ENVIRONMENTAL ASSESSMENT

PROPOSED WHITE-TAILED DEER MANAGEMENT PROGRAM

U.S. FISH AND WILDLIFE SERVICE
LONG ISLAND NATIONAL WILDLIFE REFUGE COMPLEX
WERTHEIM NATIONAL WILDLIFE REFUGE
SHIRLEY/BROOKHAVEN, NEW YORK

In compliance with the National Environmental Policy Act of 1969

Point of Contact:
Patricia L. Martinkovic, Refuge Manager
Long Island NWR Complex
P.O. Box 21
Shirley, New York 11967
(631) 286-0485

Environmental Assessment for Managing White-tailed Deer *Odocoileus virginianus* at the Wertheim NWR

Introduction

"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."(National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd), Public Law 105-57–October 9, 1997 [H.R. 1420])).

Wertheim National Wildlife Refuge (NWR), headquarters of the Long Island National Wildlife Refuge Complex, is proposing to manage its white-tailed deer (*Odocoileus virginianus*) population with a strictly controlled public hunting program designed to ensure the safety of residents, general public, and staff, and the protection of Refuge wildlife and their habitats. White-tailed deer are a much recognized and important component of the mammalian community, but are also considered a problematic species known for breeding beyond the capacity of the land to support them (Kilpatrick and Walter 1999). Overabundant populations of white-tailed deer have reduced forest regeneration, impacted the forest shrub layer, eliminated native wild flowers, damaged agricultural crops, minimized plant diversity and impacted habitats for other wildlife species, such as nesting songbirds (Healy et al. 1997). High density herds (i.e., >30 deer/mi^2) have been associated with damage to habitats (e.g., lack of forest regeneration and loss of woody understories), economic impacts (e.g., timber resources, ornamental plantings, agricultural damage, and vehicle collisions), and tick-borne disease transmission (Woolf and Harder 1979, Cypher and Cypher 1988). This environmental assessment will document the environmental attributes of various alternatives for managing white-tailed deer on Wertheim NWR. If a hunt program is approved, this document will serve as the foundation for, and will be incorporated in a hunt management plan. The management plan will describe specifically the manner in which the hunting program will be implemented.

White-tailed deer are one of the most conspicuous species on Wertheim NWR. Deer are frequently viewed in fields and along roadsides. To the trained eye, deer browse lines, where vegetation within six feet of the ground has been consumed, are noticeable on trees and shrubs (Fig. 1). In addition, deer cause more subtle effects on vegetation that potentially have a greater impact on Refuge habitats and a diversity of wildlife species. These impacts may include a reduction of forage available to other forest wildlife, damage to nesting habitats for birds such as Eastern wood pee wee (*Contopus virens*) or the chipping sparrow (*Spizella passerina*), and reduced forest edge regeneration for hibernating reptiles and amphibians such as the Eastern mud turtle *(Kinosternon subrubrum),* a State endangered species (NYDEC 1999). One of the objectives of the National Wildlife Refuge System is "to preserve the natural diversity and abundance of mammals and migratory birds on refuge lands." Currently, the deer population at Wertheim NWR is precluding attainment of this objective.

Figure 1. Example of a deer browse line in a field at Wertheim NWR. Note absence of limbs on lower portions of red cedar trees.

Some of these same effects are experienced by neighboring landowners as well, although instead of habitat destruction, the adverse effects are categorized as "property damage". One of the more serious instances of property loss is the damages to vehicles involved in collisions with deer. Property damage can also include such problems as the browsing and, ultimately, killing of shrubs and flowers used in landscaping, as well as vegetables. Refuge neighbors also report an undesirable quantity of deer feces deposited in their yards, as well as a concern about Lyme disease.

History and Purpose of Wertheim NWR

Wertheim NWR (Refuge) was established in 1947 thanks to the surrounding communities whose residents had the foresight and commitment to ensure the perpetuity of their natural environment. The first parcel of Refuge land was a donation of 1,804 acres from Cecile and Maurice Wertheim who had maintained the area as a private reserve for hunting. An additional 700 acres were acquired under provisions of the Migratory Bird Conservation Act (MBCA) and the Refuge Recreation Act. Land acquired under the MBCA is "...for use as an inviolate sanctuary and for any other management purposes for migratory birds..." Lands acquired under the Refuge Recreation Act permit consumptive and non-consumptive forms of recreation provided that the activity is compatible with the Refuge's establishing purpose and sufficient funds are available to administer those uses. The Act also maintains that Refuges are closed to all public use unless the Refuge Manager expressly "opened" it to that use via publication of a notice in the Federal Register.

Wertheim NWR protects one of the last undeveloped estuaries on Long Island. The founding purpose of the Refuge was specifically to preserve the quality marshes for the benefit of

wintering and migrating waterfowl, especially American black ducks (*Anas rubripes*). In 1974, the first year the Refuge was staffed, efforts to achieve this purpose were initiated. Since that time, management programs have been expanded to other agency objectives, such as the protection of federally-listed endangered and threatened species, the conservation of native flora and fauna, and the provision of wildlife-dependent public uses.

Since 1987, in an effort to continue preservation of contiguous wildlands for wildlife and the public, the Refuge began acquiring properties adjacent to its original western and northern borders. One such site is the 128-acre Southaven property. While its former owners did not permit deer hunting, deer poaching did occur. Such off-Refuge population controls lessened the need for deer management on the Refuge, as the deer population was maintained at a reasonable habitat carrying capacity. Wildlands on the Refuge's eastern border began yielding to increased suburban development during the mid-1980s. As each subdivision was developed, the opportunity to manage deer off-Refuge was correspondingly reduced, and the deer population began to depend increasingly on the resources of Wertheim NWR. As the deer population increased within Wertheim, damage to upland habitats was more pronounced as were damages to private property (e.g., lawns and vehicles) of neighbors in the suburban fringe.

1.0 Purpose for Proposed Action

The purpose of the proposed action is to implement a white-tailed deer hunt at Wertheim NWR, as necessary for wildlife and habitat protection. The hunt will be strictly controlled to ensure the safety of residents, the general public, and staff. Regulating the growth of the white-tailed deer population will help protect and maintain the unique biota, species diversity, and plant communities associated with Wertheim NWR. Management of white-tailed deer will also positively affect Refuge neighbors and the general public through a reduction in financial loss to residential properties, as well as improved health and safety resulting from reduced incidences of vehicle collisions with deer. It is also hoped that a reduction in deer density will, at least in a localized area, limit the spread of deer ticks which transmit Lyme disease.

One of the objectives listed in the 1992 Station Management Plan for the Long Island Complex is to maintain "Upland Habitat Diversity", and one of the strategies suggested is the reduction of white-tailed deer populations to levels consistent with habitat carrying capacity. This program would be conducted on Refuge lands in accordance with New York State regulations and Service regulations contained in Title 50 of the Code of Federal Regulations (50 CFR).

General criteria used for developing and selecting deer management alternatives and for examining impacts of the alternatives were as follows:

- Compatibility with Refuge Purposes: The alternative's contribution toward enhancing the migratory bird resource and federally-listed threatened and endangered species.
- Consistency with Applicable Federal and State Laws and Policies: The alternative must conform to relevant laws and policies regarding deer management.

- Effectiveness: The alternative's ability to reduce damage caused by deer to woodland vegetation and other wildlife and, abates public health and financial liabilities resulting from an overabundant deer population.
- Public Safety: The ability to perform the management activity without compromising public safety. The alternative should not adversely affect public health and safety.
- Funding and Economics: The monetary costs associated with each alternative. Funds needed to complete the program should be commensurate with the project's benefits and realistic in terms of the agency's budget.

2.0 Need for Action

Habitats for wildlife have diminished considerably over the past few decades as urban and suburban development expanded into Long Island's remaining wildlands. As a result, the remaining protected lands must support a wide variety of wildlife in a limited area. Competition among wildlife species for space and foraging habitat is immense, and white-tailed deer are a major source of damage to forest and grassland vegetation. White-tailed deer populations are known to breed beyond the ability of the land to support them when unchecked by predators or hunting pressures. Because white-tailed deer are well adapted to suburban environments, their increased abundance is especially problematic.

The availability of desired forage and the absence of population controls (i.e., predation or hunting) have allowed deer populations to thrive in such areas (Krausman et al. 1992). High density herds (i.e., >30 deer/mi^2) have been associated with damage to habitats (e.g., lack of forest regeneration and loss of woody understories), economic impacts (e.g., timber resources, ornamental plantings, agricultural damage, and vehicle collisions), and tick-borne disease transmission (Woolf and Harder 1979, Cypher and Cypher 1988). The need for action at the Wertheim NWR is principally based on the negative impacts to vegetation caused by deer. In order to estimate the deer population, refuge staff have performed numerous surveys since 2000. According to these varied methods, densities are currently in excess of 100 deer/mi^2. Browse lines and reduced woody understories are evident on the Refuge. Such adverse effects are principally impacting two objectives of our Station Management Plan (USFWS 1992):

- Manage habitats to provide a diversity of breeding and migration habitats that support passerine and other migratory birds,
- Maintain a diversity of upland wildlife habitats such as forest openings, various forest growth stages, grasslands, and ecotones that support migratory birds and other wildlife species.

