Chapter 4

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Judges review entries at the 2011 Federal Junior Duck Stamp Contest held at the refuge.

Management Direction and Implementation

4.1 Introduction

This chapter begins with a description of the process we used to formulate the management direction and implementation for John Heinz NWR. Next, we present the management direction and implementation for the refuge and identify decisions that we are not making at this time but will require additional NEPA analysis before a final decision can be made. We conclude with the goals, objectives, and strategies for managing each refuge.

The management direction and implementation we describe in this chapter includes a set of refuge goals, objectives to achieve those goals, and a series of strategies to implement them. The array of management actions described here are those that, in our professional judgement, will best achieve the refuge's purposes, vision, and goals, and best respond to public issues.

Refuge goals developed are intentionally broad, descriptive statements of the desired future condition of refuge resources. Goals articulate the principal elements of the refuge purposes and our vision statement, and provide a foundation for developing specific management objectives and strategies.

Objectives are essentially incremental steps toward achieving a goal; they further define management targets in measurable terms. Typically, they provide the basis for determining strategies that are more detailed, monitoring refuge accomplishments, and evaluating our successes. "Writing Refuge Management Goals and Objectives: A Handbook" (USFWS 2004a) recommends writing "SMART" objectives that possess 5 characteristics: (1) specific, (2) measurable, (3) achievable, (4) results-oriented, and (5) time-fixed. A rationale accompanies each objective to explain its context and importance. The objectives outlined in this chapter will guide the future development of refuge step-down plans, which we describe later in this chapter.

Strategies are the specific or combined actions, tools, or techniques we may use to achieve the objectives. The list of strategies in each objective represents the potential suite of actions we may implement. We will evaluate most of them further as to how, when, and where we should implement them when we write our refuge step-down plans. We will measure our successes by how well our strategies achieve our objectives and goals.

We believe the management goals, objectives, and strategies described below provide the best combination of actions to meet the Refuge System mission and policies; meet the refuge purposes, vision, goals; and respond to public issues. It emphasizes the management of specific refuge habitats to support focal species whose habitat needs benefit other species of conservation concern in the Delaware Estuary and southeastern Pennsylvania. In particular, we emphasize habitat restoration for globally rare plant communities and habitat types and related priority species of conservation concern. Under this plan, we will expand our freshwater tidal marsh restoration efforts, implement additional forest habitat restoration and management efforts, and increase the efficiency and effectiveness of our grassland management.

In addition, this plan will enhance our present visitor services programs in a manner that addresses the legislatively determined purposes of John Heinz NWR as well as national and regional Service policies and mandates. We will also expand administrative facilities to accommodate additional staff needed to implement these additional activities and to collocate refuge law enforcement with the other programs in an effort to improve cross-program coordination.

4.2 General Refuge Management

There are some actions we will take in managing John Heinz NWR over the next 15 years that are required by law or policy, or represent actions that have undergone previous NEPA analysis, public review, agency review, and approval. Others may be administrative actions that do not necessarily require public review, but we want to highlight them in this public document. They may also be actions we believe are critical to achieving the refuge's purpose, vision, and goals.

All of the following actions, which we discuss in more detail below, are current practices or policies that will continue:

- Using an adaptive management approach, where appropriate.
- Continuing land protection by purchasing fee title and conservation easements from willing sellers, and accepting donations, within the current, approved acquisition boundary.
- Controlling invasive species.
- Monitoring and abatement of diseases affecting wildlife and forest health.
- Controlling pest plants and animals.
- Facilitating or conducting biological research and investigations.
- Completing existing onsite projects managed by outside programs, such as restoring 55 acres of freshwater tidal marsh and site remediation of Folcroft Landfill.
- Developing a comprehensive GIS database for the refuge and the surrounding landscape to better inform and facilitate on-the-ground management.
- Completing findings of appropriate use and compatibility determinations.
- Providing refuge staffing and administration.

4.2.1 Adaptive Management

We will employ an adaptive management approach for improving resource management by learning from management outcomes. To provide guidance on policy and procedures for implementing adaptive management in departmental agencies, an intradepartmental working group developed a technical guidebook to assist managers and practitioners (Williams et al. 2009). It defines adaptive management, the conditions under which we should consider using it, the process for implementing it in a structured framework, and evaluating its effectiveness (Williams et al. 2009). In the guidebook adaptive management is defined as,"a decision process that promotes flexible decisionmaking that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood."

At the refuge level, monitoring key resources and management actions and outcomes will be important to implementing an adaptive management process. Our freshwater tidal marsh restoration and management, invasive species, and impoundment management activities are examples of refuge programs or activities where an adaptive management approach may be implemented. The refuge manager will be responsible for changing management actions and strategies if they do not produce the desired conditions. Significant changes from what we present in this CCP may warrant additional NEPA analysis and public comment. Minor changes will not, but we will document them in our project evaluation or annual reports. Implementing an adaptive management approach supports all six goals of the refuge.

4.2.2 Protecting Land

The Service is authorized to protect 1,200 acres within its existing, approved refuge boundary. Currently, the Service has acquired 993 acres in fee title. We will continue to work with willing sellers and in partnership with other agencies and organizations to protect the remaining 207 acres within the refuge's authorized acquisition boundary.

It is impossible to predict the size, type, and location of future acquisitions that may come under our management within the next 15 years. Although the refuge seeks to acquire suitable and available habitat within its approved refuge boundary, concerted efforts to purchase those lands is not a primary focus of refuge management since the refuge already owns the majority of lands within its approved boundary. Instead, we will focus on creating partnerships with adjacent and nearby land owners in support of broader conservation issues that affect the refuge (e.g., habitat fragmentation).

The permanent protection of land is the keystone of wildlife and habitat conservation. Land protected by the Refuge System will be available forever to support fish, wildlife, and plants. We can restore, enhance, or maintain the land we own interest in to provide optimal conditions for Federal trust resources, such as threatened or endangered species and those species whose populations are in decline.

4.2.3 Managing Invasive and Pest Species

Invasive Species

The establishment and spread of invasive species, particularly invasive plants, is a significant problem that reaches across all habitat types. For the purposes of this discussion, we use the definition of invasive species contained in the Service Manual (620 FW 1.4E): "Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous species, are species that are not native to a particular ecosystem. We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."

The unchecked spread of invasive plants threatens the biological diversity, integrity and environmental health of all refuge habitats. In many cases, they have a competitive advantage over native plants and form dominant cover types, reducing the availability of native plants as food and cover for wildlife. Over the past several decades, government agencies, conservation organizations, and the public have become more acutely aware of the negative effects of invasive species. Many plans, strategies, and initiatives target the more effective management of invasive species (e.g., USFWS 2004b, National Wildlife Refuge Association 2002). The Refuge System biological discussion database and relevant workshops continually provide new information and updates on recent advances in control techniques. Sources of funding are also available, both in the Service budget and through competitive grants, to conduct inventory and control programs.

Sixteen known invasive plant species targeted for invasive species management on the refuge are outlined in Section 3.12 Refuge Biological Resources of Chapter 3 "Existing Environment." Refuge staff currently focuses control on the following invasive plants, listed in alphabetical order by common name: bush honeysuckle, Canada thistle, phragmites, garlic mustard, Japanese hops, Japanese honeysuckle, Japanese knotweed, Japanese stiltgrass, mile-a-minute weed, multiflora rose, Norway maple, Oriental bittersweet, porcelainberry, purple loosestrife, and tree-of-heaven. Other invasive species have been identified, but have not been a focus of existing control efforts due to a combination of limited resources and the species' limited likelihood of additional expansion on the

refuge. Those species include European privet, princess tree, buckthorn, and reed canary grass. We also monitor refuge and adjacent lands and waters for the presence of invasive animal species, such as mute swans, feral cats, carp, red-eared slider, rusty crayfish, Asian stinkbugs, and snakehead, and are prepared to respond quickly to control them if discovered.

Of particular note, the emerald ash borer is an invasive insect that has spread throughout portions of the northcentral and eastern U.S., including Pennsylvania. Emerald ash borer was first identified in western Pennsylvania in 2007. A separate population was identified in central Maryland in 2003. Emerald ash borer larvae feed on the tissues under the bark of ash trees, causing the death of branches and entire trees (PADCNR 2010c). Since many of the floodplain forest communities of the refuge contain green ash as a dominant species, the location and expansion of emerald ash borer populations is another special concern.

Guidance on managing invasive species on refuges appears in the Service Manual (620 FW 1.7G). The following actions define our general strategies on the refuge:

(1) Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and to prevent new and expanded infestations of invasive species.

(2) Conduct refuge habitat management to prevent, control, or eradicate invasive species using techniques described through an integrated pest management plan, or other similar management plan, the plans comprehensively evaluate all potential integrated management options, including defining threshold/risk levels that will initiate the implementation of proposed management actions.

(3) Evaluate native habitat management activities with respect to their potential to accidentally introduce or increase the spread of invasive species and modify our habitat management operations to prevent increasing invasive species populations.

(4) Refuge integrated pest management planning addresses the abilities and limitations of potential techniques including chemical, biological, mechanical, and cultural techniques. See additional discussion on integrated pest management (section 3.3.3 below).

(5) Manage invasive species on refuges under the guidance of the National Strategy for Invasive Species Management (USFWS 2004) and within the context of applicable policy.

The following actions define our specific strategies for the refuge:

(1) Continue the treatment of the most problematic species ranked in management priority based on (a) the extent to which the species is established on the refuge, (b) the potential ecological impact of the species on refuge plant communities, and (c) the degree of management difficulty involved in controlling the species.

(2) Maintain early detection and rapid-response readiness regarding new invasions.

(3) Maintain accessibility to affected areas for control and monitoring.

(4) Continue to promote research into the biological control alternatives.

(5) Continue and increase efforts to involve the community in promoting awareness of invasive species issues, and seek assistance for control programs on and off the refuge.

Pest Species
At times, native plants and animals interfere with management objectives when they become overabundant. The Refuge Manual (7 RM 14.4A) defines a pest as, "Any terrestrial or aquatic plant or animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health." That definition could include the invasive species defined above, but in this section, we describe some situations involving native species and under what conditions we will initiate control.

We use the following general strategies in pest management:

(1) Determine the need for site-specific control based on the potential to affect our management objectives for a given area. We will employ an adaptive management strategy and we expect lethal control or removal of individual animals to be the exception rather than the rule. To establish general thresholds for lethal control is difficult. So we will determine our solution on a case-by-case basis. For example, in some years, spadderdock (also known as yellow pond lily) has expanded within the 145-acre impoundment to create a single-species population that vegetates managed mudflat habitat and outcompetes other native vegetation targeted for migratory bird management such as native, annual vegetation such as smartweeds, sedges, and rushes. As a result, we annually monitor establishment and expansion of spadderdock populations within the impoundment and adjust water level management to limit spadderdock expansion or selectively apply herbicides to favor establishment of desired annual native vegetation.

(2) Employ integrated pest management techniques, when a species is having a significant impact on an area resulting in major habitat replacement and loss of valuable canopy trees (such as oaks) or desired native vegetation (such as sedges, rushes, and smartweeds).

(3) Monitor results to ensure that pests do not exceed acceptable levels.

Integrated Pest Management
In accordance with 517 DM 1 and 7 RM 14, an integrated pest management approach will continue to be used, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on the refuge. Integrated pest management involves using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target organisms and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. Furthermore, pesticides will be used primarily to supplement, rather than as a substitute for, practical and effective control measures of other types. If a pesticide is used on the refuge, the most specific (selective) chemical available for the target species will be used unless considerations of persistence or other environmental or biotic hazards will preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides registered with the USEPA in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and as provided in regulations, orders, or permits issued by the USEPA may be applied on lands and waters under refuge jurisdiction.

Environmental harm by pest species is defined as a biologically substantial decrease in environmental quality as indicated by one or more of a variety of potential factors including declines of native species' populations or communities, degraded habitat quality or long-term habitat loss, or altered ecological processes. We define environmental harm as resulting in direct effects of pests on native species including preying and feeding on them; causing or spreading diseases; preventing other native species from reproducing or killing their young; out-competing other native species for food, nutrients, light, nest sites or other vital resources; or hybridizing with them so frequently that within a few generations, few if any truly native individuals remain. In contrast, environmental harm can be the result of an indirect effect of pest species. For example, decreased waterfowl use may result from invasive plant infestations reducing the availability or abundance of native wetland plants that provide forage during the winter.

We will refine our control program to address the most critical problems first. We may adjust our priorities to reflect regional Service priorities, the availability of new information, or a new priority resource.

4.2.4 Monitoring and Abating Wildlife and Plant Diseases

The Service has not yet published its manual chapter on Disease Prevention and Control. In the meantime, we derive guidance on this topic from the Refuge Manual and specific directives from the Director of the Fish and Wildlife Service or the Secretary of the Interior. The Refuge Manual (7 RM 17.3) lists three objectives for the prevention and control of disease:

(1) Manage wildlife populations and habitats to minimize the likelihood of the contraction and contagion of disease.

(2) Provide for the early detection and identification of disease mortality when it occurs.

(3) Minimize the losses of wildlife from outbreaks of disease.

The Service published those objectives in 1982. Since then, in addition to diseases that cause serious mortality among wildlife, diseases transmitted through wildlife to humans have received more attention. One example is Lyme disease. In 2002, the Service published a Service Manual chapter (242 FW 5) on Lyme disease prevention to inform employees, volunteers, and national service workers about this disease, its prevention, and treatment. In addition to Lyme disease, several other wildlife and plant diseases are particularly concerning at John Heinz NWR, including avian influenza and avian botulism, Chronic Wasting Disease (CWD), Epizootic Hemorrhagic Disease (EHD), and oak diseases.

These are the general strategies for preventing or controlling disease:

(1) Continue to conduct disease surveillance in conjunction with other fieldwork.

(2) Cooperate with State agencies, particularly the PGC, PFBC, and Pennsylvania Natural Heritage Program, in conducting surveillance, providing access for sampling, and following protocols in the event of an outbreak.

(3) Monitor forests and other habitats for indicators of the increased occurrence of pests or disease. For example, note changes in flowering or fruiting phenology, physical damage, decay, weakening, sudden death (particularly of canopy and source trees of major host species), and changes in wildlife use of habitats, such as the absence of breeding birds that used to appear regularly.

(4) Follow the protocols in national, State, and refuge disease prevention and control plans.

Avian Influenza and Avian Botulism
Avian influenza is a serious wildlife disease that has received considerable attention worldwide. Of particular concern is the highly pathogenic Eurasian form (H5N1). In 2006, all refuges were instructed to prepare an Avian Influenza Surveillance and Contingency Plan. The John Heinz NWR Avian Influenza Surveillance and Disease Contingency Plan was approved in April 2007 and discusses methods for dealing with this disease (USFWS 2007a).

Avian botulism is caused when birds ingest a toxin produced by the bacteria, *Clostridium botulinum*. This bacteria is common in soils, but does not produce the toxin unless warm temperatures combine with a protein source and anaerobic (no oxygen) conditions (USGS 2011). Occasionally, large numbers of fish can die off during drawdowns of the impoundment. This can result in conditions conducive to production of the avian botulism toxin. Refuge staff monitor the impoundment during drawdowns to determine whether or not conditions for avian botulism are present. If these conditions are present, refuge staff may need to open the water control structure in periods of drought to allow additional water into the impoundment to prevent an outbreak of this disease in the refuge's waterfowl and waterbirds.

Chronic Wasting Disease
CWD is a fatal disease that attacks the brain and spinal cord of deer and elk. While the exact cause is unknown, it is believed to be caused by a prion, an altered protein that causes other normal proteins to change and cause sponge-like holes in the brain. CWD was first identified in the 1960s in a Colorado research facility. Since that time, it has been found in numerous states including the nearby States of New York and West Virginia. CWD has not been found in white-tailed deer in Pennsylvania. Prion diseases like CWD do not move easily between species. There is no scientific evidence that CWD has been transmitted to animals other than deer, elk, and moose. The Chronic Wasting Disease Surveillance and Contingency Plan for John Heinz NWR was approved in October 2007 (USFWS 2007b) and discusses early detection and response to any potential CWD occurrence at the refuge.

Epizootic Hemorrhagic Disease
EHD is a virus and the most common infectious disease of white-tailed deer in the eastern U.S. It is not transferable to humans and only rarely does it cause illness in other animals. EHD is spread from animal to animal by biting midges that live in or near water and wet, muddy areas. These midges transmit the virus as they feed. Outbreaks among white-tailed deer have occurred in Pennsylvania in 1996 (unconfirmed), 2002, and in 2007. Due to the midge being the main mode of transmission, control is very difficult and typically ineffective. More frequent exposure to the virus allows deer to develop immunity, allowing it to recover. EHD outbreaks in southern states, which occur more frequently than in more northern states, typically have lower mortality rates than what is seen when the disease comes to Pennsylvania (PGC 2011). However, the New Jersey Department of Environmental Protection Division of Fish and Wildlife's Office of Fish and Wildlife Health and Forensics, reported a documented outbreak of Type 2 EHD in Salem County (approximately 20 miles from the refuge) in the fall of 2010. This outbreak of Type 2 EHD in New Jersey raises concern that this strain may persist and reoccur annually as it does in the southern U.S. (NJDEP 2010).

