowl (Woronecki 1992, AAWV undated). Many birds learn to locate food resources by watching the behavior of other birds (Avery 1994). The removal of domestic waterfowl from ponds removes birds that act as decoys in attracting other waterfowl. Domestic and feral waterfowl could also carry diseases which threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of emotional attachments to the birds and/or the aesthetic enjoyment of their presence. See capture and euthanasia below for potential capture methods. Unlike Mute Swans, it may be possible to relocate domestic ducks.

PHYSICAL EXCLUSION AND DETERRENTS

Physical exclusion and deterrents restrict the access of wildlife to resources and/or alter behavior of target animals to reduce damage.

Electric Fence: This method deters bird use of a site by preventing the birds from walking from water onto the shoreline. The preference for Mute Swans to walk or swim, rather than fly, during their molting/fledging time period contributes to the success of barrier fences. Mute Swans that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing. The application of electrified fencing is generally limited to sites in developed areas which are not used for recreational purposes because of the risk of adverse human or pet encounters with the fence. Use of electric fencing is prohibited in some municipalities for human safety reasons. Because of potential adverse impacts on nontarget species, this method would not be recommended for natural areas such as refuges.

Barrier Fence: As with electric fencing, barrier fences take advantage the preference for Mute Swans to walk or swim rather than fly during molting/fledging time period. The construction or placement of physical barriers has limited application for Mute Swans. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles,

boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing have all been used to limit the movement of waterfowl. The application of this method is limited to areas that can be completely enclosed and do not allow the birds to land inside enclosures. Similar to most abatement techniques, this method has been most effective when deterring small numbers of breeding Mute Swans and their flightless young along small portions of wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit waterfowl nesting has entrapped young and resulted in starvation (Cooper 1998). These methods would only be used in developed areas.

Surface Coverings: Mute Swans may be excluded from ponds using wire grids (Cleary 1994). Overhead wire grids have been demonstrated to be most applicable on ponds ≤ two acres, but wire grids may be considered aesthetically unappealing to some people. Wire grids render a pond unusable for boating, swimming, fishing, and other recreational activities. Balls approximately five inches in diameter can also be used to cover the surface of a pond.

Visual Deterrents: Use of visual deterrents involves installing objects such as reflective tape, flags or similar objects to deter bird use of a given area. High visibility tape has been reported effective at reducing Mute Swan damage to crops (Parrott and Watola 2008). Another study found there was some evidence that tape/twine may delay the on-set of Mute Swan grazing, which may reduce yield loss (McKay and Parrott 2002). However, this method is impractical in many locations due to its costs, and has met with some local resistance due to the negative aesthetic appearance presented on the properties where it is used. Other studies have shown reflective tape ineffective (Bruggers et al. 1986). In general, although visual deterrents may sometimes be effective for short periods of time, reflective tape is likely to only be a short-term deterrent for Mute Swans.

Dogs: Dogs can be effective at harassing waterfowl and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift 1998). Although dogs can be effective in keeping waterfowl off individual properties, they do not contribute to a solution for the larger problem of overabundant populations (Castelli and Sleggs 2000). This is one of the damage management techniques that require an ongoing financial and/or personnel commitment in order to be effective. Swift (1998) reported that when harassment with dogs ceases, the number of birds returned to pre-treatment numbers. Dogs are not recommended during the molting or fledging stages when birds are unable to fly. Wildlife Services has recommended and encouraged the use of dogs where appropriate.

Repellents: Methyl Anthranilate (MA) is an artificial grape flavoring food additive, and is a registered repellent for waterfowl marketed under the trade names ReJeX-iT and Bird Shield. Results with MA appear to be mixed. Dolbeer et al. (1993) indicated that MA was effective for many bird species, including waterfowl (Dolbeer et al. 1993). Cummings et al. (1995) reported that MA repelled Canada Geese from grazing turf for four days. However, Belant et al. (1996) found it ineffective as a grazing repellent when applied at 22.6 and 67.8 kg/ha which is the label rate and triple the label rate, respectively. MA is water soluble therefore, moderate to heavy rain or daily watering and/or mowing render MA ineffective. More recent formulation strategies have been developed to address some of the problems with water solubility. Another potentially more cost effective method of MA application is the use of a fog-producing machine (Vogt 1997, RJ Advantage 2009). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. In contrast to the turf application, the manufacturer estimates that a one gallon container of concentrate 40% MA for use in fogging applications ($189) is sufficient to treat up to 16 acres depending on airflow (RJ Advantage 2009). The technical bulletin states that

several treatments 1-4 days apart may be required for removal of all nuisance birds. As with the turf application, it's likely that additional applications would be required to address problems with locally migrating or non-resident birds. MA can be applied to temporary pools of water (i.e. pools of water on runways/taxiways) but may not be directly applied to permanent waters, such as lakes, ponds, streams and rivers.

Hazing: Hazing involves the use of frightening stimuli to deter birds from using a site. Hazing reduces losses in those instances when the affected Mute Swans move to a more acceptable area. However, birds hazed from one area where they are causing damage may also cause damage in the new area (Swift 1998, Smith et al. 1999). Habituation, birds becoming accustomed to and eventually failing to respond to frightening devices, is a primary factor limiting the utility of this method (Blokpoel 1976, Aubin 1990, Smith et al. (1999). In general, hazing is not used in projects to protect natural resources from birds because of the potential for adverse impacts on nontarget species.

Scarecrows: Effigies depicting alligators, humans, floating and dead birds have been employed, with limited success for short time periods in small areas. An integrated approach (predator effigies, distress calls and non-lethal chemical repellents) was found to be ineffective at scaring or repelling nuisance waterfowl (Conover and Chasko 1985). Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada Goose use of agricultural fields in rural areas, but their effectiveness in scaring geese from suburban/urban areas is severely limited because geese are not afraid of humans as a result of nearly constant contact with people. In general, scarecrows are most effective when they are moved frequently, alternated with other methods, and are well maintained. However, scarecrows tend to lose effectiveness over time and become less effective as waterfowl populations increase (Smith et al. 1999). Like most frightening devices, the efficacy of scarecrows may be improved/extended through the occasional use of lethal methods (e.g., shooting, real dogs) to reinforce the 'threat' associated with the frightening stimulus. Reinforcement with lethal methods like shooting is often not an available alternative for urban/suburban Mute Swan problems.