Deer foraging habits and preferences are known to change plant composition and structure over time (Porter 1991, Van Deelan et al. 1996, Brown and Parker 1997, Augustine 1998, Russell and Fowler 1999) and such alterations have subsequent impacts on other wildlife, such as songbird species richness and abundance (Figures 2 and 3) (De Calesta 1994). Several other studies

(Casey and Hein 1983, McShea and Rappole 1992) have found reduced songbird species richness and/or abundance in areas with high deer densities.

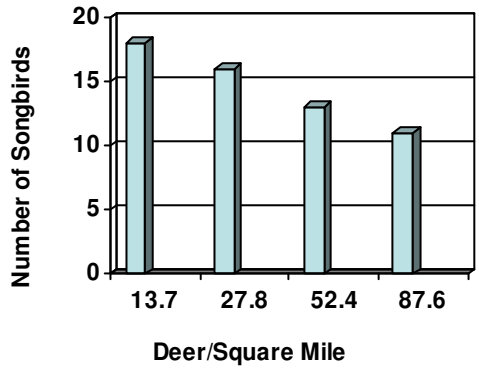

Figure 2. Songbird abundance relative to white-tailed deer density (DeCalesta 1994).

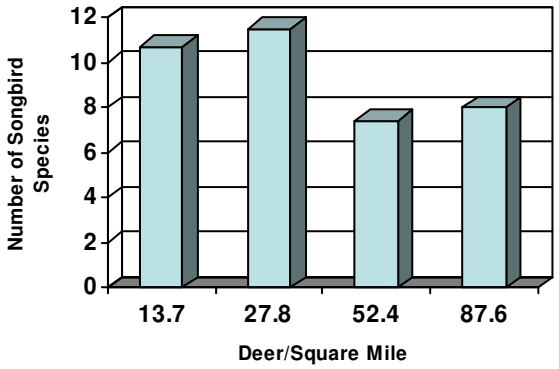

Figure 3. Number of songbird species relative to white-tailed deer density (DeCalesta 1994).

A concern of land managers regarding a high density deer population is the impact to biodiversity. More so than other species, white-tailed deer are more effective at altering habitat due to their energetic requirements and high reproductive potential (McCullough 1982; 1997).

Many authors (Behrend et al. 1970, Alverson et al. 1988, Tilghman 1989, Warren 1991, McShea and Rappole 1992, Miller et al. 1992) reported that vegetative species richness and the abundance of herbaceous and woody vegetation declined in areas with white-tailed deer densities exceeding 29 deer/mi^2; with the decline attributed directly to deer browsing. In a northwestern Pennsylvania study, Behrend et al. (1970) and Tilghman (1989) recommended a herd density of 21 deer/mi^2 to allow for successful hardwood forest regeneration. Currently, the Refuge herd exceeds this density by three to five-fold. It is reasonable to assume, therefore, that these adverse vegetative effects are occurring at Wertheim NWR. The loss or reduction of woody understories in forests or lack of forest regeneration can impact the habitat of migratory birds as well as other wildlife. In a Pennsylvania study, DeCalesta (1994) found that changes in vegetation via deer browsing impacted intermediate canopy-nesting songbirds and reduced species richness and abundance. That study recommended maintaining herds at a density of between 21 and 39 deer/mi^2 to reduce impacts on habitats and songbirds. Alverson et al. (1988) suggested a density of 10 deer/mi^2 to minimize habitat impacts caused by deer browsing.

The damage caused by deer to forest regeneration at Wertheim is evident (Figures 4 and 5). The presence of oak and maple saplings within fenced deer exclosures is obvious, while similar vegetation outside of the exclosures is browsed to the ground. While such impacts currently affect forest understory and the varied animals dependent on this vegetation zone, the longer term implications are that the Refuge's forested areas could lose the ability to replace themselves through time.

Figures 4 and 5: Effects of deer browsing vegetation at a fenced exclosure, Wertheim NWR. Note leafy plant growth inside fenced area beyond a deer's reach.

Overabundant populations of white-tailed deer have reduced forest regeneration, impacted woody understories, eliminated many herbs, damaged agricultural crops, minimized plant diversity and

impacted habitats for songbirds (e.g., birds nesting in intermediate forest canopy, forest understory, and grasslands) (Healy et al. 1997). Wertheim NWR is not managed to control deer populations and current populations exceed the carrying capacity of the Refuge. Although forest regeneration is occurring at a minimal level on the Refuge, this may not continue as long as deer populations remain high. Brookhaven National Laboratory (BNL) is seven miles from Wertheim NWR. While BNL has similar forest habitat to Wertheim, the deer density at BNL is even greater. The unmanaged deer herd at BNL has left a forest with no sign of forest regeneration or of a sustainable understory.

Estimated Growth in the Deer Population:

Prior to 2000, deer population estimates were spotty. However, it is believed that the deer population began to increase substantially during the late 1980s as suburban development increased and additional land parcels were added to the Refuge. These changes eliminated hunting in areas that were previously hunted, as well as provided additional food for deer in the form of landscaping plants.

Each fall since 2000, Refuge personnel estimated deer densities with vehicle-based surveys. The survey routes totaled 8.5 miles and traversed wooded trails and 4-wheel drive roads encompassing forest and grassland vegetation types. Staff recorded the number of deer observed along each route and their distance from the road. Although all techniques contain some form of bias, we were able to obtain a relative sense of the deer population's density. Since the survey began, densities have been variable and ranged from 62-108 deer/mi^2. These ground-based survey results were corroborated with a 2004 aerial overflight that incorporated infrared technology. The overflight located 231 deer within the Wertheim Refuge and the surrounding area. In terms of survey techniques, one should note that although the use of an airplane allows a much broader view of the refuge, not all deer are identified. The contractor noted that while the technology is highly effective in grasslands and hardwood forest, it is much less reliable in conifer forest. Therefore, any deer population estimates should be viewed as **minimum** approximations. It is important to note that even with the inherent variability of population estimates, even the lowest deer densities reported were still double the Refuge's recommended carrying capacity of <25 deer/mi^2, or roughly 60 deer for the Refuge and neighboring areas.

Deer Related Problems on Adjacent Lands:

> "*I am a native to the immediate area and until recent years it was a rarity to see deer and deer damage was also very rare.....This winter the deer have become more bold and are now eating the yews next to the foundation of the house.....The deer herd is out of control with it's (sic) environment and their numbers are increasing every year.*" Excerpted from a 1991 letter from a Refuge neighbor
>
> *"(Deer) are eating all the trees, bushes, flowers, and plants. The deer leave crap*

and tics (sic) in our yards, and that leaves an unhealthy atmosphere for the children to play." Excerpted from a 2002 letter from a Refuge neighbor

Aside from deer- related problems on the Refuge, deer are also known to cause problems in the surrounding community. Since 1991, and especially over the last five years, Refuge neighbors have expressed concerns about the effects of deer on their personal health and safety, as well as economic losses. Deer are the cause locally for collisions with vehicles; the presence of deer ticks (*Ixodes dammini*), associated with Lyme disease, and damages to ornamental plants and gardens. Lyme disease, a bacterial infection affecting people and domestic pets, is caused by a spirochete that is transmitted by the deer tick which uses deer as a host (Spielman et al. 1985). Although deer ticks feed on a variety of mammals, Wilson et al. (1990) contend that based on a study of mammalian-tick relationships in central Long Island, ticks attach to deer preferentially compared to other available hosts and that the overall abundance of deer in an area largely determines the abundance of deer ticks. This was supported in an experiment in which deer were virtually eliminated from an island where Lyme disease was prevalent. The removal of deer resulted in a reduction in deer ticks and a decline in human infection (Wilson et al. 1988). Therefore, the high density of deer present at Wertheim is likely a substantial contributor toward the incidence of Lyme disease within and surrounding the Refuge.

Deer-vehicle collisions have increased greatly since the mid-1990s. Erie Insurance Group, a Pennsylvania-based company that is one of the few to record deer-related losses reports that deer claims account for 49% of the comprehensive losses (www.erieinsurance.com). The company notes further an 8% increase in claims (i.e., 13 deer claims/1,000 insured vehicles) since 2000. The monetary loss associated with deer claims averaged $1,860 per incident.

Locally, between 1992 and 1996, Refuge personnel collected one or two road-killed deer along the perimeter of the Refuge each year. Between 1997 and 1999, the number of deer recovered numbered four or five each year (Figure 6). In contrast, we collected eight road-killed deer in 2000, thirteen in 2001, eight in 2002, and sixteen in 2003. It is likely that these figures under represent the true extent of auto-related mortality; highway crews, as well as the general public, sometimes retrieve road-killed deer, and an unknown number of deer survive some proportion of collisions only to wander into the forest fringe and die.