Oak Diseases
Diseases can affect forest health as well. Diseases that affect oaks are a special concern because of the importance of the coastal plain forest community which is dominated in part by pin oaks. More than 80 documented insects and diseases affect oak trees in the U.S. Their impacts range from minor defoliation to rapid mortality. In some years, pests cause the loss of a major portion of the acorn crop, impeding oak regeneration. A few pests have altered or may alter eastern U.S. oak forests on a broad scale. For example, humans' inadvertently transporting masses of eggs have aided the spread of the gypsy moth, an introduced defoliator, in the last few decades.

4.2.5 Biological and Ecological Research and Investigations

The Refuge Manual and the Service Manual both contain guidance on conducting and facilitating biological and ecological research and investigations on refuges. In 1982, the Service published three objectives in the Refuge Manual for supporting research on units of the Refuge System (4 RM 6.2):

(1) Promote new information and improve the basis for, and quality of, refuge and other Service management decisions.

(2) Expand the body of scientific knowledge about fish and wildlife, their habitats, the use of these resources, appropriate resource management, and the environment in general.

(3) Provide the opportunity for students and others to learn the principles of field research.

In 2006, the Service Manual provided supplemental guidance on the appropriateness of research on refuges: "We actively encourage cooperative natural and cultural research activities that address our management needs. We also encourage research related to the management of priority general public uses. Such research activities are generally appropriate. However, we must review all research activities to decide if they are appropriate or not as defined in section 1.11. Research that directly benefits refuge management has priority over other research" (603 FW 1.10D (4)).

All research conducted on the refuge must be consistent with an approved finding of appropriateness and compatibility determination for research. If a research project does not fall within the scope of a current finding of appropriateness and compatibility determination, we will need to complete a project-specific finding of appropriateness and compatibility determination before issuing a special use permit. Research projects may also contribute to a specific need identified by the refuge or the Service. As we note in chapter 3, we have allowed many research projects that meet these criteria. A special use permit will be issued for all research projects we allow. In addition, we will employ the following general strategies:

(1) Seek qualified researchers and funding to help answer refuge-specific management questions.

(2) Participate in appropriate multi-refuge studies conducted in partnership with the USGS, USDA, State agencies, and others.

(3) Facilitate appropriate and compatible research by providing compatible access and utilization of the refuge as a location for ongoing research.

4.2.6 Completing Existing Projects Outside the Scope of the CCP Process

Several projects in progress on the refuge are being managed by programs outside of the refuge either due to funding sources or jurisdiction. Although these projects are occurring on the refuge, NEPA compliance for these projects is

being addressed outside this CCP because they are being planned and analyzed by other Service programs or other Federal agencies.

The Service's Chesapeake Bay Ecological Services office in Annapolis, Maryland, is spearheading efforts to restore 55 acres of freshwater tidal marsh that is currently a phragmites-dominated wetland. Funding for this project's design and construction has been secured and is provided through the Natural Resource Damage Assessment settlement on behalf of the 2006 Athos oil spill on the nearby Delaware River. Currently, the Chesapeake Bay Ecological Services office is planning the project and will comply with NEPA as needed. This project will be the largest freshwater tidal marsh restoration project on the refuge once completed.

Remediation of the Folcroft Landfill is another large-scale effort that will likely continue for years before completion. The USEPA is leading the multi-agency effort to complete the characterization and remediation of the Folcroft Landfill. At the time of this writing, the USEPA finalized a legal agreement with a group of potentially responsible parties requiring them to perform the Remedial Investigation and Feasibility Study. The Service owns the Folcroft Landfill as part of the refuge. Field investigations on the site started at the end of November 2006 and continued until summer of 2007. During this time, groundwater wells were installed and sampled and soil samples were collected. This environmental data will be included in the Remedial Investigation and Feasibility Study for the Folcroft Landfill which is currently underway. The Remedial Investigation for the Folcroft Landfill was recently submitted to the USEPA and is currently being reviewed. Once remediation is complete, the Service will manage these lands according to an approved plan. At that time, we will determine which public uses will be allowed.

4.2.7 Protecting Cultural Resources

As a Federal land management agency, we are responsible for locating and protecting all historic resources, specifically archaeological sites and historic structures eligible for listing or listed on the National Register of Historic Places. That applies not only to refuge land, but also to land affected by refuge activities, and includes any museum properties. We are not aware of any documented archaeological resources on the refuge at this time.

Modifications to refuge structures dating over 50 years in age, construction of new refuge facilities, and habitat modifications requiring earthmoving are all subject to review under Sec. 106 of the National Historic Preservation Act. That review process requires consultation with the Pennsylvania Historical and Museum Commission and federally recognized Tribes, as well as any other interested parties that may be identified during the process. The potential for intact pre-contact or historic period resources that could be affected by a refuge undertaking varies according to the characteristics of natural landforms, extent of modern disturbance, and nature of the undertaking itself.

Under this plan, we will evaluate the potential for our management activities to impact archaeological and historical resources as required, and will consult with the Service's regional archaeologists, Pennsylvania Historical and Museum Commission, and appropriate federally recognized Tribes to ensure compliance with Section 106 of the National Historic Preservation Act and any other applicable laws and regulations. That compliance may require any or all of the following: a State Historic Preservation Records survey, literature survey, or field survey.

4.2.8 Wildlife-dependent Recreational Program

The Refuge Improvement Act designated six priority public uses on National Wildlife Refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. We will continue to use the criteria

specified in Service policy (605 FW 1) for a quality wildlife-dependent recreation program in developing refuge programs (also see chapter 1, section 1.3).

While no formal survey has been conducted, observations by refuge staff indicate that most visitors to the refuge engage in some form of wildlife-dependent recreation. Wildlife observation and onsite environmental interpretation are the two most common activities (see chapter 3, section 3.14). The refuge offers opportunities for five of the six designated priority uses. The refuge does not allow hunting because of public safety concerns and compliance with local regulations. Despite the exclusion of hunting from the refuge, we still support hunting as an activity through sponsoring related activities such as hunter-education and archery programs.

In recent years, the Service has recognized the importance of connecting children with nature. Scholars and health care professionals are suggesting a link between a loss of connection with the natural world and many physical and mental problems in our nation's youth (Louv 2005). We will continue to promote the concept of connecting children with nature in all of our compatible recreational programming. Our partners, Friends of the Heinz Refuge, and other volunteers will continue to help us expand these priority public use programs.

4.2.9 Appropriateness and Compatibility Determinations

Chapter 1 describes the requirements for determinations of appropriateness and compatibility. Appendix B includes appropriateness and compatibility determinations consistent with implementing this CCP. All existing findings of appropriateness and compatibility determinations have been updated with this CCP. These activities were evaluated based on whether or not they contribute to meeting or facilitating refuge purposes, goals, and objectives. As noted above, hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when compatible, are the priority wildlife-dependent uses of the Refuge System. According to Service Manual 605 FW 1, these uses will receive preferential consideration in refuge planning and management before the refuge manager analyzes other public uses for appropriateness and compatibility.

4.2.10 Activities Not Allowed

According to Service policy, (603 FW 1), if the refuge manager determines a use is not appropriate, it can be denied without determining its compatibility. As specified in the Refuge Administration Act, we cannot, "initiate or permit a new use of a refuge or expand, renew, or extend an existing use of a refuge" unless we have determined that the use is compatible. In addition, certain uses are generally or specifically prohibited on refuges by Service regulation (see 50 C.F.R. §27 for details). Therefore, the refuge is closed to public uses except those specified in this plan. Upon request, the refuge manager determines, in writing, appropriateness and, if applicable, compatibility for nonpriority public uses.

4.2.11 Activities Allowed

Some activities are already approved through an existing finding of appropriateness and compatibility determination. These include research, wildlife observation, photography, environmental education and interpretation, recreational fishing, and bicycling for the purposes of accessing wildlife-dependent recreation opportunities (limited to existing access roads). We are in the process of updating these compatibility determinations, which are included in appendix B for public review and comment. Appendix B details our proposals for all of those activities.

4.2.12 Refuge Staffing and Administration

Our proposals in this document do not constitute a commitment for staffing increases, or funding for operations, maintenance, or future land acquisition. Congress determines our annual budgets, which our Washington Headquarters and regional offices distribute to the field stations. Chapter 3 presents our levels

of staffing and operating and maintenance funds for the refuge over the last 5 years.

Permanent Staffing and Operational Budgets
Our objective is to sustain levels of annual funding and staffing that allow us to achieve refuge purposes, as interpreted by the goals, objectives, and strategies that we have established in this CCP. We achieved many of our most highly visible projects since refuge establishment through special project funds that typically have a one- to two-year duration. Although those funds are very important, their flexibility is limited, because we cannot use them for any other priority project that may arise. As previously mentioned, funding for land acquisition derives primarily from two sources: the Land and Water Conservation Fund and the Migratory Bird Conservation Fund. We generally direct the funds from those sources at specific acquisitions.

We will seek to fill any currently approved but vacant positions, which we believe are necessary to accomplish our highest priority projects. We also propose additional staff to support expanded biological and visitor services programs. We identify our recommended priority order for new staffing in the Refuge Operating Needs tables in appendix E. We also seek an increase in our maintenance staff, because they provide invaluable support to all program areas. Appendix D identifies current and proposed staffing levels.

Facilities Construction and Maintenance
Congress passed legislation establishing the refuge in 1972, but construction of the visitor center did not begin until 2000. Since its completion in 2001, no other major building construction has occurred on the refuge. The refuge did install a paved, 0.6-mile, handicapped-accessible trail loop near the visitor center and main parking lot in the summer of 2009. In 2011, the refuge completed installation of an outdoor pavilion. The outdoor pavilion was developed to better accommodate large school and community groups. While the visitor center provides large meeting space and smaller classroom facilities, the outdoor pavilion allows these groups to more effectively utilize their limited time on the trail and spend more time outside, experiencing the refuge.

We will continue to make incremental progress in upgrading appropriate facilities to current Americans with Disabilities Act standards. We will also continue to improve access and refuge visibility in the community for visitors. We have identified the need for additional directional signs both on and offsite. We will work with the Pennsylvania Department of Transportation (PENNDOT), SEPTA, and the city of Philadelphia to improve directional signs offsite.

Improved signage will help raise the visibility of the refuge and the Service in the region. As observed by refuge staff, and verified by numerous Web postings and blogs, the refuge remains unknown to many people living near the refuge. We must also take care to upgrade and maintain all facilities to Service standards to keep them safe, fully accessible, functional, and attractive.

Distributing Refuge Revenue Sharing Payments
As discussed in chapter 3, we pay local municipalities in Philadelphia and Delaware Counties annual refuge revenue sharing payments based on the number of acres in each municipality and the appraised value of refuge lands in their jurisdiction. We will continue these payments in accordance with the Revenue Sharing Act, commensurate with changes in the appraised market value of refuge lands, or new appropriation levels dictated by Congress.

Refuge Operating Hours
We will open the refuge for public use from official sunrise to sunset, 7 days a week. We close the refuge after dark to help ensure visitor safety and protect refuge resources. However, the refuge manager does have the authority to issue a special use permit to allow others access outside those periods. For example, we may permit access for research personnel or wildlife control specialists at different times, or organized groups to conduct nocturnal activities, such as wildlife observation, and educational and interpretive programs.

4.2.13 Conducting a Wilderness Review

The Refuge System planning policy requires that we conduct a wilderness review during the CCP process. The first step is to inventory all refuge lands and waters the Service owns in fee simple. Our inventory of this refuge determined that no areas meet the eligibility criteria for a wilderness study area as defined by the Wilderness Act. Therefore, we did not analyze further the refuge's suitability for wilderness designation. See appendix F for the results of the wilderness inventory. The refuge will undergo another wilderness review in 15 years as part of the next comprehensive conservation planning process.

4.2.14 Conducting a Wild and Scenic Rivers Review

Service planning policy also requires that we conduct a wild and scenic rivers review during the CCP process. We inventoried the segment of the Darby Creek that flows through the refuge, and determined that it does not meet the criteria for wild and scenic river eligibility (see appendix G). As such, we are not pursuing further study to determine suitability, nor recommending this segment of the river be designated as wild and scenic at this time. Should another State or Federal agency, or a non-governmental partner, initiate a study, we will participate in that effort.

4.2.15 Completing Refuge Step-down Plans

Service planning policy identifies 25 step-down plans that may be applicable on any given refuge. The existing step-down plans in place on the refuge are listed below.

- Annual habitat work plan (most recently completed 2010, updated annually).
- Wildlife disease surveillance and contingency plan (completed 2006).
- Fire management plan (most recently completed 2006, updated annually).
- Hurricane action plan (most recently completed 2010, updated annually).
- Environmental management plan (most recently completed 2003, updated annually).
- Safety plan (most recently completed 2010, updated annually).

We have identified the habitat management plan, annual habitat work plan, inventory and monitoring plan, integrated pest management plan, and the visitor services plan as high-priority step-down plans to update or complete. We describe them in more detail below. To keep them relevant, we will modify and update them as we obtain new information. The completion of these plans supports all refuge goals.

We will complete additional step-down plans as follows:

- Visitor services plan, drafted in 2012, finalized within 3 years of CCP approval (see discussion below).
- Habitat management plan will be finalized at the same time as the CCP (see discussion below).

- Annual habitat work plan, annually after CCP approval (see discussion below).
- Inventory and monitoring plan, annually after CCP approval (see discussion below).
- Integrated pest management plan, within 3 years of CCP approval (see discussion below).
- Law enforcement plan, drafted in 2012, within 1 year of CCP approval.
- Deer management plan, finalized in conjunction with the final CCP.
- Fishing management plan, within 3 years of CCP approval.

Visitor Services Plan
The visitor services plan for the refuge will be finalized with 3 years of CCP approval. Visitor services plans encompass all aspects of visitor services on the refuge and will include an environmental education plan and a facilities and sign plan a including a section on environmental education. The visitor services plan will consider carrying capacity of the refuge to balance visitor use with wildlife habitat. It will identify, define, and prioritize audiences and identify themed messages and topics that will apply to all environmental education and interpretation programming. Given the importance of environmental education to the refuge, and the refuge's critical role in connecting young people with nature and representing the Refuge System and the Service in an urban environment, developing and implementing a visitor services plan is particularly important at John Heinz NWR. For this reason, John Heinz NWR staff will begin writing the refuge's visitor services plan as soon as possible.

Habitat Management Plan
An HMP for the refuge is the requisite first step toward achieving the objectives of goals 1 and 2. The HMP will incorporate the CCP's habitat objectives developed herein, and will identify "what, which, how, and when" actions and strategies will be implemented over the 15-year period to achieve those objectives. Specifically, the HMP will define management areas and treatment units, identify the type or method of treatment, establish the timing for management actions, and define how we will measure success over the next 15 years. In this CCP, the goals, objectives, and list of strategies in each objective identify how we intend to manage habitats on the refuge. We based both the CCP and HMP on current resource information, published research, and our own field experiences. We will update our methods, timing, and techniques as new, credible information becomes available. To facilitate our management, we will regularly maintain our GIS database, documenting any major changes in vegetation at least every 5 years.

Annual Habitat Work Plan and Inventory and Monitoring Plan
The annual habitat work plan and inventory and monitoring plan for the refuge are also priorities for completion upon CCP approval. Those plans also are vital for implementing habitat management actions and measuring our success in meeting the objectives. Each year, we will generate from the HMP and annual habitat work plan that will outline specific management activities for that year. The inventory and monitoring plan will outline the methodology to assess whether our original assumptions and proposed management actions support our habitat and species objectives. We will prioritize our inventory and monitoring needs in the inventory and monitoring plan. The results of inventories and monitoring will provide us with more information on the status of our natural resources and allow us to make more informed management decisions.

Integrated Pest Management Plan
The refuge's integrated pest management plan will be completed within 3 years of CCP approval. The integrated pest management plan supplements both the CCP and HMP with documentation on how to manage invasive or pest species. Along with a more detailed discussion of integrated pest management techniques, the integrated pest management plan describes the selective use of pesticides for pest management on the refuge, where necessary. Throughout the life of the CCP or HMP, most proposed pesticide uses on the refuge will be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects will be documented in "Chemical Profiles" in the forthcoming integrated pest management document. Pesticide uses with appropriate and practical best management practices for habitat management as well as cropland and facilities maintenance will be approved for use on the refuge where there likely will be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in chemical profiles. However, pesticides may be used on a refuge where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease). Pesticide use proposals are submitted annually for each herbicide to acquire approval prior to management applications.