Lasers: The use of lasers are a non-lethal avian damage control method, has recently been evaluated for a number of species (Blackwell et al. 2002). In experimental situations, waterfowl have exhibited avoidance reactions to lasers under low light conditions (Blackwell et al. 2002), and a field test of lasers demonstrated effectiveness of lasers in dispersing large flocks of waterfowl off of a lake, with nearly no habituation to the technique (Cepek et al. 2001). A 650 nm, 50 mW diode laser effectively reduced goose numbers at night during a controlled field study at urban sites in Ohio (Sherman and Barras 2004). Motion-activated laser hazing systems have effectively repelled captive Canada geese (Werner and Clark 2006). Wide scale public use of lasers is not typically recommended at this time, pending additional research (on effectiveness and impacts) on its use as a waterfowl damage management tool. In some situations (neighborhoods, schools, hospitals), use of lasers may be particularly useful in an integrated control programs since they are silent and do not fire a projectile.

Pyrotechnics: Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells)

have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15mm screamer shells effective at reducing resident and migrant waterfowl use of areas of Colorado.

Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban areas required continuous harassment throughout the day with frequent discharges of pyrotechnics. The waterfowl usually returned within hours. A minority of resident Canada Goose flocks in Virginia showed no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada Geese in Virginia have shown quick response to pyrotechnics during winter months suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Mute Swans are not hunted species in Michigan, so pyrotechnics may be less effective for swans than migrant Canada Geese. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is also partially dependent on availability of alternative loafing and feeding areas. There are also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas.

Propane Cannons: Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for migrant waterfowl in agricultural settings, resident waterfowl in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

LOCAL POPULATION MANAGEMENT

Potential methods of managing the local Mute Swan population include egg treatments, nest destruction, capture with alpha-chloralose, toxicants, shooting, and capture and euthanasia.

Egg Treatments (Oiling, Addling, Puncturing, and Chilling): Inhibiting reproduction is one way of reducing waterfowl populations, but, given that most waterfowl are relatively long-lived (Allan et al. 1995) exclusive use of reproduction inhibition methods may take a period of years to reduce local bird populations. Consequently, this strategy will be more expensive and labor intensive compared to reducing the breeding population itself. Ellis and Elphick (2007) evaluated alternative strategies for controlling Mute Swan populations and found reproductive rates would need to decline by more than 72% to achieve the same goal as reducing adult survival rates by 17%. However, egg addling, oiling, or puncturing can be effective in reducing recruitment into the local population (Christens et al. 1995, Cummings et al. 1997). While egg treatments can reduce production of young, merely destroying an egg does not reduce a population as quickly as removing immature or breeding adults (Cooper and Keefe 1997). This method involves locating nests and treating eggs within the nest. Methods which leave the egg in the nest such as addling, oiling, and puncturing may have greater efficacy as a population control

tool because birds generally continue to attempt to incubate the eggs for a period of time after treatment. Consequently, there will likely be a greater delay between treatment and attempts to renest than with nest destruction. Generally, nests are visited 2-4 times per year to treat eggs. Usually, WS is able to reach and oil the eggs from a boat and walking on land is not necessary. Given the labor involved in locating and treating nests, and the time involved to reduce population of a long-lived species using reproductive control, this method is likely to be primarily used with small local populations and in situations where the goal is to maintain the local population at current levels.

Nest Destruction: Nest destruction can be used to reduce reproduction and as a method to discourage Mute Swan use of a specific sites. In this method, nests are located, eggs are destroyed and nest material is either removed from the site or dismantled and scattered around the nest location. Birds will usually abandon the nest location and, depending on the timing of the nest and egg destruction, may attempt to renest at another site. This method is generally more useful as a means of relocating problem birds than as a population control method because of the tendency of birds to relocate and renest.

Capture with Alpha-Chloralose: Alpha-chloralose is an avian sedative which may be used to capture Mute Swans. Use of alpha-chloralose is restricted to WS personnel and those under their supervision. Alpha-chloralose baits are hand delivered to birds, so risks to nontarget species are extremely low. Pursuant to FDA restrictions, waterfowl captured with alpha-chloralose for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days, at which time the birds may be killed and processed for human consumption. It is not legal in Michigan to capture Mute Swans and subsequently release or relocate them, therefore all Mute Swans captured using alpha-chloralose would be euthanized.

Hunting: The MDNR does not permit hunting of Mute Swans due to concerns regarding the potential for accidental take of native swans which look similar to Mute Swans. Native American tribes could potentially establish Mute Swan hunting season on tribal lands or in applicable sections of the ceded territories. However, no tribal hunting of Mute Swans is currently permitted.

Shooting: Shooting Mute Swans can be highly effective in removing/reducing local populations and for supplementing harassment activities. Wildlife Services personnel are trained in the safe and effective use of firearms including differentiation between the non-native Mute Swan, and native swan species. Lethal removal of adult breeding Mute Swans is the most effective method of reducing populations (Ellis and Elphick 2007). Shooting a few individuals from a larger flock can also reinforce birds' fear of harassment techniques.

Capture and Euthanize: Birds may be captured with panel nets, rocket nets, drive traps, net guns, hoop nets, and/or by hand. In Michigan, Mute Swans typically molt starting in late July and lasting through August or early September (MDNR and WS personal observations). Molting Mute Swans do not typically loaf on land, like Canada Geese typically do, so capturing Mute Swans using panel nets or drive traps would be

less effective than with Canada Geese. Rocket netting involves the setting of bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the birds to escape. Net guns are fire nets from a shoulder mounted gun or smaller hand-held versions. Rocket nets and net guns may be used anytime during the year and are not restricted to the flightless period. Captured Mute Swans will be euthanized by one of the methods approved by the American Veterinary Medical Association and listed in MDNR (2012). Mute Swans that are captured and euthanized would be buried, disposed of in landfills, or incinerated.