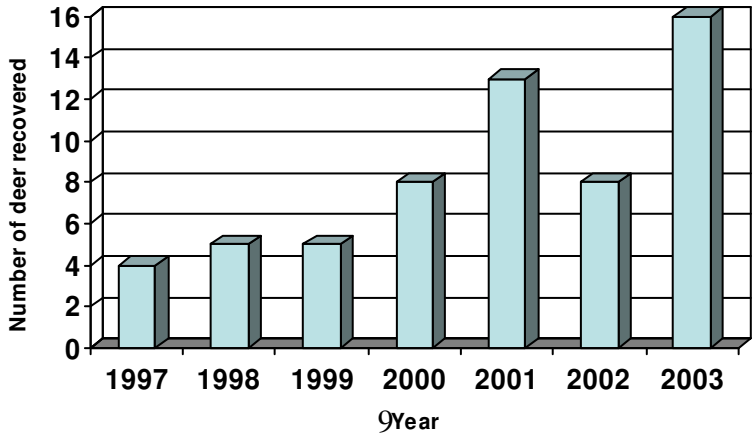

Figure 6. Deer recovered from automobile collisions adjacent to Wertheim NWR, 1997-2001.

Collisions with the Long Island Railroad (LIRR) represent another form of potential human-deer conflict. The LIRR maintains a single rail line approximately 1/6 mile south of, and parallel to Montauk Highway, the northern boundary of the Refuge. The train is responsible for killing several deer each year. Although we do not routinely canvas the railroad tracks, we have noted as many as six deer killed by train collisions in a single year (1999).

Deer existing at high densities also exhibit declining health. Without a means to limit population growth, deer populations exceeding carrying capacity are susceptible to various diseases, deformities, malnourishment, and are exposed to increased levels of internal and external parasites (Cypher and Cypher 1988, Fischer et al. 1995, Demarais et al. 2000). Deer living under such conditions can also transmit diseases to other wildlife and humans.

3.0 Alternatives Including the Proposed Action

This section addresses the Proposed Action and additional alternatives considered in meeting the purpose and need for deer management. Five management alternatives and a "no action" alternative were examined. Each management alternative was seriously considered; however, some alternatives were deemed impractical due to their ineffectiveness and/or excessive costs. The alternatives discussed in this environmental assessment are as follows:

Alternative A - (No Action): With this alternative, no action will be taken to control deer problems; neither herd size will be reduced nor will wildland vegetation be protected. The Refuge will not manage white-tailed deer regardless of their densities or their effects on Refuge habitats. Deer populations would be self-regulated by natural means (diseases and starvation), as well as collisions with vehicles. Without natural predators or some active management to control deer populations, deer density would exceed the capacity of the Refuge to sustain them. As deer populations increase, natural vegetation will decline in composition, structure, and density (Tilghman 1989, Warren 1991, Coffey et al. 1997). Only when deer densities decline substantially because of disease and starvation, will vegetation rebound. However, because of the excessive browsing that would have already occurred, vegetation composition and species diversity may not recover to pre-deer peak condition (Coffey et al. 1997). This alternative allows for deer to dominate the Refuge's upland habitats, influencing wildlife species diversity, and habitat richness for all species. This alternative is contrary to Refuge objectives of management for optimum populations of the migratory bird resource, which is dependent on healthy vegetative communities. Also, this alternative does not address human health, safety, and economic concerns relating to deer interactions in the surrounding community, including damage to landscaping and lawns, deer-vehicle collisions, or the spread of Lyme disease.

Alternative B - Preferred Alternative (Controlled Public Hunt): Under this alternative, qualified, licensed members of the public would be permitted to hunt deer at the Wertheim NWR during the state of New York deer season. Participants will possess a valid New York hunting license and will have met licensing requirements. In addition, hunters will attend a Refuge-specific orientation program focusing on requirements to protect neighbors, hunters, general public and the staff, hunter ethics, operational procedures of the hunt, and deer management objectives. If and when a firearms hunt occurs, all shotgun hunters will be required to wear a minimum 400 square inches of "hunter orange" clothing, visible from all sides.

Hunt dates will not exceed those established by New York State regulations (archery: up to 90 days, during October, November, and December; shotgun: January weekdays), and will likely be much shorter based on a desire to meet deer harvest goals in the shortest possible time and to minimize the amount of time that the Refuge is unavailable for other wildlife-dependent public use opportunities. The hunt would be administered by the Service and NYDEC. A 500-foot buffer will be established along the Refuge's boundary (including all public thoroughfares). This buffer will meet or exceed all State regulations and will be posted and identified as a "no hunting" zone. Those forest, grassland, and marsh areas of the Refuge beyond the no-hunting buffer will be divided into eight hunt units. The hunt units range in size from 69 – 474 acres, and are defined by easily identifiable features such as streams and interior refuge roads. The establishment of hunt units permits the Refuge Manager a greater degree of flexibility in administering the hunt: some units may be closed to hunting while others are open; variable hunting techniques can be implemented in different units; and hunter numbers can be more closely managed.

The Refuge's two nature trails, the White Oak trail and the Indian Landing trail will be closed to the non-hunting public during hunt days in order to maintain a quality experience for all visitors, for the safety of the non-hunting public, and for logistical considerations, such as the availability of adequate parking. Hunters will be permitted to take deer with shotguns with slugs and/or bow and arrow depending on the restrictions imposed on the corresponding open season under State regulations. The use of portable tree stands will be allowed for archers throughout all units and required for shotgun hunters within hunt units 3 and 4 to ensure the direction of fire is toward the ground. Prior to the season and within the parameters established by state regulations, the Refuge Manager will establish hunting method (i.e., shotgun only, archer only, or a combination of both shotgun and archery), season length, bag limit, number of permits, and the sex of deer to be harvested.

Because public safety is the first priority of the Preferred Alternative, the following measures will be taken:

- Possession of a valid New York big game hunting license
- Completion of a Refuge-specific hunter safety orientation program
- Establishing a "no-hunt" buffer of at least 500 feet adjacent to private property/roadways
- Wearing of "hunter orange" clothing by shotgun hunters

- Agency checks of hunters and their equipment
- Mandatory use of tree stands in certain hunt units
- Active patrols of hunt and non-hunt areas by law enforcement officers

The goal is to establish and maintain a hunting program, as needed, that reduces deer densities from an existing population approximating 100 deer/square mile, to a more sustainable <25 deer/square mile. Management of the hunt during the first few years of implementation will incorporate methods that achieve a greater overall harvest and encourage a disproportionate take of adult females in order to more quickly reduce the population density. Subsequent hunting seasons will represent a "maintenance" phase with an overall lower harvest level and a more equitable distribution of sex ratios.

Managed public hunts provide an efficient and cost-effective method for managing deer populations while expanding recreational opportunities for the public. In addition, hunting is one of the primary public uses defined in the National Wildlife Refuge Improvement Act of 1997 ((16 U.S.C. 668dd), Public Law 105-57–October 9, 1997 [H.R. 1420]). The harvesting of deer, as prescribed under this alternative, will conform to New York State and Refuge regulations. Refuge regulations are contained in 50 CFR, parts 26, 27, 28, and 32, section 32.2. These regulations describe permissible and non-permissible actions on the Refuge. This includes opening the Refuge to public hunting, public access, and land uses. Additional Refuge regulations include a permit system, equipment restrictions (e.g., shotgun only, archery only, or a combination of both shotgun and archery), limitations on Refuge areas where hunting may occur, and special regulations regarding hunting methods (e.g., use of deer stands or free roaming hunting zones), season dates and lengths, and shooting hours.

Although the number of deer taken in a given season cannot be predicted with complete accuracy, the Refuge Manager will control the following variables which contribute heavily toward the number of deer harvested:

- The number of permits issued (i.e., the number of hunters allowed on the Refuge at a given time). The daily number of hunters will not exceed 50, for a density of 1 hunter/40 acres, which is stricter than allowable hunter densities.
- The sex of the animal that may be harvested (e.g., antlerless, antlered, or either-sex). Because the intent of the hunt is to reduce the deer population, hunters will be required to take one or two antlerless deer before harvesting an antlered deer.
- The number of deer to be harvested in a single season.
- The number of days the Refuge is open to deer hunting.
- Designating which Refuge zones are open to hunting on particular days (e.g., hunt zones containing nature trails may be closed to hunting on weekends to allow their use by hikers and birdwatchers).
- The type of equipment allowed (e.g., shotgun, bow and arrow)

These factors will be determined in advance of the season based on population surveys, data collected from deer assessed at check-in stations, the response of forest vegetation to browsing, and safety factors for all.