4.3 Conducting Additional NEPA Analysis

For all major Federal actions, NEPA requires the site-specific analysis and disclosure of their impacts, either in an EA or in an Environmental Impact Statement. Most of the major actions in this CCP were fully analyzed in the draft CCP/EA and are described in enough detail to comply with NEPA, and will not require additional environmental analysis. Although this list is not all-inclusive, the following projects fall into that category:

- The HMP, including its specified restoration projects and habitat management programs.
- The white-tailed deer management plan.
- Constructing a boardwalk into Tinicum Marsh.
- Controlling invasive plants.
- Changing our priority public use programs, with the exception of new hunting and fishing proposals if applicable.

The current fire management plan has already completed the NEPA analysis process. Those environmental documents can be requested from refuge headquarters.

4.4 Refuge Goals, Objectives, and Strategies

4.4.1 Land Protection

We will continue to work with willing sellers and in partnership with other agencies and organizations to acquire the remaining 207 acres within the refuge's approved acquisition boundary.

4.4.2 Habitat Management

Habitat management will expand freshwater tidal marsh restoration within the refuge. Since protecting and preserving Tinicum Marsh is one of the refuge's establishing purposes, and it supports the greatest number and diversity of species of conservation concern, we will increase management resources for

controlling or eliminating invasive species, restoring freshwater tidal marsh, and monitoring and adapting to climate change.

Forest habitat restoration will also be expanded. This includes the restoration of a 15-acre forest stand currently dominated by a nonnative gray poplar to a mix of native coastal plain tree species. We will also initiate a deer management program. Controlling the size of the resident deer herd will improve natural regeneration of native species and enhance habitat for other wildlife such as birds, amphibians, reptiles, and small mammals.

Habitat management on the refuge will expand utilization of partnerships to enhance biological programs. In doing so, our staff can leverage the resources and expertise of our various partnerships to accomplish the goals and objectives we have set forth.

Habitat types predicted under this plan are displayed on map 4.1.

4.4.3 Inventory and Monitoring

We will continue existing monitoring and inventory efforts as long as they continue to provide useful information that will inform us about the effectiveness of habitat management, habitat adaptation to climate change, and we have the necessary resources to accomplish them. We will target any alterations or additions to these ongoing surveys toward helping us understand better the implications of our management actions and ways to improve our efficiency and effectiveness. We will also continue to seek ways to reduce our management costs for establishing and maintaining monitoring protocols.

We will expand our inventory and monitoring to inform our understanding of how sea level rise may impact our long-term habitat management. Long-term monitoring stations dedicated to measuring parameters related to marsh response to sea level rise will be monitored throughout the life of this CCP. We will also expand biological inventories and monitoring projects to improve our knowledge and understanding of species that utilize the refuge.

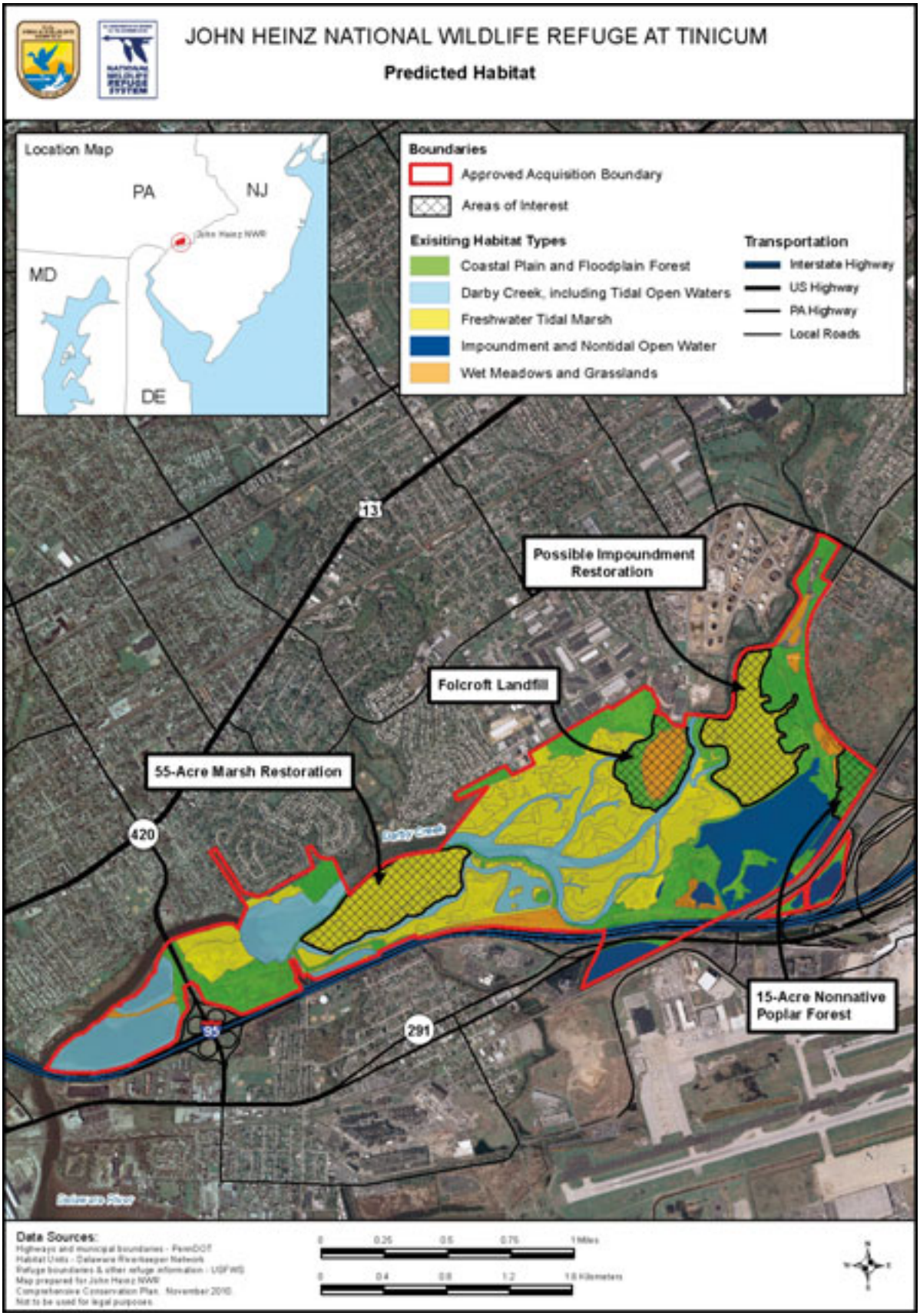
4.4.4 Visitor Services

We will expand existing opportunities for five of the six priority public uses, with an emphasis on expanding our environmental education program. Map 4.2 presents the current and proposed public use facilities under this plan. We will use the results of the Environmental Education Stakeholder Needs Assessment Phase II (Wells and White 2011) to help refuge staff develop a series of environmental education programs that are unique to the refuge.

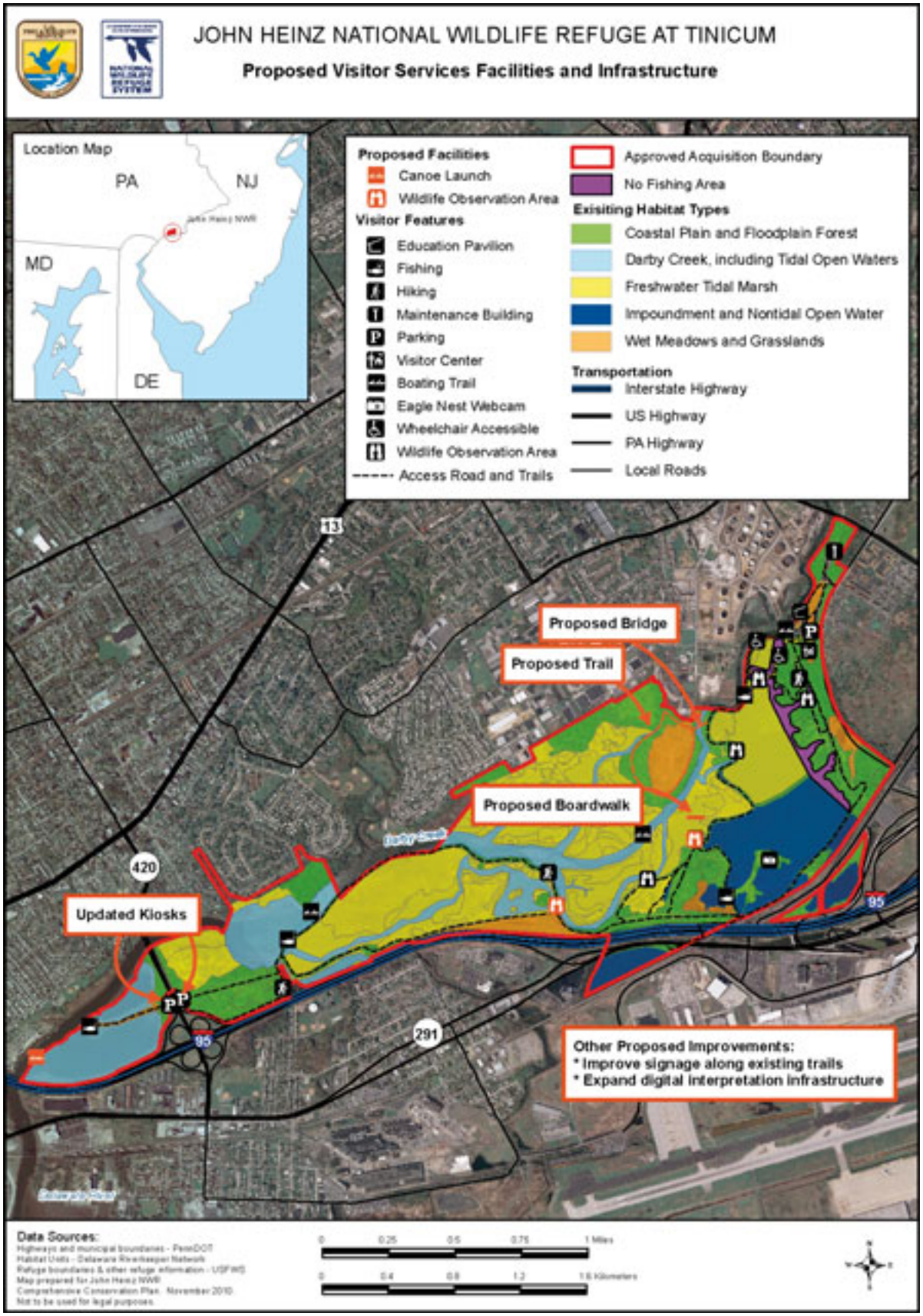
Environmental interpretation will also be updated and improved. Refuge interpretive infrastructure such as signs, kiosks, and displays will be improved and updated, and additional kiosks will be added. We will also provide more interpretive options readily accessible to urban youth and more technologically savvy visitors such as podcasts, virtual tours, and interactive programs available via the refuge Web site, cell phone, or podcast-based self-guided tour options. We will also provide more programs and materials in different languages and for visitors with disabilities.

Because of our efforts to expand programs and facilities under this plan, we expect total refuge visitation to increase. We estimate total refuge visitation to reach approximately 196,300 visits over the life of the plan. Most of this increase is expected in onsite environmental education, interpretation, and wildlife observation.

Map 4.1. Proposed Habitats Comprising John Heinz NWR



Map 4.2. Proposed Visitor Services Facilities at John Heinz NWR



In expanding opportunities for compatible wildlife-dependent recreation, we hope to contribute to communities and businesses around the refuge, both in terms of health and well-being, and economically. We will join other agencies and organizations to promote connecting children with nature. A growing body of research suggests that a lack of direct involvement with the outside world may be contributing to a variety of social issues affecting children today (Louv 2005). By offering places and programs where children and their parents can observe wildlife in natural settings, and participate in other wildlife-dependent recreation such as photography and fishing, we will contribute to the growing national initiative to reconnect children with nature.

4.4.5 Refuge Administration

Under this plan, we will expand refuge staff to support expanded habitat management efforts and increases in the visitor services program. We propose to add up to five positions: a regional visitor services coordinator (stationed at the refuge), a park ranger/volunteer coordinator, a biological technician, a maintenance worker, and an administrative assistant (see proposed staff chart in appendix D). We will base any increases in staffing on available sources of funding, and will make personnel decisions based on regional and refuge priorities.

We propose expanding administrative facilities to accommodate the additional staff and collocate refuge law enforcement with the other refuge programs (see appendix J for conceptual design plan). Under current management, maintenance and law enforcement are housed in a separate building located approximately one-quarter mile from the visitor center and refuge's administrative offices. Expanding existing offices to collocate all staff will allow the refuge to achieve the regional priority of housing all refuge programs under the same roof to improve cross-program coordination. All other facilities will be maintained and upgraded to meet safety and accessibility requirements over the 15-year life of the plan.

4.4.6 Goals, Objectives, and Strategies to Meet Refuge Goals

GOAL 1. **Protect, maintain, and restore where possible, the biological integrity, diversity, and environmental health of southeastern Pennsylvania Coastal Plain ecological communities that are unique to the refuge and sustain native plants and wildlife, including species of conservation concern.**

Strategies that apply to all objectives under this goal include:

- Recruit, hire, and train interns, volunteers, and students to assist with aspects of biological management including invasive species control and biological monitoring.
- Support Friends of Heinz Refuge to assist with aspects of biological management such as invasive species control.
- Continue to develop memorandums of understanding or memorandums of agreement for in-holdings to allow for habitat management and law enforcement, where important for maintaining refuge resources and public safety.
- Work with PENNDOT and Philadelphia International Airport to evaluate the extent of effects on the refuge of traffic and airport noise on birds, amphibians, and other wildlife in order to determine if a sound barrier is needed and if so, the most effective size, type, and location of sound barriers around the refuge.

- Within 7 years of plan approval, coordinate with partnering agencies and non-governmental organizations to conduct plant and animal species inventories and monitoring to obtain updated information on refuge populations, their distribution, and indicators of habitat use.

Objective 1.1 Freshwater Tidal Marsh

Over the next 15 years, protect the existing 282 acres of freshwater tidal marsh within the refuge, improve 55 acres of this existing habitat, and acquire and restore up to 70 additional acres as opportunities arise. Restore up to 103 acres to freshwater tidal marsh throughout the refuge. Restored and improved marsh will be dominated by native marsh vegetation including, but not limited to, wild rice (*Zizia aquatica*), spadderdock (*Nuphar lutea*), pickerelweed (*Pontederia cordata*), and tick-seed sunflower (*Bidens* spp.). Restored marshes will reestablish greater than 80 percent coverage of native marsh plant species and tidal hydrology that inundates greater than 90 percent of the marsh plain surface with shallow water (less than 1-foot maximum depth) at mean high tide and results in the development of natural channels across the marsh plain surface.

Rationale

Approximately 5 percent of the original acreage of freshwater tidal marsh remains within the Delaware Estuary, amounting to 28,921 acres (11,709 hectares) based on the latest available 1980s data from the National Wetland Inventory. Nevertheless, the Delaware Estuary still supports more of this marsh type than any other estuary in the nation (Kreeger et al. 2010). The Pennsylvania Natural Heritage Program estimates that Philadelphia County at one time contained 6,400 to 12,800 acres (10 to 20 square miles) of freshwater tidal marsh (PNHP 2008). Historically, these wetlands provided an important breeding spot for many bird, mammal, fish, and insect species. It was also a critical stopover site for migratory waterfowl and shorebirds during their annual migrations. Today, John Heinz NWR protects the largest remnant of freshwater tidal marsh, roughly 285 acres (one-third square mile) that remains in this part of the State (PNHP 2008). Freshwater tidal marshes are some of the most biologically productive ecosystems in the world: containing high plant diversity and supporting more bird use than any other wetland type (Mitch and Gosselink 1993). Coastal marshes (including freshwater tidal marshes) are among the highest priority habitats within Bird Conservation Region 30 due to impacts from surrounding land use, rates of loss, or lack of information on present spatial distribution (USFWS 2008a).