APPENDIX C

SPECIES THAT ARE FEDERALLY-LISTED AS THREATENED OR ENDANGEREDIN THE STATE OF MICHIGAN

(T= Threatened, E= Endangered)

Animals

E	Bat, Indiana (*Myotis sodalis*)
E	Beetle, American burying (*Nicrophorus americanus*)
E	Beetle, Hungerford's crawling water (*Brychius hungerfordi*)
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Clubshell (*Pleurobema clava*)
E	Dragonfly, Hine's emerald (*Somatochlora hineana*)
T	Lynx, Canada (*Lynx canadensis*)
E	Plover, piping (*Charadrius melodus*)
E	Rayed bean (*Villosa fabalis*)
E	Riffleshell, northern (*Epioblasma torulosa rangiana*)
T	Snake, copperbelly water (*Nerodia erythrogaster neglecta*)
E	Snuffbox (*Epioblasma triquetra*)
E	Warbler, Kirtland's (*Dendroica kirtlandii*)

Plants

T	Daisy, lakeside (*Hymenoxys herbacea*)
T	Fern, American hart's-tongue (*Asplenium scolopendrium* var. *americanum*)
T	Goldenrod, Houghton's (*Solidago houghtonii*)
T	Iris, dwarf lake (*Iris lacustris*)
E	Monkey-flower, Michigan (*Mimulus glabratus* var. *michiganensis*)
T	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
T	Pogonia, small whorled (*Isotria medeoloides*)
T	Thistle, pitcher's (*Cirsium pitcheri*)

APPENDIX D

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
LIST OF ENDANGERED AND THREATENED SPECIES

Filed with the Secretary of State on April 9, 2009.
These rules become effective immediately upon filing with the Secretary of State unless adopted under sections 33, 44, or 45a(6) of 1969 PA 306. Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the department of natural resources by section 36503 of 1994 PA
451, MCL 324.36503)

R 299.1021, R 299.1022, R 299.1023, R 299.1024, R 299.1025, R 299.1026, R 299.1027, and R 299.1028 of the Michigan Administrative Code are amended as follows:

R 299.1021 MOLLUSKS

Endangered Species:	
Epioblasma obliquata perobliqua (Conrad)	White catspaw
Epioblasma torulosa rangiana (Rafinesque) [*Dysnomia torulosa rangiana* (Lea)]	Northern riffleshell
Epioblasma triquetra (Rafinesque) [*Dysnomia triquetra* (Rafinesque)]	Snuffbox
Ligumia nasuta (Say)	Eastern pondmussel
Ligumia recta (Lamarck)	Black sandshell
Obliquaria reflexa Rafinesque	Threehorn wartyback
Obovaria olivaria (Rafinesque)	Hickorynut
Obovaria subrotunda (Rafinesque)	Round hickorynut
Pleurobema clava (Lamarck)	Clubshell
Simpsonaias ambigua (Say) [*Simpsoniconcha ambigua* (Say)]	Salamander mussel
Toxolasma lividus (Rafinesque) [Carunculina glans (Lea)]	Purple lilliput
Toxolasma parvus (Barnes)	Lilliput
Villosa fabalis (Lea)	Rayed bean
Threatened Species:	
Alasmidonta viridis (Rafinesque)	Slippershell
Cyclonaias tuberculata (Rafinesque)	Purple wartyback
Lampsilis fasciola Rafinesque	Wavyrayed lampmussel
Potamilus ohiensis (Rafinesque)	Pink papershell
Pyganodon subgibbosa Anodonta subgibbosa (Anthony)	Lake floater
Truncilla donaciformis (Lea)	Fawnsfoot

GASTROPODA (snails)

Endangered Species:

Catinella protracta Franzen	A land snail (no common name)
Gastrocopta holzingeri (Sterki)	Lamda snaggletooth
Guppya sterkii (Dall)	Sterki's granule
Planorbella multivolvis (Case) [*Helisoma multivolvis*]	Acorn ramshorn
Planorbella smithi (F. C. Baker)	An aquatic snail (no common name)
Stagnicola contracta (Currier) [Lymanaea contracta]	Deepwater pondsnail
Stagnicola petoskeyensis (Walker)	Petoskey pondsnail
Vallonia gracilicosta albula Sterki	A land snail (no common name)
Vertigo hubrichti Pilsbry	Hubricht's vertigo
Vertigo modesta modesta (Say)	A land snail (no common name)
Vertigo modesta parietalis (Ancey)	A land snail (no common name)
Vertigo morsei Sterki	A land snail (no common name)
Vertigo nylanderi Sterki	Deep-throat vertigo

Threatened Species:

Catinella exile (Leonard)	Pleistocene catinella
Catinella gelida (F. C. Baker)	A land snail (no common name)
Euchemotrema hubrichti (Pilsbry)	Carinate pillsnail
Euconulus alderi (Gray)	A land snail (no common name)
Fossaria cyclostoma (Walker)	Bugle fossaria
Hendersonia occulta (Say)	Cherrystone drop
Mesodon elevatus (Say)	Proud globe
Pallifera fosteri F. C. Baker	Foster mantleslug
Physella parkeri (Currier)	Broadshoulder physa
Vertigo bollesiana (E. S. Morse)	Delicate vertigo

INSECTS

Endangered Species:

Brychius hungerfordi Spangler	Hungerford's crawling water beetle
Catocala amestris Strecker	Three-staff underwing
Neonympha mitchellii mitchellii French	Mitchell's satyr
Schinia indiana (Smith)	Phlox moth
Schinia lucens (Morrison)	Leadplant moth
Somatochlora hineana Williamson	Hine's emerald dragonfly
Speyeria idalia (Drury)	Regal fritillary

Threatened Species:

Dryobius sexnotatus Linsley	Six-banded longhorn beetle
Erynnis persius persius Scudder	Persius dusky wing
Euphyes dukesi (Lindsey)	Dukes' skipper
Flexamia huroni Bess and Hamilton	Huron River leafhopper
Hesperia ottoe Edwards	Ottoe skipper
Incisalia henrici (Grote and Robinson)	Henry's elfin
Incisalia irus Godart	Frosted elfin
Lycaeides idas nabokovi Masters	Northern blue
Lycaeides melissa samuelis Nabakov	Karner blue
Oarisma powesheik (Parker)	Powesheik skipperling
Ophiogomphus howei Bromley	Pygmy snaketail
Papaipema silphii Bird	Silphium borer moth
Tachopteryx thoreyi (Hagen)	Grey petaltail
Trimerotropis huroniana E. M. Walker	Lake Huron locust
Ophiogomphus howei Bromley	Pygmy snaketail
Papaipema silphii Bird	Silphium borer moth
Tachopteryx thoreyi (Hagen)	Grey petaltail
Trimerotropis huroniana E. M. Walker	Lake Huron locust

Extirpated: The following insect species are thought to be extirpated in Michigan, but will be listed automatically as threatened if rediscovered in the state:

Nicrophorus americanus Olivier	American burying beetle

FISHES

Endangered Species:

Clinostomus elongatus (Kirtland)	Redside dace
Erimyzon claviformis (Girard)	Western creek chubsucker
Notropis anogenus Forbes	Pugnose shiner
Notropis photogenis (Cope)	Silver shiner
Noturus stigmosus Taylor	Northern madtom
Opsopoeodus emiliae Hay	Pugnose minnow
Percina copelandi (Jordan)	Channel darter
Percina shumardi (Girard)	River darter
Phoxinus erythrogaster (Rafinesque)	Southern redbelly dace

Threatened Species:

Acipenser fulvescens Rafinesque	Lake sturgeon
Ammocrypta pellucida (Putnam)	Eastern sand darter
Coregonus artedii Lesueur	Cisco
Coregonus bartletti (Koelz)	Siskiwit lake cisco
Coregonus hubbsi (Koelz)	Ives lake cisco
Coregonus zenithicus (Jordan and Evermann)	Shortjaw cisco
Hiodon tergisus Lesueur	Mooneye

Moxostoma carinatum (Cope)	River redhorse
Sander canadensis (Smith)	Sauger

Extirpated: The following fish species are thought to be extirpated in Michigan, but will be listed automatically as threatened if rediscovered in the state:

Coregonus nigripinnis (Gill)	Blackfin cisco
Coregonus reighardi (Koelz)	Shortnose cisco
Notropis amblops (Rafinesque)	Bigeye chub
Notropis chalybaeus (Cope)	Ironcolor shiner
Notropis texanus (Girard)	Weed shiner
Polyodon spathula (Walbaum)	Paddlefish
Thymallus arcticus (Richardson)	Arctic grayling

AMPHIBIANS

Endangered Species:

Ambystoma opacum (Gravenhorst)	Marbled salamander
Ambystoma texanum (Matthews)	Smallmouth salamander

Threatened Species:

Acris crepitans blanchardi (Harper)	Blanchard's cricket frog

REPTILES

Endangered Species:

Clonophis kirtlandii (Kennicott)	Kirtland's snake
Nerodia erythrogaster neglecta (Conant)	Copperbelly water snake

Threatened Species:

Aspidoscelis sexlineata (Linnaeus)	Six-lined racerunner
Clemmys guttata	Spotted turtle
Pantherophis gloydi Conant (=*Elaphe vulpina gloydi*)	Eastern fox snake

BIRDS

Endangered Species:

Ammodramus henslowii (Audubon)	Henslow's sparrow
Asio flammeus (Pontoppidan)	Short-eared owl
Charadrius melodus Ord	Piping plover
Dendroica discolor (Vieillot)	Prairie warbler
Dendroica kirtlandii (Baird)	Kirtland's warbler
Falco peregrinus Tunstall	Peregrine falcon
Lanius ludovicianus migrans (Palmer)	Migrant loggerhead shrike
Rallus elegans Audubon	King rail
Tyto alba (Scopoli)	Barn owl

Threatened Species:

Asio otis (Linnaeus)	Long-eared owl

Buteo lineatus (Gmelin)	Red-shouldered hawk
Corturnicops noveboracensis (Gmelin)	Yellow rail
Cygnus buccinator Richardson	Trumpeter swan
Dendroica cerulea (Wilson)	Cerulean warbler
Dendroica dominica (Linnaeus)	Yellow-throated warbler
Falco columbarius (Linnaeus)	Merlin
Gallinula chloropus (Linnaeus)	Common moorhen
Gavia immer (Brunnich)	Common loon
Ixobrychus exilis (Gmelin)	Least bittern
Seiurus motacilla (Vieillot)	Louisiana waterthrush
Sterna caspia Pallas	Caspian tern
Sterna forsteri Nuttall	Forster's tern
Sterna hirundo Linnaeus	Common tern

Extirpated: The following bird species are thought to be extirpated in Michigan, but will be listed automatically as threatened if rediscovered in the state:

Chondestes grammacus (Say)	Lark sparrow

MAMMALS

Endangered Species:

Felis concolor Linnaeus	Cougar
Lynx canadensis Kerr	Lynx
Microtus ochrogaster (Wagner)	Prairie vole
Myotis sodalis Miller and Allen	Indiana bat

Threatened Species:

Cryptotis parva (Say)	Least shrew
Nycticeius humeralis (Rafinesque)	Evening bat
Sorex fumeus Miller	Smoky shrew

PLANTS

Endangered Species:

Agalinas gattingeri Small [*Gerardia gattingeri* Small]	Gattinger's gerardia
Agalinas skinneriana (A. Wood) Britton [*Gerardia skinneriana* A. Wood]	Skinner's gerardia
Amerorchis rotundifolia (Pursh) Hultén	Small round-leaved orchis
Androsace occidentalis Pursh	Rock-jasmine
Antennaria rosea Greene	Rosy pussytoes
Aristida tuberculosa Nutt.	Beach three-awned grass
Arnica cordifolia Hooker	Heart-leaved arnica
Arnica lonchophylla Greene	Longleaf arnica
Asclepias ovalifolia Dcne.	Dwarf milkweed
Asplenium ruta-muraria L.	Wall-rue
Asplenium scolopendrium L. var. *americana* (Fernald) Kartesz & Ghandi [*Phyllitis scolopendrium* var. *americanum* Fern.]	Hart's-tongue fern
Baptisia leucophaea Nutt.	Cream wild indigo
Besseya bullii (Eaton) Rydb.	Kitten-tails
Botrychium acuminatum W. H. Wagner	Moonwort