Under this alternative, the public hunt would be restricted to a Refuge permit system. Hunters would be required to check in and out of the Refuge and would be assigned to one the designated hunting zones. In some areas of the Refuge, participants may be required to use elevated portable stands so that the line of fire would be toward the ground. Participating hunters will maintain a current New York State big game hunting license and must participate in a Refuge-sponsored safety orientation prior to going afield. This alternative will require materials and labor to establish hunting zones, posting those areas closed to hunting, and developing parking areas. Additional costs will be incurred regarding daily management of the hunt (e.g., law enforcement officers and a biological technician).

In addition, the Refuge Manager may seek support from other agencies and organizations to assist in the management of the hunts, in order to defray administrative costs, and to ensure the effectiveness of the hunt. Service law enforcement personnel will actively patrol the Refuge perimeter during any time hunting is permitted. Patrols will focus on public roads in residential areas bordering the Refuge, and the 500' buffer zone.

The public will be informed of hunt seasons, days, and regulations prior to the season. Press releases, information postings on the Refuge, in the local community and on Refuge-related websites (http://longislandrefuges.fws.gov, www.friendsofwertheim.org), as well as letters to Refuge neighbors within 500 feet of the Refuge boundary are examples of how the public will be informed of the hunt each year.

Alternatives Considered But Deemed Impractical: The following alternatives were considered and deemed impractical for controlling overabundant free-ranging deer. Although these alternatives may be perceived as non-lethal or very humane, they have limited applicability and have been used primarily for small, confined deer populations. Furthermore, many of the alternatives noted below are currently in development and are not readily available for controlling deer populations, and most of these alternatives are too expensive and labor intensive to be of practical use.

Reproductive Intervention (birth control)

Reproductive intervention, or birth control, is the general category for a number of fertility control methods. This alternative involves the control of deer populations with contraceptive agents. Some form of contraceptive would be used on most of the does within the Refuge and the deer population would be controlled by reducing births. Immunocontraception using porcine zona pellucida (PZP) vaccine injection is probably the best known and most widely applied. Steroid implantation has been available since the 1970s. Remote prostaglandin injection (DeNicola 1997), oral vaccination with a live vector (Miller et al. 1999), and GNRH vaccines are more recent and lack a long-term evaluation of effectiveness. Sterilization is a permanent option,

although rarely applied given the need to surgically treat individual animals.

Effectiveness and efficiency of any of the above forms of reproductive intervention is affected by a number of factors including: method of application or delivery, need or ability to capture the animal, the number of treatments needed to ensure effectiveness, size of the population, whether the population is confined or free ranging, and the longevity of treatment.

Use of birth control techniques to control free-ranging wildlife populations is not effective at the present time. Applying these measures to animals in an unconfined environment is impractical because of the need to identify specific individuals, and then capture, handle or treat most of those individual animals numerous times. Handling large wild animals introduces a great deal of stress to them, as well as presenting risks to personnel.

Immunocontraception

Immunocontraception (PZP injection) is most effective in preventing pregnancy when hand injected and combined with subsequent boosters. The PZP vaccination produces reversible infertility lasting 1-4 years (Miller et al. 1999b); however, it requires two injections, four weeks apart, to be effective for at least two years, and then annual boosters (McShea et al.1997). PZP is administered either by dart gun or blow gun from a distance of less than fifty feet (Turner et al. 1992).

Effectiveness at reducing population size and growth rate is diminished when dealing with large and unrestricted populations due to the need to treat a high proportion of the females over a large area. For a large population, contraception rates of less than 50% of does will curb growth in 30 years, but will not markedly reduce population size, whereas contraception rates exceeding 50% require at least a 5-10 year planning horizon to see significant population declines (Seagle and Close1996). Therefore, many years of effort, expertise, and handling of deer are necessary before achieving any population reduction.

Another obstacle to PZP immunocontraception is the adjuvant used for the initial injection (an adjuvant is a microbial aid necessary for boosting the vaccine once inside the animal's bloodstream). Complete Freund's adjuvant (CFA), the most commonly used, contains heat-killed mycobacterial tuberculin cells. It can cause local inflammatory lesions, chronic granulomas, abscesses, and tissue sloughs in some injected mammals. Personnel accidentally inoculated with CFA can become sensitive to the tuberculin and may test false positive for Tuberculosis (University of Iowa 1996). The U.S. Food and Drug Administration (FDA), which has jurisdiction over its commercial use, currently does not permit use of this adjuvant or any experimental fertility drugs for use on free-ranging wildlife. The FDA grants limited use of these drugs on tightly controlled or isolated populations and in combination with ear-tagging (in order to prevent the public from consuming meat from treated deer) (Warren 1999). Several other adjuvants are undergoing field tests but none have been found effective as boosters and are still pending FDA approval.

Although this technique has proven ineffective and impractical in controlling a free ranging

white-tailed deer herd (Ellingwood and Caturano 1988, Miller et al. 1999), research projects are presently underway to determine the feasibility of immunocontraception with insular populations (Kirkpatrick et al. 1993, McShea et al. 1993). PZP as a birth control agent has been used on a wild horse population at the Assateague Island National Seashore (Kirkpatrick et al. 1990 and 1997). A local study (Kirkpatrick et al. 1993 and 1997) is currently ongoing at the nearby Fire Island National Seashore and adjacent communities using PZP on white-tailed deer; however, the study's purpose is to test the ability to remotely inoculate free-roaming deer with a PZP vaccine and to study the behavioral consequences. According to the researchers "this proposed study is not designed to test whether local deer populations can be successfully controlled". In fact, the deer population within the Fire Island study area was the same in 2002 as it was when the program first began in 1993 (D. Rosenblatt, NYDEC, personal comm.).

Because impact trauma can occur with darts delivered from a firing device, there is the possibility of injuries where the wound is vulnerable to infection and occasionally requires treatment (Seal and Bush 1987). There is also some concern regarding the behavioral side effects of PZP on treated does because they reportedly continue in the breeding cycle after not becoming pregnant (Turner et al. 1992). With does remaining in the breeding cycle, the energy budget of bucks will likely also be impacted.

This alternative was deemed impractical because it is unproven in free-ranging populations. Furthermore, it requires the ability to identify and inoculate individual deer repeatedly and the compounds used are hazardous to handlers. Because such compounds reduce populations by decreasing annual recruitment to the herd rather than by eliminating existing animals, deer would continue to degrade Refuge resources and conflict with neighboring human uses over many years until the population began to decline through attrition.

Steroidal implants

Subcutaneous steroidal implants have been used during the past 25 years with varying rates of effectiveness in reducing deer pregnancy. Initially, steroidal implants required the capture and insertion of the implants under the deer's skin. Currently, remote delivery of this treatment is possible, although the long-term effectiveness is uncertain. In addition, the same factors that confound the PZP method at the population level also apply (Connecticut Dept. of Environmental Protection, Wildlife Bureau 1988). Because of the uncertainty of long-term health effects on deer and subsequent impacts on animals that consume treated deer, including humans, the FDA has not approved its use with free-ranging deer (DeNicola et al. 2000).

Oral Contraceptives

Oral contraceptives are a relatively new concept in the control of deer populations. Research is currently underway to develop an effective oral contraceptive for deer and other wildlife species. Because oral contraceptives would be placed in bait sets and left for deer to consume, successful development of such a contraceptive would reduce the stress of handling deer, improve economics, require minimal staff, and may be used on large populations. However, there are a number of safety concerns with this technique that must be addressed before they are used on free-ranging deer populations. Concerns include the use of live bacteria as the chemosterilant,

the ability to control the contraceptive dosage, the long term effects and/or side effects to deer and other wildlife, and the effects to humans who may consume treated deer. Another problem with oral contraceptives is that they are not species-specific (SCWDS 1993). Non-target animals are at risk of ingesting the contraceptive with unknown consequences. As with steroidal implants, the FDA also has not approved this method for use on free-ranging deer (DeNicola et al. 2000). Therefore, until the safety issues and other concerns with oral contraceptives are corrected, this method of contraception should be considered impractical (Miller et al. 1999).

Sterilization

Sterilization is a permanent birth control method. This method requires that personnel capture deer and surgically remove their reproductive organs. Theoretically, this technique will prevent recruitment of new individuals into the population, while over many years; herd size will be reduced through attrition. However, this will only work in a closed population. Deer are free to move on and off of the Wertheim Refuge, so movement of additional animals into the Refuge will counter any losses that occur through attrition. This technique is not a viable alternative given the low feasibility and high costs of capturing and treating all the deer necessary for effective control, as well as the extended timeframe needed to reverse impacts to native vegetation.

Summary of Reproductive Intervention Methods

Whereas today's technology enables the successful control of fertility in individually treated animals, these methods are still experimental and have not yet found to be effective at the population level for use in deer management (Warren et al. 1995, Muller et al. 1997). No matter which birth control method is used, more than 50% of the females will need to remain infertile to affect a reduction in population (Seagle and Close 1996, Hobbs et al. 2000), and the actual population reduction will take many years to be realized. When considering the physical attributes of Wertheim NWR, all of the reproductive intervention techniques described above are ineffective due to the "openness" and size of the population. These techniques are not viable in field applications because they lack FDA approval and often entail multiple captures, considerable handling time, facilities for holding captured animals or performing surgery, risk to personnel and animals, trauma losses, and recurring expense.