Although this remnant area of freshwater tidal marsh has been severely degraded over the years, it still supports a variety of species unique to the surrounding landscape and region. Nine of the 22 priority species of conservation concern identified in the refuge's HMP are primarily associated with this habitat type. At least another 8 of these 22 species also use the marsh habitat. Vegetation structure, microhabitat conditions (elevations relative to mean high tide, presence of small channels across the marsh plain, occasional shrubs or small trees), and landscape context (surrounding land use, size, and contiguousness) are more critical habitat components for species of concern, rather than specific plant species. However, the presence of high marsh, that is, portions of marsh that are at the upper extent of the high tide fluctuation and subject to shorter durations of inundation tend to support a greater variety of plant species and suitable nesting sites for species such as American bittern, least bittern, king rail, and marsh rice rat.

Several State-listed endangered or threatened waterbird species use wetlands across the refuge including American bittern, great egret, king rail, and least bittern. These species primarily use a combination of the freshwater tidal marsh habitat and nearby open waters such as Darby Creek and the impoundment. The freshwater tidal marsh provides breeding habitat for all of these State-listed species, while the open waters provide foraging habitat.

Protecting and preserving Tinicum Marsh is one of the originally mandated purposes of John Heinz NWR. Given these factors, we consider restoration and conservation of freshwater tidal marsh to be the highest priority for habitat management. The Restoration Management Plan for Lower Darby Creek identifies areas of historic tidal marsh that have been severely altered along with the approximate date of impact (Salas et al. 2006). Some of these areas are suitable locations for restoration of tidal marsh habitat. Refuge staff has recently restored approximately 10 acres of tidal marsh that was previously dominated by phragmites. Under this plan, we will pursue additional restoration of freshwater tidal marsh with the understanding that (a) restoration of existing degraded systems to freshwater tidal marsh will provide greater conservation benefit for an unspecified duration, (b) to the extent possible, restoration efforts must incorporate some resiliency to accommodate potential effects of climate change (e.g., sea level rise), and (c) that, with sufficient monitoring and evaluation, we will be able to apply adaptive management to marsh areas in light of actual changes in sea level rise and salinity.

About 60 acres of the refuge's tidal marsh are currently dominated by nonnative phragmites. Many of these populations are smaller than 0.5 acres. Marsh vegetation and elevation surveys completed in 2005 documented the correlation between marsh plain elevations and species composition (Salas et al. 2006). Phragmites was found to generally inhabit the same zone as the highly diverse areas of high marsh which provide the most suitable nesting habitats for waterbirds (Weller 1961, Palmer 1962, Meanley 1969, Kushlan 1973, Harrison 1978, Aniskowicz 1981). As such, controlling and reducing the coverage of phragmites across the freshwater tidal marsh will provide improved breeding site opportunities.

Planned restoration for a 55-acre area dominated by phragmites will restore tidal hydrology across a marsh surface. The restoration is intended to not only restore a native freshwater tidal marsh plant community, but also expand available aquatic habitat. Strategy 3 of the National Fish Habitat Action Plan (NFHAP 2006) (Reconnecting fragmented river systems and spawning and nursery habitats) will be addressed in development of this project. Planned marsh design will incorporate surface channels similar to those present under reference conditions in other portions of the marsh.

Recent reports projecting the potential effects of climate change, have underscored the high importance of monitoring freshwater tidal and other coastal marshes for their long-term conservation (USFWS 2008, Kreeger et al. 2010). Due to the unique landscape context of John Heinz NWR being situated within the Philadelphia metropolitan area, at the base of a highly urbanized watershed and at the confluence of Darby Creek with the Delaware River, as well as being less than 1 mile upstream from the river's salt line, the refuge's freshwater tidal marsh is particularly vulnerable to changing sea levels. Alteration in the balance of marsh elevations, sediment accretion rates, sea levels, and salinity can have major impacts on the existing marsh area. SLAMM modeling completed for the wetlands within John Heinz NWR indicates that up to 92 percent of the refuge's tidal marsh may be converted to shallow open water habitat over the next 100 years, depending on the extent of sea level rise. Recent literature (Chen et al. 2006, Monaghan et al. 2006) indicates that the global rise in sea levels is progressing more rapidly than was previously assumed, perhaps due to the dynamic changes in ice flow omitted within the IPCC report's calculations (Clough et al. 2010). At this time, it is unclear to what extent sea level will rise and how it might affect the refuge (UCS 2008). Due to this uncertainty, the refuge needs to create a marsh monitoring program to document and evaluate local trends in sedimentation rates, vegetative cover and species composition, as well as changes in percent of marsh surface as open water at low tide. During

the summer of 2010, scientists from the Academy of Natural Sciences and the Partnership for the Delaware Estuary have initiated research related to sea level rise, marsh accretion rates, and the nitrogen removal capacity of the freshwater tidal marsh within the refuge. Continuing to support this needed research will help develop baseline data necessary for tracking the long-term trends in the hydrogeomorphology and vegetation composition of the marsh.

Setting up long-term monitoring stations within the refuge will be critical to the ongoing protection of Tinicum Marsh. We are working with the Academy of Natural Sciences and the Partnership for the Delaware Estuary to monitor parameters related to sea level rise, marsh accretion rates, and the nitrogen removal capacity of the freshwater tidal marsh within the refuge. These researchers are establishing SETs at various locations on the refuge.

SETs measure changes in marsh elevation at the millimeter scale, on an annual, and in some cases, seasonal basis. This level of precision is required to track very slow accretion or subsidence rates over time. Installation of marker horizons at SETs helps to differentiate if subsidence or accretion is most impacting marsh elevation changes. Establishment of high-quality, permanent elevation benchmarks, at or near SETs, as mentioned above, allows tracking marsh elevation changes relative to a common vertical datum or mean sea level. SETs can be used to determine a marsh's change in elevation due to response to climate stressors such as sea level rise and non-climate stressors including management activities like prescribed burning and invasive species control.

These SETs will be incorporated into the Service's regionwide effort to monitor changes to surface elevations on refuges across the northeastern Atlantic coast. Working with all Service programs, states, and other partners we can make meaningful contributions to address tidal marsh stressors and increase marsh health and resilience. This comprehensive approach is our best opportunity to preserve existing tidal marsh habitat and to understand (and address where needed) the rate of change as sea level rises.

Although restoration of tidal marsh is a priority for the refuge, the refuge's proximity to Philadelphia International Airport may be of concern. Collisions between wildlife and aircraft are considered rare, but can be catastrophic (USDA 2010). It is important for us to work with airport management to address any potential negative effects of refuge habitat restoration on airport operations.

Strategies
Continue to:

- Provide technical support to restoration efforts upon request and to targeted projects, such as the following:
  - Tinicum Township/Long Hook Creek wildlife and riparian corridor restoration.
  - Philadelphia International Airport marsh mitigation/restoration.
- Use existing biological datasets to guide species and habitat management restoration.
- Continue annual aerial spray treatments to control 10 to 15 acres of phragmites-dominated wetlands.
- Participate in spill prevention, control, and countermeasure plans or other environmental emergency action plans as related to protection of Darby Creek, open water and tidal wetlands on refuge lands.

Upon plan approval:

- Work with Philadelphia International Airport management to conduct an assessment of wildlife hazards prior to implementing wetland restoration projects on the refuge. The assessment will evaluate potential impacts of restoration projects on airport operations and ways to mitigate any potential negative effects on the airport.

- Pursue funding for additional marsh restoration projects and complete marsh restoration as funding allows.

- Control nonnative, invasive species focused primarily on phragmites and purple loosestrife through a combination of aerial herbicide application, and spot treatments throughout the growing season when populations exceed greater than 5 percent (10 acres) areal coverage across the existing 282 acres of freshwater tidal marsh.

Within 5 years of plan approval:

- Work with the Service's Chesapeake Bay Ecological Services office to complete the restoration of a 55-acre wetland area dominated by phragmites to freshwater tidal marsh subject to daily fluctuation in tidal hydrology and dominated by a mix of native species such as pickerelweed, spadderdock, and wild rice. Restored marshes will contain a network of channels across the marsh surface that resemble the pattern, dimension, and profile of channels within reference marsh areas in order to provide foraging and nursery habitat for fish.

- Develop an assessment and prioritization list of potential freshwater tidal marsh wetland restoration projects on the refuge in accordance with the refuge's HMP and the Restoration Management Plan for the Lower Darby Creek.

- Identify and implement where feasible adaptive management strategies to minimize potential impacts of a changing climate.

- Conduct a series of inventory surveys or reviews of species and habitat use of the 145-acre impoundment and freshwater tidal marsh to evaluate benefits to wildlife of open water, managed mudflat, and tidal marsh habitats.

Within 10 years of plan approval:

- Work with partners, including the Philadelphia International Airport and Tinicum Township, to complete a study evaluating the environmental effects of restoring some (about half) of the 145-acre impoundment to freshwater tidal marsh.

- If we determine restoration is desirable, complete a restoration plan detailing the optimal size, location, and components for restoration of part of the 145-acre impoundment to freshwater tidal marsh and provide improved water control management and habitat enhancement of the remaining impoundment area. The impoundment restoration plan should address effects of potential changes in flood elevations on the impoundment's existing (or new) dikes, water control structure(s), and other structures on or near the refuge and determine if these structures need to be modified or removed.

Within 15 years of plan approval:

- If we choose to develop a restoration plan, work to obtain funding for restoration of the 145-acre impoundment. Implement restoration plan if funding is obtained.

- Implement the restoration of a 27-acre wetland area dominated by degraded floodplain forest.

Monitoring Elements
Continue to:
- Support ongoing research related to sea level rise, marsh accretion rates, and nitrogen removal capacity within tidal marsh by the Academy of Natural Sciences.

Within 5 years of plan approval:
- Monitor and adapt marsh restoration projects to address effects of climate change to the extent practical.

- Partner with local universities and regional researchers to define a baseline monitoring plan that continues monitoring of variables related to climate change impacts within the existing marsh. Utilize partners to evaluate monitoring data to verify accuracy of previous and current model results.

Within 10 years of plan approval:
- Begin to evaluate the feasibility of expanding the refuge's acquisition boundary to address rising sea level caused by climate change because much of what is currently within the refuge boundaries could be under water in the next 50 to 100 years.

Objective 1.2 Coastal Plain and Floodplain Forests

Over the next 15 years, acquire, restore, and manage up to 313 acres of forested communities (52 acres of coastal plain forest and 261 acres of floodplain forest) to provide healthy foraging and stopover habitat for migratory bird species and provide breeding habitat for the coastal plain leopard frog by maintaining a canopy dominated by native trees, increasing native understory shrub and sapling cover by 10 percent, and at least a 15 percent reduction in areal coverage of herbaceous, invasive species as compared to levels inventoried in 2005.

Rationale
Coastal plain and floodplain forests provide important habitat for migrating passerine species. The Atlantic coastal plain in Pennsylvania was historically found only in a 1 to 5 milewide strip along the lower 50 miles of the State's Delaware River frontage. The coastal plain and floodplain forest types covered a significant portion of Philadelphia, supporting a suite of species common to forests further south (PNHP 2008). Focal species of concern identified for this habitat within the HMP (appendix C) include northern oriole, prothonotary warbler, wood thrush, and worm-eating warbler. Other associated species such as the Swainson's warbler, cerulean warbler, Kentucky warbler, Acadian flycatcher, and yellow-throated vireo, are all primarily associated with forested wetlands and have high concern scores within the Mid-Atlantic Coastal Plain (PIF 1999).

The prothonotary warbler and other landbirds utilize mature deciduous floodplain, riverine, and swamp forests primarily for migratory stopover and foraging habitat at the refuge (DeGraaf et al. 1980, Christman 1984). Although this species will utilize the drier portion of the forested wetland gradient, flooded habitats have been shown elsewhere to be preferred and of higher quality (Petit and Petit 1996). Prothonotary warblers are secondary cavity nesters and a good indicator species for permanently flooded forested wetlands. Prothonotary warblers are widespread throughout the extensive swamps and riverine forested wetlands within the Mid-Atlantic region (PIF 1999). However, these habitats are largely unrepresented in this portion of Pennsylvania and along the Delaware River. Regional conservation plans developed by Partners in Flight (PIF 1999) and the Atlantic Coast Joint Venture (USFWS 2008) both emphasize the need

Wood Thrush

Bill Thompson/USFWS

for inventory and monitoring of nesting sites for forested wetland nesting species such as prothonotary warbler, wood thrush, and worm-eating warbler.

The coastal plain forest also supports the single nest location for bald eagles on the refuge. The refuge is identified on a list of bald eagle watching sites in Pennsylvania and the successful breeding pair has drawn wide media attention to the refuge. Given that the breeding territory size of eagles ranges between 1,700 and 5,300 acres (Gerrard et al. 1992, Anthony et al. 1993), we do not anticipate any additional nesting pairs of eagles to be found on the refuge. However, the existing coastal plain and floodplain forest continue to provide a visual and acoustic buffer for the successful breeding pair currently on site.

Species associated primarily with other habitats for foraging also use forested areas for nest sites. For example, bald eagles (primarily associated with the impoundment and Darby Creek habitat) require forested areas for nesting sites. Since these forest communities provide diverse habitat for a variety of landbirds, reptiles, amphibians, and small mammals, providing a mixed age stand including natural tree regeneration, primary and secondary canopy, as well as a shrub and herbaceous understory, will help maximize the biological potential available on the refuge for the species that stopover during migration or breed within this habitat type.

Under this plan, we will begin large-scale restoration of the 15-acre forest area currently dominated by the nonnative gray poplar. We will clear canopy trees, control re-sprout saplings, and plant an assemblage of canopy species typical of other coastal plain forests found on the refuge, such as pin oak and sweetgum. We will also allow grasslands that are too small to provide breeding habitat for species of regional conservation concern to transition to coastal plain and floodplain forest. These areas will be contiguous with surrounding rare forests of similar type, thereby maintaining connectivity. Forested habitats also require less maintenance than early successional habitats (like grassland and shrubland) once restored. We do not anticipate a mature forest development over the 15-year life of this CCP. Instead, we aim at creating an early successional forest habitat in transition to eventually becoming a mature coastal plain forest.

One of the most critical habitat components within forested ecosystems is a well-developed forest structure including canopy trees, sub-canopy trees, understory

shrubs, and a diverse ground cover. These structural components provide numerous feeding opportunities as well as protective cover to escape predation. Much of this natural structure has been severely altered within John Heinz NWR as a result of excessive deer browse as documented in the Restoration Management Plan for Lower Darby Creek (Salas et al. 2006) and more recently in the draft deer management plan (D'Angelo 2012). The impacts of deer on forest ecosystems and their habitat components has been well documented, including their status, trend, and impact within Pennsylvania (Latham et al. 2005). Long-term preservation of nesting habitat, conservation of high-quality habitat, and restoration of degraded areas will not be feasible with continued impacts of an unsustainable deer population.

Reduction of plant species diversity and richness is a commonly noted effect of deer overpopulation. On long affected sites, the establishment and dominance of browse resilient species often is the result. Consequently, deer browse can have a measured effect on the balance between native and introduced species. Studies have repeatedly shown that deer avoid nonnative species such as garlic mustard, Eurasian honeysuckle, Japanese barberry, and tree-of-heaven if other sources of food are available (Latham et al. 2005). Deer abundance also alters ecosystem structure by reducing densities of understory trees and eliminating shrubs. Research in central Pennsylvania indicated that the occurrence of canopy gaps increased by 41 percent on lands where deer control efforts were prohibited as compared to State lands where control efforts were undertaken (Pederson and Wallis 2004).

The adverse effects of excessive deer browse are not limited to plant species. It can also alter ecosystems to the extent that they become unfavorable habitats for other wildlife. Gray squirrel, white-footed mouse, and some amphibian species have been shown to decline in areas highly browsed by deer (Elliot 1978, Nixon and Hanson 1987). Subsequently, predators of these species, i.e., owls, hawks and other carnivores, decline (Flowerdew and Elwood 2001). At a site in Virginia, a reduction in forest plant species densities also leads to increased nest predation and lower bird abundance (Leimgruber et al. 1994). These results were reinforced by a study of songbird and deer population relationships in British Columbia that found a 93 percent decrease in bird species dependent on understory vegetation (Allombert et al. 2005).

In addition to impacts of overabundant deer on refuge wildlife, high deer populations may also increase the prevalence of the Lyme disease-bearing deer tick. This concern is discussed in more detail in the section on wildlife diseases included in chapter 3.

Refuge biologists have been conducting deer population inventories for more than 10 years. These surveys involve counting deer that are driven systematically from various portions of the refuge. The results of refuge surveys have consistently recorded population numbers in the range of 60 deer per square mile. Forward Looking Infrared counts completed by USDA Division of Wildlife Services generally confirmed similar population densities on the refuge in 2009. By comparison, a deer and songbird population relationship study in northwestern Pennsylvania concluded that the threshold level for negative effects on songbird richness was between 20 and 38 deer per square mile (deCalesta 1994).