Bouteloua curtipendula (Michaux) Torrey	Side-oats grama grass
Carex crus-corvi Kuntze	Raven's-foot sedge
Carex heleonastes Ehrh.	Hudson Bay sedge
Carex nigra (L.) Reichard	Black sedge
Carex platyphylla Carey	Broad-leaved sedge
Carex straminea Willd.	Straw sedge
Castanea dentata (Marsh.) Borkh.	American chestnut
Chamaerhodos nuttallii Fern.	Rock-rose
Chasmanthium latifolium (Michx.) Yates [*Uniola latifolia* Michaux]	Wild oats
Chelone obliqua L.	Purple turtlehead
Dasistoma macrophylla (Nutt.) Raf.	Mullein-foxglove
Dichanthelium polyanthes (Schult.) Mohlenbr	Round-seed panic-grass
Dodecatheon meadia L.	Shooting star
Draba glabella Pursh.	Smooth whitlow grass
Eleocharis atropurpurea (Retz.) Kunth	Purple spike rush
Eleocharis microcarpa Torrey	Small-fruited spike-rush
Eleocharis nitida Fern.	Slender spike rush
Eleocharis parvula (R. & S.) Link	Dwarf spike-rush
Echinodorus tenellus (Mart.) Buchenau	Dwarf burhead
Galium kamtschaticum Schultes & J. H. Schultes	Bedstraw
Gentiana flavida A. Gray [*G. alba* Muhl.]	White gentian
Gentiana puberulenta J. Pringle [*G. puberula* Michaux]	Downy gentian
Gillenia trifoliata (Muhl.) Baill. [(L.) Moench.]	Bowman's root
Gymnocarpium jessoense (Koidz.) Koidz.	Northern oak fern
Hedysarum alpinum L.	Alpine sainfoin
Hymenoxys herbacea (Greene) Cusick [*Hymenoxys acaulis* var.*glabra* (Gray) Parker	Lakeside daisy
Hypericum sphaerocarpum Michaux	Round-fruited St. John's-wort
Isoetes engelmannii A. Braun	Engelmann's quillwort
Lygodium palmatum (Bernh.) Sw.	Climbing fern
Mertensia virginica Pers. (L.)	Virginia bluebells
Mimulus michiganensis (Pennell) Posto & Prather	Michigan monkey flower
Nuphar pumila (Timm) DC. [*N. microphylla* (Pers.) Fern.]	Small yellow pond lily
Nymphaea leibergii Morong	Pygmy water lily
Ophioglossum vulgatum L. [*Ophioglossum pycnostichum* (Fern.) Löve & Löve]	Southeastern adder's-tongue
Opuntia fragilis (Nutt.) Haw.	Fragile prickly pear
Penstemon gracilis Nutt.	Slender beard tongue
Phlox ovata L. (*P. latifolia* Michx.)	Wideflower phlox
Plantago cordata Lam.	Heart-leaved plantain
Platanthera ciliaris (L.) Lindley [*Habenaria ciliaris* (L.) R. Br.]	Orange- or yellow-fringed orchid
Platanthera leucophaea (Nutt.) Lindley [*Habenaria leucophea* (Nutt.) A. Gray]	Prairie white-fringed orchid
Poa canbyi (Scribner) Piper	Canbyi's bluegrass
Populus heterophylla L.	Swamp or Black cottonwood
Potamogeton pulcher Tuckerman	Spotted pondweed
Prosartes hookeri Torr.	Fairy bells
Proserpinaca pectinata Lam.	Mermaid-weed
Rhynchospora (Psilocarya) nitens (Vahl) A. Gray	Short-beak beak-rush

Rhynchospora recognita (Gale) Kral	Globe beak-rush
Rubus acaulis Michaux	Dwarf raspberry
Ruellia strepens L.	Smooth ruellia
Rumex occidentalis S. Wats	Western dock
Sanguisorba canadensis L.	Canadian burnet
Schoenoplectus americanus (Pers.) Schinz & R. Keller	Three-square bulrush
Scleria pauciflora Willd.	Few-flowered nut rush
Scutellaria nervosa Pursh	Skullcap
Silene virginica L.	Fire pink
Solidago bicolor L.	White goldenrod
Sporobolus clandestinus (Biehler) Hitch.	Dropseed
Stellaria crassifolia Ehrh.	Fleshy stitchwort
Subularia aquatica L.	Awlwort
Tipularia discolor (Pursh) Nutt.	Cranefly orchid
Trillium undulatum Willd.	Painted trillium
Utricularia inflata Walter [*U. radiata* Small]	Floating bladderwort
Vaccinium vitis-idaea L.	Mountain cranberry
Viola epipsila Ledeb.	Northern marsh violet
Woodsia alpina (Bolton) S. F. Gray	Northern woodsia

Threatened Species:

Agoseris glauca (Pursh) Raf.	Prairie or pale agoseris
Agrimonia rostellata Wallr.	Beaked agrimony
Allium schoenoprasum L. (native variety)	Chives
Arabis perstellata E. L. Braun	Rock cress
Aristida longespica Poiret	Three-awned grass
Aristolochia serpentaria L.	Virginia snakeroot
Armoracia lacustris (A. Gray) Al-Shehbaz & V. Bates [*Armoracia aquatica* (Eaton Wiegand)]	Lake cress
Artemisia ludoviciana Nutt.	Western mugwort
Asclepias hirtella (Pennell) Woodson	Tall green milkweed
Asclepias purpurascens L.	Purple milkweed
Asclepias sullivantii Engelm.	Sullivant's milkweed
Asplenium rhizophyllum L. [*Camptosorus rhizophyllus* (L.) Link]	Walking fern
Aster drummondii Lindl	Drummond's aster
Aster furcatus Burgess	Forked aster
Aster modestus Lindley	Great northern aster
Aster sericeus Vent.	Western silvery aster
Astragalus canadensis L.	Canadian milk vetch
Bartonia paniculata (Michaux) Muhl.	Panicled screwstem
Beckmannia syzigachne (Steudel) Fern.	Slough grass
Berula erecta (Nutt.) Fern. [*Berula pusilla* (Nutt.) Fern.]	Cut-leaved water parsnip
Botrychium campestre W. H. Wagner	Prairie Moonwort or Dunewort
Botrychium hesperium (Maxon & Clausen) W. H. Wagner & Lellinger	Western moonwort
Botrychium mormo W. H. Wagner	Goblin moonwort
Botrychium spathulatum W. H. Wagner	Spatulate moonwort
Braya humilis (C. A. Meyer) Robinson	Low northern rock cress
Bromus pumpellianus Scribner	Pumpelly's bromegrass
Calamagrostis lacustris (Kearney) Nash	Northern reedgrass