Live Trapping and Relocation

This alternative consists of the annual trapping or capturing of deer for transportation to other locales. Trapping would occur during the winter months using baited Stevenson box traps. Traps would be monitored daily and animals moved within 24 hours of capture. Ideally, release sites would include natural areas on Long Island, where permission could be obtained to release deer. However, under New York State Law, it is illegal to trap deer for any purpose and no known sites are available to receive relocated deer (D. Rosenblatt, NYDEC, personal comm.).

In addition to the absence of locales to accept relocated deer, capturing and handling deer involve risks to deer and handlers. Live-capture techniques subject deer to stress and sometimes to traumatic injury during capture, handling, and transportation phases (Coffey et al. 1997). Deer

are susceptible to capture myopathy, a form of muscle dysfunction that is stress-related and can result in delayed mortality. Capture-related morality may exceed 50% (Coffey et al. 1997, McCullough 1997, Messmer 1997). Survival rates of relocated deer are usually low due to capture-related stress and also because deer originating from over-populated environments are often already in poor physical condition. Relocated deer are predisposed to starvation, accidents, and predation due to their physical condition and unfamiliarity with their new surroundings (Connecticut Dept. of Environmental Protection, Wildlife Bureau 1988). Losses as high as 85% have been reported in the first year following relocation and release (O'Bryan and McCullough 1985, Coffey et al. 1997). An added concern is that relocated deer can potentially introduce diseases into their new surroundings, thereby potentially affecting otherwise healthy deer.

The capture and relocation technique is used most often to remove specific problem animals, such as bears and medium-sized mammals (Hawthorne 1980). In suburban settings, problem raccoons and skunks are most often subject to this management technique. As a deer management alternative, relocation is implemented most often in scientific studies (Ellingwood and Caturano 1988). The value of this alternative in reducing large populations of free-ranging deer is questionable. The use of live trapping and relocation is a costly and labor intensive process. The legal prohibition against trapping deer, a lack of suitable relocation sites, threats to deer associated with live-capture and relocation, and cost makes this alternative impractical for managing the Wertheim NWR deer population.

Fencing

Fencing is commonly used as a mechanical barrier for reducing deer impacts at a specific site or to a particular resource, such as home vegetable gardens (Hawthorne 1980, Coffey and Johnston 1997). In the context of the Refuge, this technique would require the construction of an eight-foot chain link fence with a wire strung one foot above its perimeter, as well as a heightened electronic gate at the Refuge's main entrance to allow visitors to pass unimpeded. However, deer have the ability to jump an 8-foot fence, as evidenced by the Refuge deer exclosures, where deer sign has been found inside the 8-foot fence circles constructed to keep deer out for the purpose of a forest regeneration study. This option would necessitate approximately eight miles of fencing at an estimated cost of $40 per linear foot, for a total estimated cost of $1.7 million (personal communications with several local fencing companies). A variant of this method would involve fencing certain sections of the Refuge to restrict deer movement and to reduce deer-vehicle collisions. Such an option exists at the Refuge's boundary with Montauk Highway. The estimated cost for fencing the Refuge's Montauk Highway frontage is approximately $635,000 (personal communications with various local fencing companies). Over time, substantial funds would be needed to maintain the fence's integrity.

Provided that the fence is maintained as an effective barrier to deer movement, this management alternative would address the concern of deer roaming freely between the Refuge and the surrounding suburban communities. While it could reduce conflicts with humans and neighboring land uses, this alternative will not improve the overall health of the deer population or prevent additional destruction of Refuge habitats. The cost of this management alternative

would be high compared to the others as it requires fence purchase, construction, and continual maintenance to periodically check and repair the fence.

Biologically, this alternative would not control over-abundant deer densities. In terms of the deer population, this alternative will encourage the continually poor health of deer and restrict them within a degraded habitat. Deer numbers would be limited only through starvation and potential outbreaks of disease. Also, fencing would negatively affect other terrestrial wildlife through a restriction in their movements.

Sharpshooting

While in theory, shooting deer with trained individuals, either Service employees or contractors will effectively reduce deer densities, this is not a viable alternative for an area of Wertheim's size. Such an effort would require hundreds of person-hours to remove the approximately 150 deer desired in the initial years of a management program. A larger labor force would also be necessary to perform drives whereby deer are "pushed" toward pre-positioned shooters. This alternative would generate a large number of deer carcasses and as much as 7,500 lbs. of deer meat, necessitating creation of a donation program and incurring substantial processing costs. Finally, this alternative would preclude public participation in big game hunting, an activity that is in limited supply locally and that has been identified as a primary public use of National Wildlife Refuges. Due to a lack of public participation available under this management option, the NYSDEC would not endorse sharpshooting as an alternative for an area so well-suited to deer hunting.

4.0 Affected Environment

Location

Long Island is located in the southern coastal zone of New York State (Chambers 1984). The Island is approximately 120 miles long by 20 miles wide. Long Island is bordered to the north by Long Island Sound and the south by the Atlantic Ocean. The long axis of the Island is in a west-east direction. The westernmost tip of the Island contains Brooklyn and Queens, two boroughs of New York City. Nassau and Suffolk Counties lie to the east of New York City, and represent the remainder of Long Island. The nine refuge units of the Long Island National Wildlife Refuge Complex are located in Nassau and Suffolk Counties. The 2,550-acre Wertheim National Wildlife Refuge, the second largest of the Complex's refuge units and its headquarters, is located in the Town of Brookhaven in western Suffolk County, on the easternmost portion of the Great South Bay.

Topography

Long Island can be generally categorized as flat, low elevation terrain. Elevation ranges from sea level to 60 ft above sea level with the highest points occurring on the moraines located along the

east-west axis on the north shore and the mid-section of Long Island. Topography south of the moraines is flat with a south facing aspect. Topography north of the moraines is generally flat or rolling with a north facing aspect. Slopes are gradual at most Long Island sites with the exception of coastal headland habitats which have extreme slopes. The soils of Long Island are less than 12,000 years old and reflect their glacial parent materials. The soils north of the moraines are medium to coarse textured and moderately well drained; topography tends to be rolling. An outwash plain exists south of the moraine at the Wertheim NWR. Soils in this area are coarse textured, excessively drained, infertile, and flat. Sandy loams are a predominant soil type, but range from loams to sands.

Vegetative Cover Types

Ecologically, the vegetation types of Long Island have been categorized into a variety of classification schemes. Vegetation at the Wertheim NWR is classified by Bailey (1995) as Eastern Broadleaf Forest (Oceanic) Province. Barbour and Billings (1988) place Long Island in their ecological coastal grouping which includes the northern most portion of the southeastern coastal plain. The authors specifically refer to the vegetation of Long Island as the northern Pine Barrens. On a more local scale, Olsvig et al. (1979) and Villani (1997) have provided a classification scheme of Long Island's terrestrial vegetation types focusing on pine barren types. The Service has placed Wertheim NWR into the Hudson River/New York Bight ecosystem.

The Wertheim Refuge has both terrestrial and aquatic habitats in approximately equivalent numbers. Roughly 64%, or 1,630 acres of the Refuge can be considered deer habitat. Terrestrial habitats are principally pine barren habitat types and aquatic habitats include both tidal and non-tidal wetlands. Non-tidal waters include marshes, ponds, streams, and swamps. Tidal waters include bays, ponds, salt marshes, brackish marshes, streams, and freshwater marshes. A brief description of the main vegetative cover types on the Refuge can be found in Appendix I.

Wildlife

The refuge units of the Long Island NWR Complex provide significant and critical habitat for the majority of wildlife species known to occur on Long Island. Close to 500 vertebrate species and approximately 500 plant species have been documented at the Wertheim NWR. The Refuge encompasses many of the vegetation types found on Long Island, providing habitat for a variety of wildlife ranging from forest interior nesting, Neotropical migrant birds to marine mammals. The coastal location of the Refuge also makes it part of a major migration corridor for a variety of birds including waterfowl, waterbirds, raptors, and songbirds.

Birds represent the largest single class of vertebrates at the Long Island NWR Complex, with 300 bird species having been documented at the Wertheim Refuge. Waterfowl use is extensive and the Refuge serves as important wintering habitat for waterfowl particularly from October through April. Principal species include black duck (*Anas rubripes*), greater scaup (*Aythya marila*), bufflehead (*Bucephala albeola*), and red breasted merganser (*Mergus serrator*). Wood ducks (*Aix sponsa*) are common nesters at the Refuge. Common nesting raptors include osprey

(*Pandion haliaetus*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), and screech owl (*Otus asio*). The coastal location of the Refuge also makes it an important migratory habitat for raptors.