In partnership with the USDA Division of Wildlife Services, refuge biologists are currently finalizing the deer management plan. This plan will inventory and evaluate the level of deer browse pressure on the refuge habitats and develop population management recommendations based on measurable results from browse surveys and vegetation transects. This plan guides deer management

based on actual impacts to refuge habitats, rather than attempting to achieve an arbitrary density estimates (i.e., deer per square mile or set number of individuals) (D'Angelo 2012). We will reduce the deer herd over the course of several years to a level that will allow adequate regeneration of native plants and benefit the habitat and other wildlife on the refuge. We will use wildlife control specialists to control the deer population. Other land managers throughout the Philadelphia area have used similar specialists to successfully reduce and manage deer populations, most notably, the Fairmount Park Commission and Valley Forge National Historical Park.

As part of the deer management plan, fenced vegetation plots that exclude white-tailed deer are incorporated into long-term monitoring. These plots will be used to gauge the potential for natural forest regeneration when browsing by deer is suppressed. Fenced plots will be paired with nearby unfenced plots.

Most invasive plants reduce the availability and quality of native habitats, and these can have major impacts on priority bird species (USFWS 2008). The Restoration Management Plan for Lower Darby Creek documented extensive invasive species populations within the coastal plain and floodplain forest ecosystems (Salas et al. 2006). Multiflora rose, garlic mustard, Japanese honeysuckle, Japanese stiltgrass, and mile-a-minute vine are the most common invasive plant species found throughout forested habitats (Salas et al. 2006). An abundance of invasive species can result in reduced biodiversity and poor habitat quality. Invasive herbaceous and vine species can dominate the forest understory and prevent or inhibit tree and shrub regeneration. Many floodplain forest restoration projects in and around the Delaware Valley have not been successful at restoring this habitat type due to competition by nonnative, invasive species (PNHP 2008). Oriental bittersweet, Japanese hops, Japanese knotweed, Chinese wisteria, and bush honeysuckle are also major invasive species in this habitat at John Heinz NWR. In a few cases, some native birds of concern, including northern saw whet owls, have benefited from the cover provided by entanglements of invasive vines including Oriental bittersweet and Japanese honeysuckle.

A portion of the floodplain forest located in the southeastern portion of the refuge is dominated by a hybridized, nonnative gray poplar (*Populus x canescens or alba*). This 15-acre area also contains other nonnative species including wineberry (*Rubus phoenicolasius*) and the invasive annual mile-a-minute vine. Regeneration within this portion of forest is dominated by new sprouts of gray poplar within canopy gaps. Surrounding forests are dominated by native coastal plain and floodplain forest species such as pin oak, wild black cherry, sweetgum, and green ash; however, these species have historically been unable to compete with the nonnative and fast growing poplar species.

Strategies
Continue to:

- Reforest naturally occurring canopy gaps within the 15-acre stand of nonnative poplar with native tree species.

- Install occasional tree plantings to close canopy gaps and supplement poor regeneration due to deer browse pressure. Protect saplings with individual deer exclosures to minimize browse and decrease associated tree mortality.

- Finalize the deer management plan drafted by USDA Division of Wildlife Services.

- Restrict public access to eagle nesting areas during the breeding season and limit public access to areas of the refuge used by other rare species during their breeding seasons as needed.

Within 5 years of plan approval:

- Reduce and then maintain resident deer populations through the use of wildlife control specialists, based on recommendations of the finalized deer management plan, to reduce deer population densities, improve the available deer habitat, improve tree regeneration, and reduce potential conflicts with human populations (e.g., risk of deer/vehicle collisions). Monitor regeneration for density, plant richness, and diversity within established monitoring plots.

- Adapt long-term management plan for forest habitats to create mixed-age stands of hardwood species identified as primary components of coastal plain and floodplain target communities.

Within 10 years of plan approval:

- Initiate phased restoration of 15 acres of nonnative, poplar-dominated forest to establish a successional trajectory towards coastal plain and/or floodplain forest communities containing biological diversity and integrity similar to other forest habitats existing on the refuge.

- Restore at least 8.3 acres of existing cool-season grasslands to at least 50 percent cover by coastal plain forest species (7.7 acres near the 10-acre marsh restoration site and an additional 0.6 acres of the grasslands restored as part of the oil spill wetland mitigation site).

Monitoring Elements

- Continue to monitor deer browse impacts using USDA Animal and Plant Health Inspection Service protocols to help adaptively manage deer population control efforts.

Objective 1.3 Darby Creek

Over the next 15 years, manage on-refuge inputs to Darby Creek to reduce contaminants, reduce stormwater impacts from the refuge, and provide spawning, nursery, foraging, and cover habitat for anadromous (e.g., herring, alewife) and catadromous (e.g., American eel) fish populations and other Federal trust species.

Rationale

Tidal portions of Darby Creek, in combination with freshwater tidal marsh, provide a unique and productive habitat for many fish species. Some estuarine species, such as killifishes and mummichogs (*Fundulus spp.*) complete their entire life cycle in estuarine portions of rivers, creek, and tidal marshes. Anadromous fish, such as the blueback herring and alewife, use tidal streams and rivers like Darby Creek and its side channels as nursery habitat for juveniles (Odum et al. 1984). American eel, the only catadromous fish species in Atlantic Coast estuaries, spends most of its adult life in freshwater and are common in tidal creeks, rivers, and marsh channels (Lippson et al. 1979). Waterfowl like the American black duck, lesser scaup, and northern pintail as well as shorebirds like black-bellied plover, greater yellowlegs, and semipalmated sandpiper also utilize open water habitats along Darby Creek for migratory stopovers. These species are all noted as high management priorities in plans such as Mid-Atlantic Coast Bird Conservation Region Plan (USFWS 2008a), the Service's Birds of Conservation Concern list (USFWS 2008b), and Pennsylvania's Wildlife Action Plan (PGC and PFBC 2008).Thus, improving water quality and restoring suitable channel morphology where possible is critical to maintaining healthy biological

integrity, diversity, and environmental health parameters that support fish and bird species.

The National Fish Habitat Action Plan outlines several management strategies that can help guide aquatic habitat management on the refuge, as well as connecting habitats both up and downstream (NFHAP 2006). Restoration efforts by local and regional organizations within the Darby Creek watershed support components of Strategy 2 of the National Fish Habitat Action Plan (restoring natural flow and habitat variability to streams and rivers). Dam removal and other fish barrier removal efforts along Darby Creek support Strategy 3 (reconnecting fragmented river systems and spawning and nursery habitats). While these efforts are mainly located beyond the boundaries of John Heinz NWR, Strategy 3 can be supported at the refuge by freshwater tidal marsh restoration efforts that incorporate the development of shallow, sinuous, marsh surface channels that support spawning and nursery habitat for estuarine and freshwater fish species.

As previously described in detail in chapter 3, section 3.7, water quality within the refuge is a highly variable and complex phenomenon. Due to the complexity and regional scale of these water quality impacts, there is little that can be done to alleviate these concerns through management on the refuge. However, John Heinz NWR can play an active role in coordination and technical assistance toward efforts that result in improved water quality on and off the refuge. The geographic location of the refuge at the base of the Darby Creek watershed and near the Delaware River, make it an ideal location for environmental education and interpretation of watershed-based impacts to the refuge, fish, and wildlife.

Given the relative stability of the channel itself, and available habitat provided by adjacent marsh channels, overhanging vegetation, and large woody structure, the largest management concerns are related to the water quality and environmental health of waters entering the refuge. Much of the management related to Darby Creek at the refuge level relates to prevention, response, and monitoring. Given the potential for hazardous spills from neighboring roads, trains, tank farms, industrial sites, and communities, refuge staff annually reviews and updates the refuge's spill response and coordination plans. Under this plan, we will continue to support the variety of ongoing efforts to monitor basic water quality parameters within Darby Creek.

We will continue to implement best management practices, such as adhering to instructional labels when applying herbicides, to protect against potential contamination of the tidal rivers and other open tidal waters that could be impacted by refuge management activities.

We will also install water quality monitoring equipment along Darby Creek within the refuge. To date, it has been difficult to adequately gather and analyze the variety of data sets collected by agencies and volunteer-based monitoring groups. Improved and automated collection of long-term data will inform our refuge biologist on changes in long-term trends, timing (and potential affects) of acute changes in water quality, and long-term trends in salinity.

Strategies
Continue to:
- Maintain existing partnerships to assess and manage for water quality improvements impacting the refuge.

- Coordinate with USEPA and other stakeholders to complete remediation of Folcroft and Clearview landfills and minimize environmental health impacts related to contaminants associated with these sites.

- Annually, review and refresh staff in spill response protocols and emergency protection measures.

- Assist Chesapeake Bay Ecological Services office in coordinating and providing technical assistance to fish passage, stream, and riparian restoration projects within the Darby Creek watershed that have potential to increase available habitat for species utilizing the refuge or improvements to water quality.

Over the life of the plan:
- Where feasible, install stormwater management systems, such as vegetated swales or rain gardens to minimize stormwater runoff from the refuge and surrounding lands.

Monitoring Elements
Continue to:
- Support volunteer-based water quality monitoring along Darby Creek on the refuge as resources allow.

- Support of occasional and ongoing research to evaluate fish tissue surveys, contaminant level accumulation, and other environmental impacts of environmental hazards.

- Complete installation of a water quality monitoring unit along Darby Creek on the refuge to implement long-term and continuous monitoring.

Within 5 years of plan approval:
- Install a network of water quality monitoring equipment along Darby Creek on the refuge to implement long-term and continuous monitoring of salinity, dissolved oxygen, pH, temperature, flow rate, and other parameters.

GOAL 2. **Contribute to the enhancement of native species diversity in the Delaware Estuary, including migratory birds and other species of conservation concern, within the refuge's managed open waters and grasslands.**

Objective 2.1
145-Acre Impoundment and Nontidal Open Waters

Restore about half (78 acres) of the 145-acre impoundment to freshwater tidal marsh and manage the remaining 67-acre impoundment and 57 acres of nontidal open water (ponds) to enhance habitat available for shorebirds, waterfowl, and wading birds during their peak spring and fall migration periods, while maintaining essential habitat for other freshwater species of management concern, such as eastern redbelly turtles, through a combination of water level management, wetland restoration, and invasive species control.

To the extent practicable, these measures will include:

(1) Annually support migratory shorebirds by maintaining a mix of shallow water (less than 6 inches water depth), mudflat with sparse vegetation less than 10 percent cover), and mudflats with no vegetation, at times of peak migration (spring: May, and fall: mid-August to September).

(2) Annually support migratory waterfowl by maintaining a mix of shallow (6 to 24 inches water depth) flooded vegetation *(Carex, Polygonum, Peltandra)* at times of peak migration (spring: late March, and fall: late October).

(3) Annually support migratory wading birds by maintaining a mix of shallow remnant pools (6 to 12 inches water depth) at times of peak migration (spring: late March, and fall: late August).

(4) Sustain State-threatened eastern redbelly turtle by protecting hibernation, foraging, basking, and nesting habitat.

Rationale
As discussed in chapter 3, section 3.12 under *Impoundment and Nontidal Open Waters*, over the past several years the Service has participated in an impoundment study, managing the water levels within the impoundment to benefit migratory waterfowl, wading birds, and shorebirds with successful results (Green et al. 2008, Phillips personal communication 2008). It appears that the timed management developed as part of the study has been successful in supporting diverse bird population use of the impoundment area (Green et al. 2008, Phillips personal communication 2008). Draft results indicate that this management should be continued.

Management of the impoundment requires an adaptive approach to reduce, control, or eliminate undesirable plant species such as the invasive, nonnative purple loosestrife and the aggressive, native spadderdock, while at the same time promoting the germination of seed producing vegetation such as smartweeds and providing mudflats for benthic invertebrates. In some years, it is anticipated that the annual water level management objectives will likely require some variation from the timing most beneficial for migratory birds. To maintain extensive mudflats, annual vegetation, and shallow pools, the impoundment may occasionally require extensive inundation to prevent long-term establishment of perennial invasive species, such as purple loosestrife.

Extended inundation periods should be employed when the presence of invasive species becomes larger than feasible for control through herbicide applications. The threshold for this type of management action will be when the impoundment begins to support approximately 10 acres (7 percent) coverage of a nearly monotypic population of invasive nonnative or aggressive native species.

When timed well, this intensive form of water level management can produce beneficial habitat for a wide range of migratory and resident species of birds, reptiles, and amphibians. Unfortunately, as discussed in chapter 3, water level management of the 145-acre impoundment is currently difficult.

For this reason, under this plan, we will restore about half of the 145-acre impoundment to freshwater tidal marsh in an effort to reduce overall impoundment management and maintenance, restore additional acres of a priority habitat type, and provide improved access to this habitat for educational and interpretive purposes. Given the complexities of marsh restoration and impoundment management, the size, type, location, and cost of such restoration is unknown at this time.

Biologists have questioned how much impact the water level management has on actual bird population versus perceived populations. While the three-year impoundment study did indicate an increase in bird populations within the impoundment during migration, there were no corresponding control surveys conducted within the adjacent freshwater tidal marsh (Phillips personal communication 2010). The increase in use observed may actually be the result of birds favoring the impoundment over use of the freshwater tidal marsh during the drawdowns, which will cause a corresponding decrease within the freshwater tidal marsh.

In addition, the impoundment provides habitat for other species of conservation concern, for example the State-listed eastern redbelly turtle. It is also possible that nonnative invasive aquatic crayfishes, which represent a significant threat to the refuge's aquatic systems, occur within the refuge (Urban 2012 personal communication). Management actions, including the removal of dams and other

blockages may cause the dispersal of nonnative crayfishes, potentially allowing them to invade new areas. Therefore, we will complete a survey and analysis of both habitats to better inform the extent and location of marsh restoration within the impoundment.

The other open water areas (the 5-acre Hoys Pond and the 16-acre pond) will not be managed. These areas consist of several isolated water bodies located near I-95. Due to the shallow open water habitat, lack of species of conservation concern, and biological isolation (each pond is surrounded by heavily traveled secondary roads); we will not invest resources into long-term management of these areas. We will complete a series of inventories and evaluations related to priority species, such as the red-bellied turtle, to better inform long-term management of these areas.

Strategies

Continue to:

- Control invasive species impacting the impoundment and nearby open water habitats as feasible. Purple loosestrife (*Lythrum salicaria*) and phragmites when they spread over 5 percent (7 acres) of areal coverage across the impoundment. The aggressive native species—spadderdock (*Nuphar lutea*) when it spreads across greater than 10 percent (14 acres) of areal coverage. Control through a combination of herbicide application, mechanical controls, and water level manipulation treatments where feasible.

- Attempt management of impoundment water levels as conditions allow maximizing benefits to migrating shorebirds, waterfowl, waterbirds, and wading birds during each group's peak migration periods. Adjust drawdown timing and duration to control nonnative, invasive species when herbicide applications become a less effective option against larger populations.

- Maintain existing dike system to prevent and minimize structural damage sustained to access roads and dikes by flood events and muskrat nesting burrows.

- Close the water control structure into the impoundment during forecasted storm events to minimize stormwater runoff and pollution inputs.

- Partner with Tinicum Township to manage stormwater inputs into the impoundment and open waters along Long Hook Creek.

- Work with partners to identify and obtain resources to replace the water control system in the impoundment.

- Maintain existing wood duck and swallow nesting boxes primarily through volunteer assistance.

Within 5 years of plan approval:

- Begin to phase out some of the wood duck and swallow nesting boxes. Better monitor and manage a minimum number of boxes in a few locations as determined by the refuge manager for interpretive purposes.

- Conduct a series of inventory surveys or reviews of species and habitat use of the 145-acre impoundment and freshwater tidal marsh to evaluate benefits to wildlife of open water, managed mudflat, and tidal marsh habitats.

- Evaluate sources and locations of stormwater drainage discharging onto refuge lands and develop improvement measures such as redirecting stormwater inputs from Philadelphia International Airport to Long Hook Creek.

Within 15 years of plan approval:

- If we decide to pursue restoration of some of the impoundment, work with partners to complete and implement a restoration plan detailing the optimal size, location, and components for restoration of part (about half) of the 145-acre impoundment to freshwater tidal marsh and provide improved water control management, habitat enhancement, and visitor facilities for the remaining impoundment area (see strategies under objective 1.1 for additional details).

Monitoring Elements

Continue to:

- Support annual State and volunteer frog monitoring.
- Monitor water quality (temperature, pH, and dissolved oxygen) and water level fluctuations within the impoundment throughout the year.
- Conduct weekly inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance within the impoundment during spring and fall migrations. Use data to document the ongoing effectiveness of water level management activities and adjust management protocols as necessary.
- Conduct migratory bird surveys for landbirds, waterbirds, and waterfowl.
- Complete fisheries inventory of Hoy's Pond and the 16-acre pond on refuge lands.