Calamagrostis stricta (Timm)	
Callitriche heterophylla Pursh	Large water starwort
Caltha natans Pallas ex Georgi	Floating marsh marigold
Calypso bulbosa (L.) Oakes	Calypso or fairy-slipper
Camassia scilloides (Raf.) Cory	Wild hyacinth
Carex albolutescens Schw.	Sedge
Carex assiniboinensis W. Boott	Assiniboia sedge
Carex atratiformis Britton	Sedge
Carex conjuncta F. Boott.	Sedge
Carex lupuliformis Dewey	False hop sedge
Carex media R. Br.	Sedge
Carex novae-angliae Schwein.	New England sedge
Carex oligocarpa Willd.	Eastern few-fruited sedge
Carex rossii Boott	Ross's sedge
Carex scirpoidea Michaux	Bulrush sedge
Carex seorsa Howe	Sedge
Carex tincta Fern.	Sedge
Carex typhina Michaux	Cattail sedge
Castilleja septentrionalis Lindley	Pale Indian paintbrush
Ceanothus sanguineus Pursh	Wild lilac
Cerastium brachypodum (Engelm. ex A. Gray) B.L. Rob.	Shortstalk chickweed
Cirsium pitcheri (Eaton) Torrey & A. Gray	Pitcher's thistle
Collinsia parviflora Lindley	Small blue-eyed Mary
Coreopsis palmate Nutt.	Prairie coreopsis
Corydalis flavula (Raf.) DC.	Yellow fumewort
Cryptogramma acrostichoides R. Br.	American rock-brake
Cypripedium candidum Willd.	White lady slipper
Cystopteris tennesseensis Shaver	Tennessee bladder fern
Dalibarda repens L.	False violet
Dennstaedtia punctilobula (Michx.) T. Moore	Hay-scented fern
Dentaria maxima Nutt.	Large toothwort
Diarrhena obovata (Gleason) Brandenburg	Beak grass
Dichanthelium leibergii (Vasey) Freckmann	Leiberg's panic grass
Draba cana Rydb.	Ashy whitlow grass
Draba incana L.	Twisted whitlow grass
Draba reptans (Lam.) Fern.	Creeping whitlow grass
Dryopteris celsa (W. Palmer) Small	Small log fern
Eleocharis compressa Sulliv.	Flattened spike rush
Eleocharis tricostata Torrey	Three-ribbed spike rush
Empetrum nigrum L.	Black crowberry
Erigeron acris L.	Fleabane
Erigeron hyssopifolius Michaux	Hyssop-leaved fleabane
Eryngium yuccifolium Michaux	Rattlesnake-master or button snakeroot
Eupatorium fistulosum Barratt	Hollow-stemmed Joe-pye weed
Eupatorium sessilifolium L.	Upland boneset
Euphorbia commutata Engelm.	Tinted spurge
Euphrasia hudsoniana Fernald & Weigand	Eyebright
Euphrasia nemorosa (Pers.) Wallr.	Eyebright
Festuca scabrella Torrey [*F. altaica* Trin.]	Rough fescue
Filipendula rubra (Hill) Robinson	Queen-of-the-prairie

Fraxinus profunda (Bush) Bush [*F. tomentosa* F. Michaux]	Pumpkin ash
Fuirena pumila (Torr.) Spreng.	Umbrella-grass
Galearis spectabilis (L.) Raf.	Showy orchis
Gentiana linearis Froel.	Narrow-leaved gentian
Gentianella quinquefolia (L.) Small	Stiff gentian
Geum triflorum Pursh	Prairie smoke
Glyceria melicaria (Michx.) C.E. Hubb.	Slender manna grass
Gnaphalium sylvaticum L.	Woodland everlasting
Gratiola aurea Pursh [*G. lutea* Raf.]	Hedge-hyssop
Gratiola virginiana L.	Annual hedge hyssop
Gymnocarpium robertianum (Hoffman) Newman	Limestone oak fern
Helianthus mollis Lam.	Downy sunflower
Hieracium paniculatum L.	Panicled hawkweed
Hydrastis canadensis L.	Goldenseal
Hypericum adpressum Raf. ex W. Bart.	Creeping St. John's-wort
Ipomoea pandurata (L.) G. F. W. Meyer	Wild potato vine or man-of-the-earth
Iris lacustris Nutt.	Dwarf lake iris
Isotria verticillata (Willd.) Raf.	Whorled pogonia
Juncus brachycarpus Engelm.	Short-fruited rush
Juncus militaris Bigelow	Bayonet rush
Juncus scirpoides Lam.	Scirpus-like rush
Juncus stygius L.	Moor rush
Juncus vaseyi Engelm.	Vasey's rush
Justicia americana (L.) Vahl	Water willow
Lactuca floridana (L.) Gaertner	Woodland lettuce
Lechea pulchella Raf. [*Lechea leggettii* Britton & Hollick]	Leggett's pinweed
Linum virginianum L.	Virginia flax
Lonicera involucrata (Richardson) Banks	Black twinberry
Ludwigia sphaerocarpa Ell.	Globe-fruited seedbox
Luzula parviflora (Ehrh.) Desv.	Small-flowered wood rush
Lycopodiella margaritae J. G. Bruce, W. H. Wagner, & Beitel	Clubmoss
Lycopus virginicus L.	Virginia water-horehound
Moehringia macrophylla (Hook.) Fenzl	Big-leaf sandwort
Morus rubra L.	Red mulberry
Muhlenbergia richardsonis (Trin.) Rydb.	Mat muhly
Myrica pensylvanica Mirbel	Northern bayberry
Myriophyllum farwellii Morong	Farwell's water milfoil
Nelumbo lutea (Willd.) Pers. [*Nelumbo pentapetala* (Walter) Fern.]	American lotus
Oplopanax horridus (Smith) Miq.	Devil's club
Orobanche fasciculata Nutt.	Broomrape
Oryzopsis canadensis (Poiret) Torrey	Canada rice grass
Osmorhiza depauperata Phil.	Sweet Cicely
Panax quinquefolius L.	Ginseng
Panicum longifolium Torrey	Panic grass
Panicum philadelphicum Bernh. Ex Trin.	Philadelphia panic-grass
Panicum verrucosum Muhl.	Warty panic grass
Parnassia palustris L.	Marsh grass-of-parnassus
Pellaea atropurpurea (L.) Link.	Purple cliff brake