Songbirds are a conspicuous component at the Wertheim NWR and a major attraction for many of the visitors. The songbird community is diverse and includes many neotropical migrant species. Dominant breeding songbirds of forested habitats include ovenbird (*Seiurus aurocapillus*), American redstart (*Setophaga ruticilla*), yellowthroat (*Geothlypis trichas*), catbird (*Dumetella carolinensis*), rufous-sided towhee (*Pipilo erythrophthalmus*), great crested flycatcher (*Myiarchus crinitus*), eastern wood peewee (*Contopus virens*), blue jay (*Cyanocitta cristata*), Carolina wren (*Thryothorus ludovicianus*), wood thrush (*Hylocichla mustelina*), red eyed vireo (*Vireo philadelphicus*), and pine warbler (*Dendroica* pinus).

Dominant breeding songbirds of shrub and grassland habitats include song sparrow (*Milospiza melodia*), tree swallow (*Spizella arborea*), blue winged warbler (*Vermivora pinus*), yellow warbler (*Dendroica petechia*), prairie warbler (*Dendroica discolor*), mockingbird (*Mimus polyglottos*), barn swallow (*Hirundo rustica*), house wren (*Troglodytes aedon*), eastern bluebird (*Sialia sialis*), northern cardinal (*Cardinalis cardinalis*), and American goldfinch (*Carduelis tristis*). The Refuge also provides important stop-over habitat during migration for many species using the coastal migration corridor. Dominant winter songbirds at the Refuge include the white throated sparrow (*Zonotrichia albicollis*), dark eyed junco (*Junco hyemalis*), black capped chickadee (*Parus atricapillus*), white breasted nuthatch (*Sitta carolinensis*), tufted titmouse (*Parus bicolor*), northern cardinal, and blue jay.

Approximately thirty species of mammals have been documented at the Refuge. Dominant terrestrial mammals include white-tailed deer, eastern cottontail (*Sylvilagus transitionalis*), gray squirrel (*Sciurus carolinensis*), eastern mole (*Scalopus aquaticus*), eastern chipmunk (*Tamias striatus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), red fox (*Vulpes vulpes*), opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor*). The dominant aquatic mammal is the muskrat (*Ondatra zibethica*). Bats comprise about a quarter of the mammalian species at the Refuge. Woodland-dwelling bats such as: little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), eastern pipistrelle (*Pipistrellus subflavus*), and the red bat (*Lasiurus borealis*) are the most common.

Approximately thirty species of reptiles and amphibians occur at the Refuge. Dominant freshwater reptiles include the eastern snapping turtle (*Chelydra serpentina*), eastern painted turtle (*Chrysemys scripta*), spotted turtle (*Clemmys guttata*), and the northern watersnake (*Nerodia sipedon*). Eastern box turtle (*Terrapene carolina*), black racer (*Coluber constrictor*), eastern milk snake (*Lampropeltis triangulum*), eastern ribbon snake (*Thamnophis sairitus*), and the common garter snake (*Thamnophis sirtalis*) are the dominant reptile species of terrestrial habitats. Eastern box turtles and eastern hognose snakes (*Heterodon platyrhinos*) are of interest because of the perceived current decline of these species on Long Island where both were once considered abundant and dominant species.

The dominant amphibians at the Wertheim NWR include red backed salamander (*Plethodon cinereus*), bullfrog (*Rana catesbeian*), green frog (*Rana clamitans*), wood frog (*Rana sylvatica*), Fowlers toad (*Bufo woodhousei*) and spring peeper (*Hyla crucifer*).

The Refuge does not have an exhaustive inventory for its invertebrate communities. However, standard works (Boyd and Marucci 1979, Dindal 1979, Boyd 1991, Weiss 1995) provide information on invertebrates likely to occur at the Refuge, particularly within pine barrens and tidal habitats.

Federally designated endangered and threatened species which occur at Wertheim NWR are limited to the bald eagle (*Haliaeetus leucocephalus*). Bald eagles are occasional visitors that principally use the refuge during fall migration, although immature bald eagles have over-wintered at the Refuge since 2003. They are associated with aquatic/wetland habitats and adjacent terrestrial borders.

New York State designated threatened and endangered species which occur at the Wertheim Refuge include the northern harrier (*Circus cyaneus*), common tern (*Sterna hirundo*), least tern (*Sterna albifrons*), black tern (*Chlidonias nigra*), and eastern mud turtle. The three tern species make use of aquatic and strand habitats. Northern harriers use emergent wetlands and grasslands. The eastern mud turtle uses emergent wetlands, mature pitch pine and oak-pitch pine stands as hibernation sites, and warm season grasslands as nesting sites.

Twenty-five other rare species or species of special concern (USFWS Migratory Nongame Birds of Management Concern or New York State Species of Special Concern) which occur on the Wertheim Refuge include: common loon (*Gavia immer*), American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), northern harrier, northern goshawk (*Accipiter gentilis*)), red-shouldered hawk (*Buteo lineatus*), black rail (*Laterallus jamaicensis*), upland sandpiper (*Bartramia longicauda*), black tern, short-eared owl (*Asio flammeus*), red-headed woodpecker (*Melanerpes erythrocephalus*), northern flicker (*Colaptes auratus*), sedge wren (*Cistothorus platensis*), veery (*Catharus ustulatus*), Bicknell's thrush (*Catharus usulatus*), wood thrush (*Hylocichla mustelina*), loggerhead shrike (*Lanius ludovicianus*), blue-winged warbler (*Vermivora pinus*), golden-winged warbler (*vermivora chrysoptera*), chestnut-sided warbler (*Dendroica pensylvanica*), cerulean warbler (*Dendroica cerulea*), worm-eating warbler (*Helmitheros vermivorus*), Louisiana waterthrush (*Seiurus motacilla*), field sparrow (*Spizella pusilla*), and eastern box turtle.

Archeological and Cultural Resources

The USFWS Region 5 Archeologist has conducted several site visits to the Long Island NWR Complex. No structures at Wertheim NWR have been proposed, identified or listed on the National Register of Historic Structures. The Wertheim NWR possesses several small cemeteries which are protected from disturbance. Although the Long Island region was inhabited by Native Americans and settled early during the colonial period, any resources that may be present on the Refuge will not be impacted by either alternative.

Public Use

Public visitation of the Wertheim NWR ranges between 30,000 and 40,000 visits per year. Since 2000, the Refuge has been open daily between 8:00 am and 4:30 pm, and has just recently expanded its hours of operation to open one-half hour after sunrise. Activities at the refuge include wildlife observation and photography, self-guided environmental education and interpretation, hiking, fishing and boating—particularly canoeing and kayaking. There are three main access points to the refuge. The first is from Montauk Highway, south 0.4 miles on Smith Road to gain access to the Refuge's White Oak Nature Trail and headquarters. A 15-vehicle parking area is adjacent to an information kiosk. The 1.5-3.0 mile White Oak Nature Trail begins and ends at the parking area. The second access point is the fishing access site located at the northern end of the Refuge off of Montauk Highway. A 20-vehicle parking area is provided and a trail leads to the Carmans River. The public uses the trail to gain access to the river to fish or to launch a canoe/kayak. From a canoe/kayak, the public can gain access to the 1.0 mile Indian Landing Nature Trail. The third access is at the eastern end of Beaverdam Road and Squassux Landing, owned respectively by the Town of Brookhaven and Brookhaven Village Association. Brookhaven residents launch watercraft or dock their watercraft at the Squassux Landing facility to use on the river or Great South Bay. The east end of Beaverdam Road is used also by the public for recreational fishing, particularly crabbing, and to launch canoes/kayaks for use on the river.

5.0 Environmental Consequences

None of the alternatives considered would conflict with legislation regarding wetlands, wild or scenic rivers, wilderness, flood plains, navigable waterways, coastal zone management, or historic preservation. No prime or unique farmland exists in the proposed action area.

Alternative A – (No Action): This alternative will not seek to exercise control over the deer population at Wertheim NWR; there will be no attempt to manage deer density, the adverse effects of deer to Refuge habitats, or effects that deer might have on private property. This has been the management scheme adopted by the Service for this Refuge since acquisition, as the deer population had not attained the present high density.

a. Natural Resource Effects. Failure to reduce the deer herd to levels within the carrying capacity of Wertheim NWR may have serious impacts on the deer herd, their habitat, and habitats important to an array of forest-dependent wildlife. As the deer population increases and forage becomes less available, deer are expected to exhibit a poorer physical condition, with a greater proportion of deer anticipated to die from starvation. When existing both at high density and poor physical condition, deer are more susceptible to diseases like epizootic hemorrhagic disease and various parasites.

The current over-population of deer is degrading forested habitats as a result of overbrowsing.

The biological impacts of retaining a high density deer herd include the continual negative impacts from deer on the Refuge's vegetation (i.e., lack of forest regeneration and loss of woody understories), and the associated reduction in habitat quality of the Refuge for a variety of wildlife species. Although affected grassland vegetation may regenerate more, species composition may be permanently altered (Porter 1991).