In addition:

- Conduct weekly inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance within the impoundment. Use data to determine the effectiveness of water level management activities and adjust management protocols as necessary.

Within 5 years of plan approval:

- Conduct baseline eastern redbelly turtle inventory surveys and create a long-term monitoring program within the impoundment, open water areas, and the freshwater tidal marsh to determine forage, hibernaculum, and nesting sites. Where feasible, complete inventories in partnership with local universities and state agencies.
- Explore opportunities for reducing turtle nest predation through predator trapping, predator relocating, or other measures.
- Explore coordination with PFBC for potential red-eared slider removal.

Objective 2.2 Grasslands and Early Successional Habitats

Manage up to 64 acres of grasslands and wet meadows to create a mix of native grasses and flowering plants, including early successional shrubs and trees, to sustain stopover foraging and cover for migratory landbirds. Specifically,

- Annually, manage habitat around Frog Pond and Hoy's Pond fringe as wet meadow containing less than 15 percent areal coverage of tree and shrub species, no more than 5 percent bare ground, and at least 90 percent of the total areal cover is comprised of native species.
- Within 10 years of plan approval, restore biological diversity to the existing 7 acres of grasslands surrounding the visitor center and refuge entrance, so that at least 90 percent of the total areal cover is comprised of native species and support a minimum of seven species of native grasses, and seven species of native flowering plants.

Rationale
Grasslands were uncommon in the Northeast prior to European settlement, and grassland birds are of moderate concern in the region (USFWS 2008a). Fewer grasslands are available to birds throughout the Mid-Atlantic region as agricultural lands have been lost to commercial and residential development as well as natural succession. Today, grassland-dependent birds within the Mid-Atlantic region depend upon agricultural landscapes and other artificial habitats to maintain populations. Military installations, airports, golf courses, parks, recreational fields and other artificial and maintained grasslands also provide some modified types of this habitat today.

Until the past few decades, the upland habitats of John Heinz NWR were comprised of a substantially greater amount of grasslands than today (McCormick et al. 1970, McMenamin personal communication 2008). The Restoration Management Plan for Lower Darby Creek compared habitat coverage between those documented in the Two Studies of Tinicum Marsh (McCormick et al. 1970) and those identified as part of field inventories conducted in 2005 (Salas et al. 2006). Many forested areas along the existing dike system and within areas east and south of the 145-acre impoundment contained scattered trees (less than 10 percent cover) and "old field" vegetation in 1968, making the forested habitats of the refuge a relatively recent cover type. Additionally, historic aerial photographs reviewed as part of that plan documented a greater extent of grasslands east of the existing impoundment (Salas et al. 2006). Due to this relatively isolated and small (less than 100 acres) component of grassland, it is unlikely that the refuge ever had (or will be able to) contribute significantly to regional populations of priority grassland birds.

Today, many of these historic grasslands are covered by coastal plain or floodplain forest community types. Coastal plain and floodplain forests are the habitat type that is considered to be the late-successional forest community typical of the Pennsylvania Coastal Plain region. As a result of the urbanization of the Philadelphia area, few examples of this habitat are available in Pennsylvania, causing the State to list some of the associated community types as S3, or State-rare.

While the grasslands of John Heinz NWR are generally too small to support nesting of priority grassland species within the region, some grassland areas can provide suitable migratory stopover and foraging habitat for migratory birds. Additionally, these grasslands provide important habitat for focal species of concern such as the short-eared owl, sedge wren, marsh wren, and the coastal plain leopard frog. The southern leopard frog in particular is known to breed in some of the shallow permanent water and vernal pool habitats found within the refuge's wet meadow grasslands (Phillips and McMenamin personal communication 2008).

Most of the grasslands existing on the refuge today are the result of managed utility right-of-ways that intersect portions of the refuge. Utility corridors transporting oil, gas, potable water, wastewater, and electricity all pass through the refuge. Utility companies are required to maintain these areas free of trees and shrubs in order to prevent damage by root growth or wind thrown trees. Maintaining these areas without tree or shrub growth also aids utility maintenance and emergency response by facilitating efficient access to the corridor when needed.

Grasslands also require a great amount of maintenance to control invasive species and reduce woody species establishment. While there is some variation in area sensitivity among grassland-dependent birds (Ribic et al. 2010), they

generally need areas greater than 25 acres for nesting, with many preferring or requiring patches greater than 75 acres (Mitchell et al. 2000, Morgan and Burger 2008).

We must maintain some of the refuge's grasslands to protect existing pipelines that will be damaged by tree or shrub roots if the area was allowed to succeed to forest. Likewise, the Folcroft Landfill area will need to remain in early successional habitat, probably grasslands, to ensure that deep-rooted trees do not compromise the integrity of the site remediation resulting in the release of contaminants. These areas also benefit from being maintained as grassland to provide access for maintenance and emergency response. Under this plan, areas where we have identified the least habitat benefit due to a combination of maintenance needs, patch size, and current species composition will be allowed to succeed to shrub or forest. We want to maintain and enhance the remaining grasslands to provide habitat diversity, breeding habitat for coastal plain leopard frog, and for environmental interpretation purposes.

As described under objective 1.2, we will allow two main areas of grassland to transition to shrub or forest: the first is 7.7 acres along the southern edge of the refuge, along I-95 near Hoy's Pond, and the second, an additional 0.6 acres of warm-season grasslands located at the location of the 2000 oil spill mitigation site on the eastern border of the impoundment. Under this plan, we will cease regular mowing and promote the conversion of these to early successional forest and scrub-shrub habitat. This change in management will reduce resources needed for management and also create an additional habitat type to support landbirds such as prothonotary warblers and short-eared owls. In addition, we will work with utilities to discuss the feasibility of converting additional grasslands along the utility right-of-ways to scrub-shrub habitat. Providing additional benefits to the landbirds mentioned above and further reducing resources needed for management.

The remaining 64 acres of grassland found within the refuge will be enhanced though a combination of invasive species control and supplemental planting or seeding. Grasslands near the refuge entrance and along right-of-ways are comprised largely of cool-season grasses such as Kentucky bluegrass, fescue, orchard grass, and brome grass. An endophyte (*Neotyphodium coenophialum*) present in the cold-season grass tall fescue (*Lolium arundinaceum*) has been shown to have detrimental effects on herbivorous species and associated ecosystems (see summary in Rudgers and Clay 2007). Under this plan, where possible, we will undertake efforts to enhance species diversity and conversion to grasslands dominated by warm-season grasses to enhance the habitat value for landbirds of conservation concern and benefit herbivorous animals such as voles and rabbits. Some areas may not be appropriate for warm-season grass enhancements due to jurisdiction or where warm-season grasses may interfere with long-term management and protection, such as Folcroft Landfill.

Strategies
Continue to:

- Annually mow to maintain the existing 72 acres of wet meadow, grassland, and forest opening habitats for wildlife, environmental education, and interpretive purposes.

- Control invasive species impacting wet meadow and grassland habitats through a combination of herbicide application, hand pulling, and mowing.

- Maintain vernal pool and wet meadows for amphibian breeding and grassland bird stopover habitat.

- Promote warm-season grass establishment in areas previously dominated by cool-season grasses.

Within 5 years of plan approval:

- Cease annual mowing of 8.3 acres of existing grasslands targeted for successional transition into a scrub-shrub dominated habitat type.

- Begin supplemental plantings within the grasslands surrounding the visitor center to enhance species diversity so that 90 percent of the total areal cover is comprised of native species and support a minimum of 7 species of native grasses, and 7 species of native flowering plants.

- Where feasible, install stormwater best management practices, such as vegetated swales or rain gardens to minimize stormwater runoff from the refuge and surrounding lands.

- Discuss feasibility of converting portions of utility right-of-ways to additional shrub-scrub habitat in light of access, maintenance requirements, and compromising infrastructure (i.e., pipelines).

Within 15 years of plan approval:

- Complete habitat management, compatible use, and public use planning for the Folcroft Landfill site within 2 years of site remediation and release.

Monitoring Elements

Annually conduct frog call surveys of known vernal pools to monitor species and their use of areas for breeding sites. Utilize data to document sensitive breeding areas and long-term effectiveness of management activities in order to adjust management protocols as necessary.

GOAL 3. **Provide a wide range of environmental educational opportunities, focusing on urban youth, which raise awareness and understanding of the Service and the National Wildlife Refuge System, inspire appreciation and stewardship of our natural and cultural resources, and expand understanding of Tinicum Marsh as a unique component of the Delaware Estuary and the local community.**

Discussion

As discussed in chapters 1 and 2, environmental education is one of the original establishing purposes of John Heinz NWR. In its establishing legislation, the refuge was directed to develop "…a wildlife interpretative center for the purpose of promoting environmental education, and to afford visitors an opportunity for the study of wildlife in its natural habitat." (86 Stat. 891, dated June 30, 1972). The Refuge Improvement Act also identifies environmental education as a priority public use on refuges.

The Service policy on Priority Wildlife-dependent Recreation (605 FW 6) defines environmental education as activities that use a planned process to build knowledge, skills, and abilities in students and others, about wildlife-related environmental topics. Environmental education teaches students the history and importance of conservation and ecological principles, and scientific knowledge of our nation's natural resources. In doing so, we can help develop a citizen base that has the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively toward the conservation of our nation's environmental resources.

As discussed in chapter 1, section 1.5, the Service recently developed a new vision for the Refuge System. The vision, which provides guidance for the entire Refuge System over the next 10 to 15 years, was released in October 2011 (online at: *http://americaswildlife.org/vision/*). As part of its recommendations, the vision outlines an urban refuge initiative that highlights the importance and role of urban refuges in connecting with diverse audiences and a more urban population. With its natural resources, visitor facilities, and proximity to the Philadelphia metropolitan area, John Heinz NWR is well situated to help fulfill the goals for urban refuges in the Refuge System vision. It offers teachers, urban students, and other environmental education partners an opportunity to study habitat management and restoration, effects of climate change, and five different habitats including Pennsylvania's largest tidal marsh in a natural setting. The School District of Philadelphia alone manages over 280 schools and is the 8th largest school district in the United States. Over 160,000 students are enrolled in Philadelphia public schools (School District of Philadelphia 2010). Philadelphia is also one of the largest college towns in the U.S., with over 120,000 students enrolled among the 80 colleges, universities, trade, and specialty schools in the area.

As with many other states in the country, Pennsylvania has incorporated environmental education into required State curricula through the Pennsylvania Department of Education Academic Standards for Environment and Ecology. These standards describe what students should know and be able to do in the following areas: ecology, watersheds and wetlands, natural resources, agriculture and society, humans and the environment, integrated pest management, threatened, endangered, and extinct species, environmental laws and regulations, renewable and nonrenewable resources, and environmental health. John Heinz NWR, the Refuge System, and the Service can help teachers and schools meet these educational standards while raising the awareness of area students about the role of the refuge, the Refuge System, and the Service in protecting species and habitats. Students will also understand the benefits of these conservation efforts for species and society and the importance and value of the history and cultural resources on the refuge. Refuge environmental education programming should continue to incorporate science and chemistry curricula.

To encourage visitors to better understand the natural history of the area and related cultural resources, the refuge engages students in understanding cultural resources and conservation history as an introduction to environmental education lessons. No cultural or archaeological areas of significance are believed to remain on the refuge itself.

As discussed in chapter 3 section 3.14, about 9,400 students a year participate in environmental education opportunities led by their teachers or by refuge staff and volunteers. Education activities currently offered by refuge staff focus primarily on assisting teachers in developing environmental lesson plans for both onsite and offsite learning, sponsoring various onsite environmental workshops, and conducting onsite field trips for school groups. About 200 teachers a year participate in these programs. Typical audiences for existing education activities consist of School District of Philadelphia and Delaware County elementary classes, summer camps, and some interest from local college programs for sustainable architecture, landscaping, wildlife, and environmental studies. Also, see appendix H (USGS Phase 1 Environmental Education Needs Assessment) for additional information on the refuge's current environmental education program.

The study of the environment and ecology allows students to actively participate in solving real issues that affect them, their homes, their schools, and their communities. This provides a tremendous opportunity for mutually beneficial relationships between the refuge and surrounding schools. Opportunities

to support State educational standards are not limited to the study of the environment and ecology. This plan expands education programs at the refuge to incorporate subjects such as writing, math, art and history into all lesson plans. Providing refuge programming with connections to a variety of school subjects is an opportunity not only to educate, but to also inspire stewardship and connect many young people with nature who traditionally may have limited access to or experience with refuges and nature.

As staff, volunteers, and budget allow, under this plan, we expect to increase our onsite and offsite student visits from 9,400 to up to 24,000 visits, as well as maintaining our teacher training programs. To accommodate this increase, we will hire additional refuge staff and will recruit and train additional volunteers. To ensure high quality delivery of the new refuge programs, we will create a docent training program, in which volunteers are trained and evaluated with baseline competency guidelines for knowledge, skills, and abilities (examples include Philadelphia Zoo Docent Training Program and National Park Service), to provide unified and consistent programming. They would also be rewarded for their service and dedication.

There are several environmental education centers located within an hour's drive of the refuge, including the Cobbs Creek Community Environmental Education Center, Schuylkill Center for Environmental Education, Overbrook Environmental Education Center, Tyler Arboretum, and Riverbend Environmental Education Center. Our intent is to provide a site-specific education experience that focuses on the natural resources found at John Heinz NWR. To help us ensure that we are addressing target audiences and meeting the needs of environmental education participants, we initiated a study with USGS to both capture the refuge's current program (Phase I, see appendix I) and the needs of current and potential participants in the refuge's environmental education program (Phase II). The Environmental Education Stakeholder Needs Assessment Phase II report (Wells and White 2011) identifies some of the existing programs around the area, reviews demographics and potential audiences, summarizes where opportunities are available, and makes some suggestions to guide future planning. Under this plan, we will use these results to guide our future environmental education program planning, including developing new environmental education programming and completing the environmental education component of the refuge's visitor services plan.

Every national wildlife refuge is required to complete a visitor services step-down plan which will help focus visitor services efforts. Visitor services plans encompass all aspects of visitor services on the refuge, including a section on environmental education. Under this plan, the visitor services plan will identify, define, and prioritize audiences. It will also identify themed messages and topics that will apply to all environmental education and interpretation programming. Given the importance of environmental education to the refuge, and the refuge's critical role in connecting young people with nature and representing the Refuge System and the Service in an urban environment, developing and implementing a visitor services plan is particularly important at John Heinz NWR. For this reason, John Heinz NWR staff will begin writing the refuge's visitor services plan as soon as possible.

Strategies that apply to all objectives under this goal include:

- Within 2 years of CCP approval, complete the refuge's visitor services plan. This plan will: (1) specify themed messages and topics tied to refuge-specific resource conservation issues, the Refuge System mission and new vision, and the Service mission and goals, (2) be consistent among the different visitor services programs (i.e., environmental education and interpretation), and (3) identify, define, and prioritize audiences.

- Use the visitor services plan and the results of the Environmental Education Stakeholder Needs Assessment Phase II Report (Wells and White 2011) to guide the refuge's environmental education program focusing on urban schools (grades K to 12), including creating a series of lesson plans that explore the resources of the refuge that are unique to the refuge, and consistent with themed messages and topics, Expand the refuge's capacity to deliver quality environmental education programming by recruiting additional volunteers and establishing a docent training and reward program for volunteers.

- Pursue ongoing alignment of the refuge's environmental educational program with Pennsylvania State academic standards and if applicable, certifications for curricula and teacher trainings.

- If resources allow, hire two additional outreach and environmental education and interpretation staff (one will be stationed at John Heinz NWR but shared with other refuges in the Northeast Region) to help expand the environmental education program and meet the projected increase in visitation. We will also hire an additional maintenance worker to help maintain visitor facilities to support programs if resources allow (see appendix D for proposed staffing chart).

- Work with FOHR to continue funding and pursue alternative funding or grant programs if needed for supporting transportation to and from the refuge for interested and qualifying schools and groups based on the results of the Environmental Education Stakeholder Needs Assessment and actions outlined within the visitor services plan.

- Update and incorporate all appropriate media (brochures, Web site, social media, displays, etc.) to accurately communicate the environmental education components available to the public.