Penstemon calycosus Small	Beard tongue
Petasites sagittatus (Pursh) A. Gray	Sweet coltsfoot
Phacelia franklinii (R. Br.) A. Gray	Franklin’s phacelia
Phlox maculata L.	Wild sweet William
Poa alpina L.	Alpine bluegrass
Poa paludigena Fern. & Wieg.	Bog bluegrass
Polemonium reptans L.	Jacob’s ladder
Polygonum careyi Olney	Carey's smartweed
Polygonum viviparum L.	Alpine bistort
Polymnia uvedalia L.	Yellow-flowered leafcup
Potamogeton bicupulatus Fern. [*Potamogeton capillaceus* Poiret]	Waterthread pondweed
Potamogeton hillii Morong	Hill's pondweed
Potamogeton vaseyi Robins	Vasey's pondweed
Potentilla paradoxa Nutt.	Sand cinquefoil
Potentilla pensylvanica L.	Prairie cinquefoil
Prenanthes crepidinea Michx.	Nodding rattlesnake-root
Prosartes trachycarpa S. Watson	Northern fairy bells
Pterospora andromedea Nutt.	Pine-drops
Pycnanthemum muticum (Michx.) Pers.	Mountain mint
Pycnanthemum pilosum Nutt.	Hairy mountain mint
Ranunculus ambigens Watson	Spearwort
Ranunculus cymbalaria Pursh	Seaside crowfoot
Ranunculus lapponicus L.	Lapland buttercup
Ranunculus macounii Britton	Macoun's buttercup
Ranunculus rhomboideus Goldie	Prairie buttercup
Rhexia mariana L.	Maryland meadow beauty
Rhynchospora scirpoides (Torr.) A. Gray	Bald-rush
Ruellia humilis Nutt.	Hairy wild petunia
Ruppia maritima L.	Widgeon grass
Sabatia angularis (L.) Pursh	Rosepink
Sagina nodosa (L.) Fenzl	Pearlwort
Sagittaria montevidensis Cham. & Schlecht.	Arrowhead
Salix planifolia Pursh	Tea-leaved willow
Sarracenia purpurea f. *heterophylla* (Eaton) Fern.	Yellow pitcher plant
Saxifraga paniculata Miller [S. aizoön Jacq.]	Encrusted saxifrage
Saxifraga tricuspidata Rottb.	Prickly saxifrage
Schoenoplectus hallii (A. Gray) S.G. Sm.	Hall’s bulrush
Scleria reticularis Michaux	Netted nut rush
Scutellaria ovata Hill	Forest skullcap
Scutellaria parvula Michaux [sensu lato]	Small skullcap
Senecio indecorus Greene	Northern ragwort
Silene nivea (Nutt.) Muhl. ex Otth	Evening campion
Silene stellata (L.) Aiton f.	Starry campion
Silphium integrifolium Michaux	Rosinweed
Silphium laciniatum L.	Compass plant
Silphium perfoliatum L.	Cup plant
Sisyrinchium atlanticum Bickn.	Atlantic blue-eyed-grass
Solidago houghtonii A. Gray	Houghton's goldenrod
Solidago missouriensis Nutt.	Missouri goldenrod
Spiranthes ovalis Lindley	Lesser ladies’-tresses

Tanacetum huronense Nutt.	Lake Huron tansy
Tofieldia pusilla (Michaux) Pers.	False asphodel
Trichostema brachiatum L. [*Isanthus brachiatus* (L.) BSP.]	False pennyroyal
Trichostema dichotomum L.	Bastard pennyroyal
Trillium nivale Riddell	Snow trillium
Trillium recurvatum Beck	Prairie trillium
Trillium sessile L.	Toadshade
Triphora trianthophora (Sw.) Rydb.	Nodding pogonia or three birds orchid
Utricularia subulata L.	Bladderwort
Vaccinium cespitosum Michaux	Dwarf bilberry
Vaccinium uliginosum L.	Alpine blueberry
Valeriana edulis var. *ciliata* (T. & G.) Cronquest	Edible valerian
Valerianella chenopodiifolia (Pursh) DC.	Goosefoot corn salad
Valerianella umbilicata (Sull.) A. W. Wood	Corn salad
Viburnum edule (Michx.) Raf.	Squashberry or mooseberry
Viola novae-angliae House	New England violet
Viola pedatifida G. Don	Prairie birdfoot violet
Vitis vulpina L.	Frost grape
Wisteria frutescens (L.) Poiret	Wisteria
Wolffia papulifera Thompson [*W. brasiliensis* Weddell]	Watermeal
Woodsia obtusa (Sprengel) Torrey	Blunt-lobed woodsia
Zizania aquatica var. *aquatica* L.	Wild rice
Zizia aptera (A. Gray) Fern.	Prairie golden alexanders

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

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

Agropyron spicatum (Pursh) Scribner & J. G. Smith	Bluebunch wheatgrass
Aristida dichotoma Michaux	Three-awned grass
Buchnera americana L.	Bluehearts
Carex decomposita Muhl.	Log sedge
Carex gravida Bailey	Sedge
Carex haydenii Dewey	Hayden's sedge
Cerastium velutinum Raf.	Field chickweed
Commelina erecta L.	Slender dayflower
Cyperus acuminatus Torrey & Hooker	Cyperus, Nut grass
Dalea purpurea Vent. [*Petalostemon purpurem* (Vent.) Rydb.]	Purple prairie clover
Digitaria filiformis (L.) Koeler	Slender finger grass
Diphasiastrum (Lycopodium) alpinum (L.) Holub	Alpine clubmoss
Echinacea purpurea (L.) Moench.	Purple coneflower
Eleocharis geniculata (L.) Roem & Schult.	Spike-rush
Eleocharis radicans (Poiret) Kunth	Spike rush
Equisetum telmateia Ehrh.	Giant horsetail
Fimbristylis puberula (Michaux) Vahl	Chestnut sedge
Gentiana saponaria L.	Soapwort gentian
Glyceria acutiflora Torrey	Manna grass
Hedyotis nigricans (Lam.) Fosb.	Hedyotis

Helianthus microcephalus Torrey & Gray	Small wood sunflower
Hibiscus laevis All.	Smooth rose-mallow
Houstonia caerulea L.	Azure bluet
Isotria medeoloides (Pursh) Raf.	Smaller whorled pognia
Lactuca pulchella (Pursh) A. Gray	Blue lettuce
Lechea minor L.	Least pinweed
Lemna valdiviana Phil.	Pale duckweed
Lespedeza procumbens Michaux	Trailing bush clover
Liatris punctata Hooker	Dotted blazing star
Liatris squarrosa (L.) Michx.	Plains blazing star
Lithospermum incisum Lehm.	Narrow-leaved puccoon
Lysimachia hybrida Michaux	Swamp candles
Mikania scandens (L.) Willd.	Mikania
Mimulus alatus Aiton	Winged monkey flower
Muhlenbergia cuspidata (Hooker) Rydb.	Plains muhly
Onosmodium molle Michx.	Marbleweed
Oxalis violacea L.	Violet wood sorrel
Paronychia fastigiata (Raf.) Fern.	Low-forked chickweed
Phaseolus polystachios (L.) BSP.	Wild bean
Phleum alpinum L.	Mountain timothy
Phlox bifida Beck	Cleft phlox
Polygala incarnata L.	Pink milkwort
Polytaenia nuttallii DC.	Prairie parsley
Prosartes maculata (Buckley) A. Gray	Nodding mandarin
Rudbeckia subtomentosa Pursh	Sweet coneflower
Scutellaria incana Biehler	Skullcap
Scutellaria ovata Hill	Forest skullcap
Senecio congestus (R. Br.) DC.	Marsh fleabane
Sisyrinchium fuscatum E.P. Bicknell	Farwell's blue-eyed grass
Sisyrinchium hastile Bickn.	Blue-eyed grass
Tomanthera auriculata (Michaux) Raf. [*Agalinas auriculata* (Michaux) S. F. Blake]	Eared foxglove
Tradescantia bracteata Small	Long-bracted spiderwort
Woodwardia areolata (L.) T. Moore	Netted Chain Fern