If left unmanaged, the deer herd would survive a number of years at the expense of other wildlife species, a condition contrary to the Refuge's mandate to manage for migratory birds, of which forest-dependent birds are a significant component. By allowing the herd to continue to overpopulate, a more pronounced browse line would develop. This would further reduce food and cover for nearly all species that depend on the layer of vegetation within roughly six feet of the ground. Ground and shrub nesting birds, and small mammals which utilize surface vegetation for food and cover would be adversely affected.

b. Community Effects. In the absence of deer management strategies, increased negative interactions between humans and deer will continue as a greater number of deer roam freely in residential neighborhoods, foraging for food no longer available on the Refuge. The increased presence of deer in neighborhoods will likely increase damage to private landscaping and gardens. The increased movement of deer off-Refuge will also potentially increase the incidence of deer-vehicle collisions, as well as the possibility of vehicle occupants sustaining bodily injuries.

This alternative will continue to provide such existing public recreational opportunities as wildlife observation, fishing, environmental education, interpretation, and photography. However, it will not provide additional recreational opportunities.

c. Economics. Currently, this alternative has the lowest direct cost to the Service. However, costs to the public in terms of damage to property (e.g., landscaping, vehicles) are expected to rise. A study in an Islip, New York neighborhood reported that deer inhabiting a Refuge and surrounding suburban areas caused damages to landscaping, nursery stock, and gardens amounting to $28,000 annually. At Wertheim NWR, staff recovered sixteen road-killed deer during 2003. Because even minor damages to a vehicle can cost more than a thousand dollars to repair, vehicle collisions represent a substantial and increasing economic cost.

An additional potential cost would involve the Refuge investing in major grassland and reforestation projects to recover degraded habitats. Monies would be spent on acquiring seed and seedlings and would require the use of fences to protect restoration sites from browsing deer. In some cases, the reintroduction of other native wildlife species would be necessary to restore species richness and diversity.

d. Public Safety. The principal safety concerns regarding this alternative are the potential for an increasing number and severity of deer-vehicle collisions, as has been experienced since 1999, as well as the added abundance of deer ticks and the associated transmission of Lyme disease.

Alternative B – Preferred Alternative (Controlled Public Hunt): Managed public hunts are the most common and effective method for managing deer densities in North America (Palmer et al. 1980, Cypher and Cypher 1988, Ellingwood and Caturano 1988, Wildlife Restoration 1996, Hansen et al. 1997). Furthermore, hunting is the most common form of deer population control on National Wildlife Refuges in the Service's northeast region (i.e., New England and the Middle Atlantic States). Public hunts help control, reduce, or maintain deer densities at various levels depending on management objectives. Positive results have been observed at the Great Swamp NWR in New Jersey, where so far the deer density has been reduced to 38 deer/mi^2. Hardwood regeneration and survival is evident at the refuge, whereas regeneration is not occurring at the nearby Jockey Hollow National Historical Park, a site at which deer are not managed (C. Bittler, USFWS, personal comm.). Results of a controlled public deer hunt were equally encouraging at the Patuxent NWR where deer densities were reduced from >100 deer/mi^2 in 1998 to approximately 30 deer/mi^2 in 2003. Equally important is the observation of oak tree regeneration and a reduction in the browse line (H. Obrecht, USFWS, personal comm.). Parker River NWR reports a deer density of roughly 30 deer/mi^2. This represents a four-fold reduction on this barrier island from the population noted during the 1980s. Plants once heavily browsed are now increasing in vigor, a browse line is no longer evident, and deer health has improved markedly (D. Melvin, USFWS personal comm.).

In other deer-managed areas, such as the Forest Preserve District of DuPage County, Illinois, the annual reduction of deer densities has resulted in improved forest regeneration. Lethal removal of deer has proven successful at reducing deer population density, decreasing deer-vehicle collisions, and restoring native ecosystems in DuPage County forest preserves. They have successfully reduced deer densities at Waterfall Glen preserve from 138 deer/mi^2 in 1992 to 31 deer/mi^2 in 1997. Floral studies in the area have detected increases in species diversity, mean plant height, and percent vegetative ground cover in those forest preserves with a declining deer population (Etter et al. 1997).

a. Natural Resource Effects. Biologically, the reduction of deer densities would allow forest vegetation to recover from the effects of overbrowsing. A decline in deer browsing will allow development of an herbaceous layer and woody understory representative of a balanced ecosystem. Such effects have begun to be noted in deer exclsoures established throughout the Refuge; trees are regenerating within the exclosures while plants outside of the exclosure are browsed to the ground. In addition to increasing plant density and species diversity, this added vegetative growth will provide the structure necessary to benefit ground-nesting birds, as well as reptiles, amphibians, and small mammals. Achieving parity between deer densities and the habitat's carrying capacity is expected to improve the overall health of the deer population; deer are expected to attain greater body weights, show fewer signs of disease, and succumb less often to starvation. With a staggering of hunt days and mix of shotgun and bow hunting, implementation of a hunting program is not expected to encourage deer to leave the Refuge in greater number; hunting tends not to cause deer to leave their normal home ranges, but instead shifts the deer into areas with more adequate cover (Kufeld et al. 1988). Disturbance to non-migratory wildlife would increase on the Refuge due to the presence of sportsmen. However, this would be mitigated by permitting hunting between October and January, a time of year when

wildlife occurrence and activity is lowest. An additional mitigating factor is that at least 586 acres, or 23% of the Refuge's land area will be closed to hunting with implementation of a 500-foot, no-hunt buffer established around the Refuge's perimeter and additional safety zones.

Impacts to the deer population would include the annual harvest of an estimated 60-100 deer over the next several years, after which, the deer population will be maintained at a lower density through an annual harvest, if necessary, of approximately 40 deer. Attainment of this harvest rate will result in reducing the deer population from an estimated 100 deer/mi^2 to a level more consistent with the carrying capacity of the habitat (i.e., less than 25 deer/mi^2) (Woolf and Harder 1979, Cypher and Cypher 1988). Consequently, the deer population will exhibit a more balanced sex ratio, will be more resistant to disease, and individual animals will maintain a high level of physical condition.

The timing and location of this activity would preclude disturbance to any federal or state designated endangered and threatened species, hence the proposed action will not affect any threatened or endangered species.

b. Community Effects. This alternative would permit additional public recreational opportunities, consistent with the primary public uses identified in the Refuge Improvement Act of 1997. Hunting is named specifically as a priority public use of Refuges in the Act, along with fishing, photography, wildlife observation, environmental education, and environmental interpretation. At the local level, public sport hunting opportunities are limited on Long Island, especially during the shotgun season. The New York DEC maintains 111 parking spaces at its Long Island Management Areas with the capacity for 2109 hunting parties during the January season. During the 2002 season, these areas were at 92% capacity (D. Little, pers. comm.). This proposal would provide opportunities for up to 40 hunters each day, for a total potential of 920 hunter-use days for the shotgun season (i.e., 40 hunters x 23 days) and 3,680 hunter-use days for the bow season (i.e., 40 hunters x 92 days) during October - January. Because both of the Refuge's nature trails will be closed when hunting occurs in their vicinity, those visitors, interested in viewing or photographing wildlife, or hiking on the Refuge's nature trails, will be excluded from those activities during hunt days. Approximately 42 visitors to the trail system will be excluded during each day hunting is permitted on weekdays, while as many as 80 visitors could be excluded during those weekend days when bow hunting is permitted due to closure of the nature trails. Although restricted at Wertheim during hunt days, the general public also has an opportunity to visit the nature trails provided at Morton and Target Rock NWRs.

Hunters could contribute up to 40 vehicles to the overall traffic on Montauk Highway and Smith Road during early morning and evening hours on hunt days. This increased level of traffic is immeasurable when compared to the thousands of daily vehicle trips presently observed on these roads. The sound of firearms discharges are expected to be only minimally noticeable to surrounding homeowners given the distance between homes and hunt areas (i.e., more than 500 feet) and the noise attenuation provided by forest vegetation. The sound effects will also be minimized as shotgun hunting will occur only during daylight periods on weekdays when most residents are at work and away from home.

Over a several year period, a reduction in the Refuge's deer density is anticipated to have localized effects within the adjacent community. The presence of fewer deer is expected to limit their overall occurrence on residential properties, resulting in less damage to landscaping and fewer deer will be available to transport Lyme disease-bearing ticks. Although deer will undoubtedly continue to move off-Refuge, especially during the breeding season, a smaller deer population could likewise reduce the number of vehicle collisions.

c. Economic Effects. Economic benefits of this alternative would include a reduction in damage to gardens and ornamental plantings in the private lands surrounding the Refuge, as well as a reduction in costs borne by landowners to protect their landscaping. Although it is difficult to measure the cost savings associated with a reduction in deer-vehicle collisions, based on information from www.erieinsurance.com, the 16 recorded vehicle-deer collisions in 2003, could have accounted for estimated repair costs of 16 x $1,860 (per incident average) = $29,760.