LaVonda Walton/USFWS

Children watching birds during a refuge interpretive program

Monitoring elements:

- Determine which schools or school districts will be defined as urban and non-urban. Monitor and record visitation by urban and non-urban schools to determine if we are reaching our target audience.
- Annually complete an evaluation summary of environmental education opportunities provided (number of programs, events, outreach efforts provided) and their utilization (number of visits, schools, teachers, and students engaged).
- Work with teachers, school administrators, and other environmental education partners to monitor and assess the efficacy of new environmental education curricula and materials. Modify the lesson plans as needed to ensure content is meeting identified priorities [i.e., curricula are (1) consistent with themed messages and topics identified in the visitor services plan (once developed), (2) relevant to urban youth, (3) staff and volunteer led, hands-on, place-based (i.e., unique to the refuge), and (4) aligned to applicable education standards.]
- Work with environmental education partners to monitor efficacy of established environmental education programs every 1 to 3 years. Monitoring efforts may include surveys developed and conducted by partners, peer observation and review, self-evaluations, verbal discussions with participants (teachers and students), record number of repeat visits (within and among years) and new participants.

Objective 3.1 Providing Environmental Education Focusing on Youth in Urban Schools

Over the 15-year life of the plan, provide a quality environmental education program at John Heinz NWR with specific themes and learning objectives. The environmental education program will:

(1) Focus on urban schools (grades K to 12).

(2) Provide a variety of programming that is site specific and relevant to the target audiences.

(3) Meet State education standards when applicable.

(4) Be based on refuge management and conservation programs.

(5) Support the missions of the Service and Refuge System.

(6) Increase student visits from urban schools to approximately 16,000 per year.

(7) Focus on providing staff-led and volunteer-led programming.

(8) Develop long-term relationships with students and at least three schools and respective school districts.

(9) Provide stewardship opportunities.

Rationale (In Addition to Discussion)
John Heinz NWR is one of four refuges within the Northeast Region (of 73 refuge units) that is located within 45 miles of a major metropolitan area[1]. Given

[1] The U.S. Census Bureau defines a major metropolitan area as containing a population of one million or more people.

its location partially within the city of Philadelphia and Delaware County, the refuge has the opportunity to form long-term relationships with local urban schools containing a population of students and teachers who traditionally may have had limited access to and experience with nature.

When asked, refuges identify transportation costs, transportation (i.e., bus) schedules, and school proximity to the refuge as three of the largest barriers to their ability to work with populations from urban environments (USFWS Northeast Region unpublished data). For John Heinz NWR, these barriers are significantly reduced as there are more than 300 urban public schools that serve over 146,000 students (grades K to 12) within the Philadelphia and Delaware County school district alone (Philadelphia School District 2011). Friends of Heinz Refuge also offers grants to schools to pay for busing. Given the important opportunity that John Heinz NWR has for working with students from urban settings, the refuge will focus limited staff and volunteer time towards working directly with students from urban schools (grades K to 12) through both on and offsite programming. The intention is to maintain and expand the current program and also to formulate long-term relationships with school districts that involve: (1) incorporation of refuge lesson plans into school curricula, (2) school participation in the program over many years, and (3) refuge staff working with students multiple times in a year. Repeated visits help students gain confidence with nature, foster a connection between students and the refuge, and increase the chances that students will feel a sense of stewardship towards the environment.

Since every school has different needs, refuge staff and volunteers will work with schools to design programming that meets Pennsylvania State standards of learning, covers a range of media (e.g., outdoor investigations, service projects, discovery hunts, etc.), and is relevant to the audience. One way we may be relevant to our audiences will be to connect with the lives of students, working to identify ways they can make a difference in solving problems and high priority issues within the local community. We will focus on environmental education programming at the refuge but will use offsite programs to develop long-term relationships with urban schools. In addition, this programming will be designed in accordance with the visitor services plan with well defined themes and topics, and with an evaluation system in place. All programming will complement the missions of the Service and Refuge System, and speak to refuge management strategies.

Strategies
In addition to the strategies presented above under strategies that apply to all objectives:

Within 7 years of plan approval:
- Maintain relationships and programming with area schools that currently visit the refuge for environmental education.

- Offer at least 12 workshops annually that focus on teaching teachers how to implement refuge environmental education programs so interested teachers are provided an opportunity to lead their own classes on the refuge.

- Work with local teachers, school administrators, and other environmental education partners to develop additional lesson plans that will enhance environmental education programs that are (1) consistent with themed messages and topics identified in the visitor services plan (once completed), (2) targeted towards urban schools and relevant to urban youth, (3) led by

refuge staff or trained volunteers and hands-on, place-based (i.e., unique to the refuge), and (4) aligned to applicable education standards.

- Review and evaluate existing components (e.g., Habitats of the Refuge, Birds of a Feather, Peoples Interaction with the Environment, teacher education courses, Microlife) of the environmental education program to determine if they meet the specific criteria identified under this objective and are effective. Modify, add, or eliminate components as needed.

- Identify local urban schools and school districts that meet our definition of targeted audiences and create a prioritized list of at least 15 of these schools.

- Use our relationship with the Interboro School District in Delaware County as a model to help develop long-term relationships with at least three additional local urban school systems from our prioritized list. A long-term relationship could include formal adoption of refuge programs into the school districts' curricula, repeated visits of refuge staff to the school, and repeated visits of students to the refuge both within the academic year and in subsequent years.

- Expand use of alternative funding or grant programs for transportation to and from the refuge for schools based on the results of the Environmental Education Stakeholder Needs Assessment Phase II Report and actions outlined within the visitor services plan.

- Have refuge staff or trained volunteers lead 200 student-focused programs per year both on and offsite, totaling about 12,000 student visits per year.

Within 15 years of plan approval:

- Continue to develop and expand course lesson plans in cooperation with local teachers, school administrators, and other environmental education partners.

- Expand long-term relationships with local schools to at least three more urban schools.

- Have staff and trained volunteers lead 275 student-focused programs per year both on and offsite, totaling about 16,000 student visits per year.

Monitoring Elements

- Work with teachers, school administrators, and other environmental education partners to annually monitor efficacy of established environmental education programs targeting urban youth. Monitoring efforts may include surveys developed and conducted by partners, peer observation and review, self-evaluations, verbal discussions with participants (teachers and students), record number of repeat visits (within and among years) and new participants.

- After new programs have been in place for 3 years, assess feasibility of developing an official Service survey to evaluate effectiveness of programs.

Objective 3.2 Environmental Education for Other Youth Audiences

Over the 15-year life of the plan, provide a quality environmental education program at John Heinz NWR with specific themes and learning objectives. The environmental education program will:

- Include programs for other youth audiences, for example home schooled students, 4H, YMCA, SeaGrant, Boy Scouts, Girl Scouts, college students, and other nonprofit youth organizations.

- Increase student participation in refuge programs by these groups to 8,000 student visits per year.

- Focus on providing teacher and group leader education.
- Provide a variety of programming that is site specific and relevant to the audiences.
- Meet State education standards.
- Be based on refuge management and conservation programs.
- Support the missions of the Service and Refuge System.
- Provide stewardship opportunities.

Rationale (in addition to the Discussion)
While our focus is on youth in urban schools, we recognize the importance and value of providing environmental education opportunities to all interested partners. Refuge neighbors and partners are crucial to helping the refuge and the Service meet conservation goals. We would like to support these groups in their environmental education efforts. Participants under this objective will include a variety of groups such as: students that are from outside of the local urban area, non-traditional K to 12 students (e.g., home-schooled students), participants in non-formal education programs (e.g., Boy Scouts, Girl Scouts), college-level students, and education providers for these groups. Because refuge resources are limited and much of the staff and volunteer time will be focused on priority urban youth audiences, environmental education programming for other youth audiences will focus on more teacher-led programs with less direct involvement from staff and trained volunteers. Ultimately, our goal will be for most educators of these audiences to independently lead refuge programming or their own program (provided it incorporates appropriate refuge themes as identified in the visitor services plan and refuge-specific content) with minimal input from staff. When staff time and other resources allow, refuge staff and volunteers will work directly with these audiences.

To support teachers' environmental education efforts within their classrooms, the refuge will expand on available teaching materials and loan boxes offered to schools. School budgets are often restricted and materials that teachers can borrow which teach about local environmental concerns and about the refuge make it easier for teachers to implement environmental education into their curricula. Lesson plans developed to reach priority urban youth will also be made available for these other youth audiences.

Strategies
In addition to the strategies presented above under strategies that apply to all objectives, we will continue to:

- Provide educational activities, curriculum, and other appropriate resources on the refuge Web site.
- Continue to offer at least 12 workshops annually that focus on teaching teachers how to implement refuge environmental education programs so that education providers can lead programs on the refuge.

Within 7 years of plan approval:
- Work with teachers, university professors, academic administrators, and other environmental education partners to expand the teachers workshops to include additional programming based on the results of the Environmental Education Stakeholder Needs Assessment and actions outlined within the visitor services plan (e.g., additional college-level programs).

- Evaluate and modify or expand, if appropriate, loan boxes and teaching equipment and supplies.

- Review and evaluate existing components (e.g., teach the teacher workshops, Microlife) of the environmental education program to determine if they meet the specific criteria identified under this objective and in the visitor services plan and are effective. Modify or eliminate components as needed.

Within 15 years of plan approval:

- Develop a set of days dedicated to programming for less formal youth organizations (i.e., not traditional school groups).

- Formalize partnerships with youth organizations such as Big Brother Big Sister Program, 4H, YMCA, SeaGrant, Boy Scouts, Girl Scouts, college students, and other nonprofit youth organizations that are not already covered by national agreements.

Monitoring Elements
Same as monitoring elements under strategies that apply to all objectives under this goal.

GOAL 4.

Visitors, students, and local residents of all ages and abilities enjoy their refuge experience, understand and appreciate the refuge's natural and cultural resources and its contribution to conserving those resources in the Delaware Estuary, and are inspired to become better stewards in their everyday lives.

Objective 4.1
Environmental Interpretation

Over the life of the plan, expand on and offsite environmental interpretation opportunities through updating refuge infrastructure and developing electronic media for up to 35,600 visitors, students, and area residents that emphasize the refuge's natural and cultural resources and its contribution to conserving those resources in the Delaware Estuary and enhance the infrastructure and facilities necessary to provide a quality interpretive experience.

Rationale
The Refuge Improvement Act identifies environmental interpretation as one of the six priority public uses. Environmental interpretation includes activities, talks, publications, events, programs, audio-visual media, signs, and exhibits that convey key messages about natural and cultural resources to visitors, but that do not address a specific educational curriculum requirement. It provides opportunities for visitors to make their own connections to nature and wildlife, which invites participation in resource stewardship and helps refuge visitors understand their relationships to, and impacts on, those resources.

With over 35 million people within a 2-hour drive, the refuge lies within one of the most densely populated areas of the nation. Being located in such a high density, urban area with many recreational options, the refuge can easily be overlooked. Life-long residents located near the refuge report never having known about the refuge prior to their first visit.

The refuge interpretive programming includes a variety of experiences that appeal to varying audiences, visitor interests, and learning styles. In addition to passive interpretation, the refuge offers several interpretive events annually such as the Cradle of Birding Festival, National Refuge Week events, and Pennsylvania's division of the Federal Duck Stamp competition. Refuge staff and volunteers also participate in a variety of interpretive programs with partnering organizations such as scout troops, the YMCA, and the Audubon Society.

In early spring of 2010, the refuge was home to its first-ever recorded pair of bald eagle chicks. This successful breeding of bald eagles at this highly urban refuge provides a unique opportunity for interpreting the importance of conservation. The hatching of these chicks was nationally recognized online, on television, and in newspapers including the Philadelphia Inquirer, the Washington Post, and the Kansas City Star. To expand the interpretive opportunities associated with the eagles, the refuge is currently implementing plans to install a Web cam near the nest site to allow the public to view the eagles up close and without disturbance via the internet.

Under this plan, we will build upon our existing programs to make upgrades in interpretive infrastructure necessary to improve accessibility and utilize newer technologies to convey our interpretive goals. Providing an array of options for engaging visitors in interpretive programs and events is critical to increasing refuge visitation and expanding participation in resource stewardship and protection. It also achieves a national Service priority which is connecting children with nature.

We will expand upon our existing mix of guided interpretive tools, Service-sponsored events (such as the Cradle of Birding Festival and National Wildlife Refuge Week), and partner-sponsored events to increase annual participation from its current level (13,300 participants in 2009) up to 26,000 participants within 15 years of plan approval. We hope to improve the amount of off-season visitation (November through early March) to the refuge by providing programs and events that target young families and will encourage connecting youth with nature. By inviting visitation through off-season interpretive events, we can showcase the seasonal variation of the refuge and encourage repeated visitation throughout the year.

We hope to increase the amount of offsite participation in environmental interpretation to about 9,600 participants. New Web-based programs combined with additional partnerships will help us reach these additional goals.

Improving the quality self-guided services, signs, and facilities will also enable us to reach a larger audience, be more readily available, and allow visitors to use them at their own pace, while still initiating discussion and providing answers to questions.

Improving interpretation of Tinicum Marsh is another focus of this plan. By constructing additional infrastructure in the form of boardwalks, bridges, and observation areas, we can improve access and visibility of the marsh areas existing and proposed for restoration. When coupled with the addition of digital technology, such as a cellular phone tour or podcast, we will open a broad array of new interpretive options for visitors.

Strategies
Continue to:

- Maintain existing publications, access points and infrastructure, including trails, parking, and interpretive exhibits, kiosks, printed materials, and signage.
- Host environmental art displays at the visitor center as opportunities arise.
- Maintain ongoing updates to the refuge Web site.
- Annually, host at least 100 volunteer-led nature walks and programs, for example regular bird and plant walks.

- Provide programs and camps designed specifically for families and youth including: Through the Lens, MicroLife, Wildlife Photography Summer Camp, and a Birding and Fishing Summer Camp.

- Annually, host at least six conservation-oriented or wildlife-dependent interpretive events.

- Annually, conduct at least five offsite environmental interpretation programs.

- Work with partners and volunteers to develop and present onsite and offsite programs for non-school audiences, such as families, libraries, festivals, and scout groups that support the mission and goals of the Service.

- Complete the redevelopment of the existing example backyard habitat.

- Complete installation of the Web cam at the eagle's nest.

- Promote and participate in Service initiatives such as the National Junior Duck Stamp Program, Nature Champions, Urban Youth Initiative, and Project Bud Burst.

Within 2 years of plan approval:

- Identify key user groups utilizing the refuge and compile a targeted list of associated organizations, businesses, and affiliations potentially interested in learning more about the refuge through interpretive events and programs.

- Improve directional trail, regulatory, and interpretive signage, including development of a formalized entrance along SR 420 and improve directional signage to the refuge.

- Develop new day camp programs and expand the number of day camps offered to at least 12 per year.

Within 5 years of plan approval:

- Complete the refuge's visitor services plan, including an environmental interpretation component. This will specify themed messages that will be consistent among the different programs and will prioritize audiences. Themes will describe refuge management and its relationship to habitats and wildlife and will include larger-scale concepts such as climate change and green building.

- Develop events and programs tailored to targeted audiences incorporating themes from the visitor services plan. Host these events between November and May to encourage use in these slower months.

- Reorient existing displays and expand exhibits in a way that promotes exploration and longer viewing time by visitors.

- Develop at least two interpretive materials (e.g., bilingual signs and brochures) in other languages (e.g., Spanish) to help increase our effectiveness at reaching out to non-English speaking audiences.

- Develop at least three interpretive materials and programs specifically designed for people with disabilities including activities such as guided bird song tours of the refuge, signs and brochures in braille.

- Update all refuge displays, kiosks, signage, and trail system to support a more digital interpretive infrastructure applicable to urban youth and technology-ready visitors. Possibilities include the following:
  - Providing at least three tools available via the Web such as podcasts, virtual tours, and interactive programs.
  - Developing a cellular phone-based interactive trail.
  - Updating refuge-orientation DVD.
  - Creating an interactive flyover exhibit to explore the habitats of the refuge.
- Pursue additional alternative funding or grant programs for supporting transportation to and from the refuge for interested and qualifying groups based on actions outlined within the visitor services plan.

Within 10 years of plan approval:

- Work with the USEPA to develop an interpretive plan for the Folcroft Landfill including public use features such as an interpretive trail system, observation tower, and pedestrian bridge to develop access to upon site release.
- Create more interactive exhibits suitable for younger visitors (2 to 8 years old).
- Develop easily updated displays related to the various habitats found across the refuge.
- Improve access to and interpretation of Tinicum Marsh utilizing methods that provide access while minimizing visitor impacts to the marsh and wildlife using the marsh through new interpretive infrastructural measures such as boardwalks, wildlife viewing blinds, and bridges.
- Develop a series of programs and travelling exhibits on specific topics targeted to particular groups and events. Work with group leaders to develop environmental education programs that are hands-on, place-based, and aligned with applicable education standards/requirements.

Monitoring Elements

- Annually complete an evaluation summary of environmental interpretation opportunities provided (number of programs, events, outreach efforts provided) and their utilization (number of visits, number of participants engaged, and type of activity).