REGIONAL FORESTERS SENSITIVE SPECIES LIST
HURON-MANISTEE NATIONAL FORESTS

MAMMALS	
Glaucomys sabrinus	Northern flying squirrel
Martes americana	American marten
Moytis lucifugus	Little brown myotis
Nyotis septentrionalis	Northern myotis
Perimyotis subflavus	Tri-colored bat
BIRDS	
Accipter gentilis	Northern goshawk
Ammodramus henslowii	Henslow's sparrow
Ammodramus savannarum	Grasshopper sparrow
Botaurus lentiginosus	American bittern
Buteo lineatus	Red-shouldered hawk
Chlidonias niger	Black tern
Contopus cooperi	Olive-sided flycatcher
Cygnus buccinators	Trumpeter swan
Falcipennis canadensis	Spruce grouse
Gavia immer	Common loon
Haliaeetus leucocephalus	Bald eagle
Ixobrychus exilis	Least bittern
Lanius ludovicianus migrans	Migrant loggerhead shrike
Melanerpes erythrocephalus	Red-headed woodpecker
Picoides arcticus	Black-backed woodpecker
Setophaga cerula	Cerulean warbler
Setophaga discolor	Prairie Warbler
REPTILES	
Clemmys guttata	Spotted turtle
Clonophis kirtlandii	Kirtland's snake
Emydoidea blandingii	Blanding's turtle
Glyptemys insculpta	Wood turtle
Sistrurus catenatus catenatus	Eastern massasauga
Terrapene carolina carolina	Eastern box turtle
FISH	
Acipenser fulvescens	Lake sturgeon
Clinostomus elongates	Redside dace
Moxostoma carinatum	River redhorse
Moxostoma valenciennesi	Greater redhorse
Notropis anogenus	Pugnose shiner
Percina copelandi	Channel darter
INVERTEBRATES-BIVALVES	
Alasmidonta viridis	Slippershell mussel
Lasmigona compressa	Creek heelsplitter
Ligumia recta	Black sandshell

INVERTEBRATES – INSECTS

Appalachia arcana	Michigan bog grasshopper
Atrytonopsis hianna	Dusted skipper
Callophrys irus	Frosted elfin
Erynnis persius	Persius duskywing
Lepyronia gibbosa	Hill-prairie spittlebug
Papaipema sciata	Culver's root borer
Phyciodes batesii	Tawny crescent
Pyrgus wyandot	Southern grizzled skipper
Schinia indiana	Phlox moth
Trimerotropis huroniana	Lake Huron locust

PLANTS

Agoseris glauca	Pale false-dandelion
*Arabis missouriensis (*syn+ *A. missouriensis v deamii*)	Green rockcress
Asclepias purpurascens	Purple milkweed
Astragalus canadensis	Canadian milkvetch
Berula erecta	Wild parsnip
Botrychium mormo	Little goblin moonwort
Botrychium oneidense	Bluntlobe grapefern
Botrychium rugulosum	Ternate grapefern
Carex luuliformis	False hop sedge
Carex schweinitzii	Schweinitz's sedge
Cirsium hillii	Hill's thistle
Cynoglossum virginianum var. boreale	Northern wild comfrey
Cypripedium arietinum	Ram's-head lady's-slipper
Dalibarda repens	Robin runaway
Dryopteris goldiana	Goldie's woodfern
Eleocharis atropurpurea	Purple spikerush
Eleocharis tricostata	Englemann's spikerush
Eupatorium sessilifolium	Upland boneset
Festuca altaica	Rough fescue
Fuirena squarrosa	Hairy umbrella-sedge
Galearis spectabilis	Showy orchid
Geum triflorum	Prairie-smoke
Huperzia selago	Fir clubmoss
Hypericum adpressum	Creeping St. John's-wort
Hypericum gentianoides	Orange-grass St. John's-wort
Juglans cinerea	Butternut
Juncus brachycarpus	Short-fruit rush
Lechea pulchella	Leggett's pinweed
Linum sulcatum	Grooved yellow flax
Liparis liliifolia	Large twayblade
Lipocarpha micrantha	Dwarf bulrush
Lycopodiella subappressa	Northern bog clubmoss
Malaxis brachypoda	White adder's-mouth orchid
Mertensia virginica	Virginia bluebells
Orobanche fasciculata	Clustered broomrape
Panax quinquefolius	American ginseng
Platanthera hookeri	Hooker's orchid
Poa paludigena	Bog bluegrass

Polygala cruciata	Crossleaf milkwort
Potamogeton bicupulatus	Snail-seed pondweed
Pterospora andromedea	Giant pinedrops
Pycnanthemum verticulcillatum	Whorled mountainmint
Rhexia virginica	Handsome Harry
Rhynchospora scirpoides	Bald rush
Schoenoplectus hallii	Hall's bulrush
Scleria pauciflora	Few-flower nutrush
Scleria triglomerata	Whip nutrush
Sisyrinchium atlanticum	Eastern blue-eyed-grass
Sisyrinchium strictum	Strict lue-eyed-grass
Spiranthes ochroleuca	Yellow nodding ladies'-tresses
Sporobolus heterolepis	Northern dropseed
Symphyotrichum sericeum	Western slivery aster
Taxus canadensis	Canada yew
Trichophorum clintonii	Clinton's bulrush
Trichostema brachiatum	False pennyroyal
Trichostema dichotomum	Forked bluecurls
Triplasis purpurea	Purple sandgrass
Viola novae-angliae ssp. grisea	New England blue violet