Local businesses could expect a slight increase in revenue due to the purchasing of food, hunting supplies, meat processing, fuel, and lodging. Because the Refuge would be closed to the general public during hunt days, this increase in economic activity might be offset somewhat by a decline in local expenditures by general visitors. In any event, economic gains or losses are expected to be insignificant.

Costs to the Refuge of implementing a hunt include approximately $3,000 to establish and post hunting zones and $800 in salary costs for each day the hunt occurs.

d. Public Safety. Because this alternative involves the use of firearms or a projectile firing device, the safety of hunters, Refuge staff, and the general public is the primary concern. To a large extent, safety will be afforded by the layout of the hunt areas and selecting only qualified hunters. After a 500-foot, no-hunt buffer is placed around the Refuge's perimeter to provide a safety zone for neighbors and the general public, the Refuge will be subdivided into distinct hunt zones, which will be limited to, on average, 1 hunter per 42 acres, a much reduced density compared to the no more than 5 hunters per 100 acres, prescribed by State law. Both Service and NYDEC officials will screen potential hunters. Screening will include checks of their hunting license and hunter education certificate, if applicable, and participation in a Refuge-specific hunter orientation program. Staff will also perform random safety checks of hunting equipment. When afield, shotgun hunters will be required to wear a minimum 400 square inches of "hunter orange" clothing. Within the smaller hunt zones, the use of portable tree stands will be mandated during the shotgun season to ensure the direction of fire is toward the ground. Agency personnel will staff the Refuge during each hunt day. At least two law enforcement officers will be present at all times.

Statewide, New York recorded 32 hunting-related injuries among the nearly 700,000 hunters who went afield in 2003, the fewest ever noted. Of these, 20 injuries were incurred by those hunting deer and two of the injuries were fatal. These figures represent a 65% decline in the injury rate since the 1960's and have been attributed to New York State's Sportsman's Education Program

which was instituted for minors in 1949 and all hunters beginning in 1960 (NYSDEC Press Release 2004).

6.0 Consultation and Coordination with Others

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Little, Doug. Wildlife Biologist. New York State Department of Environmental Conservation, Bureau of Wildlife.

Melvin, Deborah. Wildlife Biologist. Parker River National Wildlife Refuge. U.S. Fish and Wildlife Service.

Rosenblatt, Dan. Regional Manager, Wildlife Program. New York State Department of Environmental Conservation, Bureau of Wildlife.

Obrecht, Holliday. Wildlife Biologist. Patuxent Research Refuge. U.S. Fish and Wildlife Service.

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APPENDIX I: Vegetation types at the Wertheim NWR

Open Water (17.8%) - This habitat type consists of subtidal, tidal, and nontidal waters. This acreage also includes freshwater and brackish ponds/impoundments. Common vegetative species of these open water areas include: eel grass (*Zostera marina*), green fleece (*Codium fragile*), sea lettuce (*Ulva lactuca*), waterweed (*Elodea canadensis*), sago pondweed (*Potamogeton pectinatus*), widgeon grass (*Ruppia maritima*), bladderwort (*Utricularia vulgaris*), and ribbon grass (*Vallisneria americana*).

Strand (0.1%) - This habitat borders tidal waters and typically consists of coarse sediment (sand or small stone). Strand habitat begins at the waters' edge and terminates at the edge of upland vegetation, typically beach grass (*Ammophila breviligulata*).

Grassland (1.5%) - Both warm season and cool season grasslands are represented at Wertheim NWR. Warm season grasslands are dominated by little bluestem (*Andropogon scoparius*), switch grass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), broomsedge (*Andropogan virginicus*), and big bluestem (*Andropogon gerardii*). Warm season grasslands are considered the native grasslands of Long Island. Warm season grasslands occur in both forest openings and the larger grasslands (>5 acres) at the Refuge. Cool season grasslands are dominated by non-native grasses including meadow grass (*Poa* spp.), orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), fescue (*Festuca* spp.), and crab grass (*Digitaria sanguinalis*). One native cool season grass - sweet vernal grass (*Anthoxanthum odoratum*), occurs on forest edges and as a component of forest meadows.

Improved grounds (0.2%) - This type occurs at public use facilities and structures. Improved grounds tend to be adjacent to roadways, buildings, and parking lots. The grounds are dominated by cool season grasses principally bluegrass (*Poa annua*), crab grass, and fescue species. Improved grounds also possess some shade trees and ornamental shrubs. These grounds are mowed approximately every two weeks during the growing season.

Intertidal Marsh (1.6%) - The intertidal marsh is flooded daily by the tide and the vegetation is dominated by tall growth form cordgrass (*Spartina alterniflora*).

High Marsh (12.2%) - High marsh is dominated by salt hay (*Spartina patens*), short growth form cordgrass, salt grass (*Distichlis spicatum*), black grass (*Juncus gerardia*), and saltmarsh bulrush (*Scirpus americana).* High marsh occurs between the intertidal marsh and terrestrial lands. High marsh is flooded either during high rainfall events, spring tides, or above normal high tides.

Robust Emergent Marsh (13.2%) - The vegetation is dominated by either great reed (*Phragmites communis*), cattails (*Typha spp.*), brackish cordgrass (*Spartina cynusoides*), or bulrush (*Scirpus* spp.). The height of the vegetation ranges from three to twelve feet.

Upland Shrub (1.0%) - Upland shrub habitats are dominated by arrowwood (*Viburnum dentatum*), bittersweet (*Celastrus orbiculata*), honeysuckle (*Lonicera* spp.*)*, scrub oak (*Quercus*

ilicifolia), dogwood (*Cornus* spp.), hightide bush (*Baccharis halimifolia*), beach plum (*Prunus maritima*) and other woody species. Upland shrub areas grow along wetland boundaries, forest edges, on impoverished soils, and areas where high white-tailed deer densities limit forest regeneration. Shrub height in these habitats range from four to twelve feet.

Shrub Swamp (1.5%) - These habitats are dominated by arrowwood, swamp loosestrife (*Decodon verticillatus*), willow (*Salix nigra*), and alder (*Alnus maritima*). Shrub swamps typically occur on the edges of marshes and streams. Shrub height ranges from three to ten feet.

Pioneer Hardwoods (1.5%) - This forest type is typically the first forest vegetation to occur during succession. Dominant overstory vegetation include black cherry (*Prunus sertonia*), sassafras (*Sassafras albidum*), black locust (*Robinia pseudoacacia*), and tree of heaven (*Ailanthus altissima*). Woody understories are robust and include raspberry/dewberry (*Rubus* spp.), briar (*Smilax spp*.), black huckleberry (*Gaylussacia baccata*), and lowbush blueberry (*Vaccinium vacillans*).

Red Maple/Tupelo (6.5%) - This forest type is dominated by an overstory of red maple (*Acer rubrum*) and tupelo (*Nyssa sylvatica*). The robust woody understory consists of spicebush (*Lindera benzoin*), arrowwood (*Viburnum dentatum*) and pepperbush (*Clethra alnifolia*). This forest type frequently has a prevalent ground layer frequently including tussock sedge (*Carex stricta*). This forest type grows on moist sites, particularly along stream corridors, although some stands occur at more mesic sites.

Red Cedar (0.6%) - This forest type is dominated by red cedar (*Juniperus virginiana*) with few other species in the overstory. The woody understory and ground layer are sparse.

Pitch Pine (6.7%) - Pitch pine (*Pinus rigida*) is the dominant tree species (>70%); other overstory species present include white oak (*Quercus alba*), red oak (*Quercus rubra*), and black oak (*Quercus velutina*). Woody understory species include black huckleberry, lowbush blueberry, and briar. In a closed canopy stand, the woody understory is sparse and in an open canopy stand the woody understory is robust.

Conifer Plantations (0.04%) - Plantations are dominated by white pine (*Pinus strobus*) or Norway spruce (*Picea abies*). Woody understories and ground vegetation layers are sparse.

Mixed-Oak (27.5%) - This forest type is the most common by acreage at the Refuge. Dominant overstory vegetation includes white oak, red oak, black oak, scarlet oak (*Quercus coccinea*), and pignut hickory (*Carya glabra*). Pitch pine may be present but generally consists of less than ten percent of the overstory. The woody understory is robust and ranges in height from one to six feet. The woody understory is dominated by black huckleberry, lowbush blueberry, briar, and highbush blueberry (*Vaccinium corymbosum*). Ground vegetation is sparse and the litter layer is robust. In areas of past gypsy moth infestations, where mortality has occurred to oaks, the stands are open canopied and the understory is fuller and more robust.

Oak/Pitch Pine (8.0%) - The overstory vegetation is similar to the mixed oak type except that the pitch pine component comprises 10-70% of the overstory. The woody understory, field layer, and leaf litter layer are similar to the mixed oak type. The oak-pitch pine type, like the mixed oak type, occurs as both closed and open-canopied stands due to past oak mortality by gypsy moth.