GOAL 5. **Provide quality, wildlife-dependent recreation that allows a diversity of visitors to connect with nature in the outdoors.**

Objective 5.1 Wildlife-dependent Recreation

Annually, provide visitors with wildlife-dependent recreation opportunities including fishing, wildlife observation, and nature photography, and maintain the infrastructure and facilities necessary to provide a quality experience.

Rationale

As discussed in chapter 3 section 3.14, John Heinz NWR offers shaded trails, vistas of the impoundment and tidal marsh, as well as fishing and other activities allowing people to take a break from the busy urban setting in which they work and live (VanBeusichem et al. 2009). The refuge provides recreation opportunities unique to the Philadelphia area through its management for habitat protection and wildlife diversity. All refuges are encouraged to provide wildlife-dependent

recreation opportunities under the Refuge Improvement Act. This type of recreation is intended to encourage connection with nature and foster wildlife conservation and environmental stewardship. With over 120,000 visitors annually participating in some form of wildlife-dependent activity, wildlife-dependent recreation is by far the largest reason for visitation to the refuge.

Fishing is a large draw for anglers and families who visit the refuge. Panfish, largemouth bass, and striped bass are species commonly fished for on the refuge. The refuge sponsors fishing days. Also available to visitors, free of charge, is the Rod Loaner program. Sponsored by PFBC, this program allows visitors to borrow some of the basic equipment needed to fish the waters around the refuge during their visit. All of these opportunities allow for public interaction with refuge staff and volunteers while participating in a priority public use. USA Today Travel highlights the refuge as a primary fishing destination for children near Philadelphia (Russell 2010). Yahoo's Associated Content Web site also highlights the refuge as the "best fishing spot in Philadelphia" (Bove 2010).

The refuge also offers several opportunities for wildlife observation and photography. These opportunities consist of both self-guided and staff and volunteer guided programs. Resources that promote self-guided wildlife observation and photography include equipment loans, photography blinds, and boardwalks and other structures outfitted with telescopes. Staff and volunteers guide regular bird and plant walks, sponsor a photography contest and traveling photo exhibit, and provide a series of programs and camps designed specifically for families and youth. These programs and camps include Through the Lens, MicroLife, and various summer camps (VanBeusichem et al. 2009).

The annual return and successful breeding of bald eagles on the refuge have generated renewed interest in the refuge and its residents. To expand upon this interest, the refuge is continuing to support its Friends group with the installation of a Web cam that will afford Web browsers the opportunity to observe the refuge wildlife at their convenience. The installation of this Webcam will create new opportunities for education and interpretation with area schools and other environmental education programs.

According to surveys conducted as part of the Pennsylvania State Comprehensive Outdoor Recreation Plan, most recreationists do not distinguish the differences in management directives between local, county, state, and Federal lands and agencies (Graefe et al. 2009). For many visitors the refuge is considered another city park. Trail users at John Heinz NWR participate in activities typically not allowed on other wildlife refuges: dog walking, bicycling, and running. In recent years, we have received requests for increases in recreational use not considered to be wildlife-dependent including, but not limited to, geocaching and bike trail development. We are reevaluating compatible recreational uses as part of this comprehensive conservation planning process (see appendix B).

By improving signs to direct visitors, promoting compatible recreational use, and expanding recreational infrastructure, we will encourage wildlife-dependent recreational use and seek participation by up to 170,000 visitors annually. Under this plan, we will begin improvements in wildlife-dependent recreation by ensuring enforcement of inappropriate or non-compatible uses. We will upgrade and expand the onsite directional signs to better guide users, pedestrian traffic, and parking for cars and bicycles. In particular, we will work with the PENNDOT to develop self-serve contact stations at the trailheads located along State Highway 420. A contact station along this eastern entrance has been requested by Delaware County staff and neighboring residents for several years. The refuge receives numerous visitors throughout the year from this entrance

point. A contact station will welcome visitors and encourage interpretive uses at this location.

The majority of visitors at the refuge are interested in wildlife observation and experiencing nature. As we pursue an increase in visitation over the next 15 years, we hope to develop additional accessible infrastructure to expand opportunities for traditional wildlife observation, water-based wildlife observation and recreation, and trail access, primarily around Tinicum Marsh. Construction of additional observation platforms or blinds will be focused on improving observation of wildlife within Tinicum Marsh, improved trails and additional boardwalks will increase access to those observation areas. Access to Tinicum Marsh via waterways and water trails will be improved as well. We will expand access to Darby Creek and Tinicum Marsh by improving and adding canoe launches as well as exploring partnerships with neighboring marinas or boat launches to promote the refuge.

Strategies
Continue to:

- Provide visitors with the opportunity to engage in wildlife-dependent recreation opportunities throughout the year by:
  - Maintaining fishing piers and other bank access points along Darby Creek, including an Americans with Disabilities Act-compliant fishing pier.
  - Maintaining equipment loans (e.g., binoculars), photography blinds, viewing telescopes, hiking trails, water trails, and viewing platforms for wildlife observation and photography.
  - Providing brochures and other literature to support fishing and wildlife observation and photography on the refuge.
- Support hunting programs by facilitating PGC hunter education classes as well as distributing PGC hunting publications.
- Complete installation and networking of a Webcam viewing the bald eagle nest.
- Promote self-guided wildlife observation and photography by maintaining and providing equipment loans, photography blinds, boardwalks, and other structures outfitted with viewing telescopes.
- Have staff and volunteers guide programs including:
  - Regular bird and plant walks.
  - Sponsoring a photography contest and traveling photo exhibit.
  - Providing programs and camps designed specifically for families and youth, such as Through the Lens, and various summer camps.

Within 2 years of plan approval:

- Improve wildlife-viewing and photography by expanding enforcement of non-compatible trail uses.
- Explore opportunities to connect to regional bicycle trails and greenways to encourage non-motorized visits to the refuge.

Within 5 years of plan approval:
- Improve signs to direct pedestrian bicycle traffic and hiking accessibility as well as parking.

- Construct a self-serve contact station at State Road 420.

Within 15 years of plan approval:
- Construct a boardwalk into Tinicum Marsh to provide opportunities for visitor to observe wildlife and for us to better interpret the marsh.

- Based on the visitor service plan, construct additional fishing access points, bird and photography blinds, and non-motorized water recreation enhancements (i.e. canoe launches).

- Partner with neighboring marinas and boat launches to institute organized boat tours of Tinicum Marsh, upon request.

Monitoring Elements
- Annually complete an evaluation summary of wildlife-dependent recreation opportunities provided (number of opportunities, events, outreach efforts provided) and their utilization (number of visits, type of activity, and participants engaged).

Objective 5.2 Evaluate Possibility of Providing Deer Hunting Opportunities

In partnership with the PGC, evaluate the possibility of providing a quality deer hunt program by opening portions of refuge lands to public deer hunting.

Rationale
The PGC is interested in expanding hunting opportunities in Pennsylvania. In particular, there is interest in the refuge providing opportunities for a limited youth or handicap-accessible hunt, consistent with State and local regulations. At present, we have not developed a hunt program proposal to the extent that we could conduct a NEPA analysis and involve the public. Instead, within 10 years of CCP approval, we will initiate preliminary public scoping and detailed discussions with PGC about the possibility of opening the refuge to a limited deer hunt program. If there is public and PGC interest in pursuing a deer hunt program, we will identify and analyze a detailed proposal and involve the public before making a decision. Because the refuge provides important resting and foraging habitat for migrating birds as well as other species of conservation concern, there is limited marsh habitat available in the State, and because the available marsh habitat on the refuge is limited, we are not considering opening the refuge to migratory waterfowl hunting.

Hunting, if approved, will provide a priority public use in an area where public hunting opportunities have largely been eliminated by development. John Heinz NWR is in a unique position to offer limited deer hunting in an urban environment and there are potential benefits to refuge habitats associated with controlling the resident deer population. The Refuge Improvement Act specifically identifies hunting as a priority, wildlife-dependent recreational activity on refuges, and as such we are required to give it enhanced consideration on refuges. Our particular interest in evaluating a hunt program at this refuge stems from its urban location, limited upland areas, concentrated public use, potential concerns over public safety, and potential conflicts with one of the refuge's establishing purposes (i.e., providing opportunities for environmental education) and other priority public uses.

Strategies
Within 10 years of CCP implementation:

- Initiate preliminary public scoping and detailed conversations with the PGC to see if a detailed analysis of a deer hunt program is warranted.

- If warranted, partner with the PGC to evaluate in detail a proposal to provide opportunities for deer hunting on the refuge that are consistent with State and local regulations and laws. Other alternatives, including no action (i.e., no hunting) will be considered in this evaluation, and there will be additional opportunities for public involvement before a final decision will be made.

GOAL 6.

Communicate and collaborate with local communities, Federal and State agencies, Tribal governments, academic institutions, and conservation organizations throughout the Delaware Estuary to promote natural and cultural resource conservation and the mission of the National Wildlife Refuge System.

Objective 6.1 Role of Refuge in Regional Conservation

Within 15 years of CCP approval, establish the refuge as a regional center for hosting and sponsoring conservation-related events to facilitate collaboration with a variety of partners and increase community understanding and appreciation of the refuge's regional significance to natural resource conservation, its contribution to the Refuge System, and to garner additional support for refuge programs.

Rationale
The Philadelphia metropolitan area and the three states bordering the majority of the Delaware Estuary (Delaware, New Jersey, and Pennsylvania) contain numerous state and Federal agencies, dozens of nongovernmental conservation organizations, and hundreds of municipalities and environmentally concerned citizens. With this diversity of interested parties and stakeholders, the refuge plays a unique role in regional conservation efforts. The refuge's proximity to Philadelphia and Delaware County provides a facility for housing conservation workshops and meetings that bring together partners from around the region. The refuge is also the only Federal property within an hour drive of Philadelphia whose primary mission is wildlife conservation and management.

In addition to regular refuge volunteers, the Friends of the Heinz Refuge provides a great deal of support to the refuge in terms of volunteer assistance in carrying out all aspects of our mission. Their members participate and guide interpretive and educational programs, invasive species control workdays, monitoring efforts, and cleanup projects. Moving forward, we will continue to partner with Friends of Heinz Refuge and work together to accomplish our mission and management goals, while providing opportunities for volunteer participation.

The refuge's proximity to the city of Philadelphia, along with its location within the Delaware Estuary and close proximity to I-95 and other transportation routes (plane, bus, and rail), allows potential visitors multiple options for commuting to the refuge. The visitor center provides an easily accessible facility making it an ideal location for conservation-related meetings, workshops, and events. Under this plan, we will encourage the refuge's regional role in conservation as a center for meetings, workshops, and seminars. By housing these events, we introduce visitors to the refuge, foster regional efforts in habitat protection and environmental conservation, and introduce new audiences to the Refuge System.

In addition to providing facilities for conservation-related meetings by agencies and organizations from around the region, we will work to expand the refuge

and Service's role in regional conservation by hosting and/or leading technical workshops and meetings or by providing project tours, technical workshops, or public presentations. These efforts are focused on making us more visible to our partners and interested audiences around the region. By increasing our visibility in the conservation community of greater Philadelphia, we help promote the Service, Refuge System, and garner additional support for refuge programs.

Additionally, the refuge has a unique partnership with Philadelphia International Airport. The refuge has provided opportunities for previous wetland mitigation projects on the refuge. Both the airport and the refuge have also found common ground in their desire to preserve open space around the refuge and airport. The airport desires such lands for a safety, visual, and acoustic buffer, while some properties could also provide additional habitat buffers for refuge lands where applicable.

Strategies

Continue to:

- Collaborate with a diversity of partners (academic institutions, State and Federal agencies, transportation partners, municipalities, non-governmental organizations, private landowners, and businesses) on regional habitat issues and instilling the values of habitat conservation and environmental stewardship.

- Work with Philadelphia International Airport to conduct wetland mitigation, restoration, and land acquisition both on and off the refuge.

- Provide a facility for regional, conservation-related meetings, workshops, and activities, upon request.

Within 5 years of plan approval:

- Develop an interpretive exhibit outlining the refuge and the Refuge System's role and purpose in relation to other natural areas within the Delaware Estuary and the Landscape Conservation Cooperative.

- Annually host and lead at least two national or regional workshops related to climate change, biological management and monitoring, environmental education, or other topics supporting the refuge goals.

Within 15 years of plan approval:

- Work with academic institutions to encourage climate change research that will inform refuge management and will support regional and global initiatives on the effects of climate change.

- Study adjacent and nearby areas, including potential expansions to the refuge's acquisition boundary to determine ways the refuge can adapt to climate change.

- Explore opportunities to assess and evaluate ecosystem services provided by the refuge habitats through collaboration with universities and agencies.

- Establish and promote the refuge's role as a regional center for conservation, freshwater tidal marsh management, and fish and wildlife protection by providing project tours, technical workshops, or public presentations.

Monitoring Elements

- Annually complete an evaluation summary of partnership efforts and roles that the refuge has played in regional conservation through those partners/events.

Objective 6.2 Outreach and Partnerships

Throughout the life of the CCP, work with partners throughout the Philadelphia metropolitan area to increase community understanding and appreciation of the refuge's significance to natural resource conservation, its contribution to the Refuge System, and to garner additional support for refuge programs by increasing refuge visitation and participation in refuge programs.

Rationale

The vision for John Heinz NWR embodied in this CCP cannot be fulfilled without the continued and diverse benefits the refuge receives from its partnering organizations, businesses, and agencies. The refuge strives to generate partnerships with a broad array of local, regional, state, and national partners to achieve its conservation mission and mandated purpose. We accomplish this through a variety of events, sponsorships, and workshops provided by or with partner organizations. The work of the Friends of the Heinz Refuge is critical to this goal. The Friends and other volunteers provide support to refuge staff by operating the visitor center gift shop, organizing and participating in volunteer-led programs, and assisting in community outreach.

According to the Pennsylvania State Outdoor Recreation Plan (PADCNR 2009), many park users have a difficult time distinguishing the difference in land ownership, management focus, and mission between parks (municipal, State, national, and private) and national wildlife refuges. For John Heinz NWR, it is critical to communicate the refuge's role in wildlife conservation and habitat protection. We utilize a variety of local media outlets to convey this message and generate interest and visitation, including internet, radio, newsprint, and television media. Maintaining connections with these media outlets allows us to connect with diverse audiences that otherwise may not be reached.

Under this plan, we will continue these outreach avenues while pursuing increased partnership with area non-profit organizations, local tourist attractions, transportation agencies, and travel businesses. The refuge is located within a half-mile of the Philadelphia International Airport. With 18 hotels within a 4-mile radius of the refuge and airport, there is a large population of traveling public that is within close proximity to the refuge for an extended period of time. This presents an opportunity for the refuge to partner with area hotels and the Philadelphia Airport to highlight the refuge as a local point of interest.

In doing so, we will increase the refuge's visibility and generate increased interest by coupling with other local travel destinations such as Bartram's Gardens and Fort Mifflin. We anticipate that partnering with these and other local attractions can position the refuge and its neighbors as a local day-trip destination.

Strategies

Continue to:

- Maintain partnerships with at least ten organizations, agencies, and individuals in relation to the diverse habitats, programs, and goals encompassed by refuge management. Examples include:
  - 50 inner city volunteers through Student Conservation Association.
  - 600 volunteers from Big Brother/Big Sister for special event work days.
  - Nature Champions partnership.
- Maintain close partnership with Friends of the Heinz Refuge to support the refuge mission and management activities.
- Maintain weekly updates to refuge information station 1670 AM.

- Develop close partnerships with local print and broadcast media to reach diverse audiences through multiple channels.

- Conduct or sponsor at least three outreach programs or events each year and provide regular updates on refuge programming and events through local media outlets.

Within 2 years of plan approval:
- Pursue a specialized partnership with Fort Mifflin and Bartram's Gardens to co-schedule and promote events and programs.

Within 5 years of plan approval:
- Implement at least three examples of cross-referencing and publishing of workshops and events with partnering organizations.

- Work with at least three hotels around the airport to install a display advertising the refuge as a visitor destination to promote visitation.

- Provide refuge brochures to an additional 10 area hotels to promote refuge visitation.

- Work with PENNDOT, SEPTA, and Philadelphia International Airport to provide displays, brochures and information identifying the refuge as a visitor destination.

- Expand media outreach into online social networking and modern technology communications.

Within 10 years of plan approval:
- Work with PENNDOT, SEPTA, and Philadelphia International Airport to improve the visibility of and transportation connections to the refuge.a

Monitoring Elements
- Annually complete an evaluation summary of partnership and outreach efforts and resulting benefits to the refuge (increased visitation, awareness, or understanding).

Little boardwalk

Larry Woodward/USFWS