

## Chapter 3



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

## **Alternatives Considered, Including the Service-preferred Alternative**

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## 3.1 Introduction

This chapter describes our process for formulating alternatives, the actions that are common to all of the alternatives, the actions or alternatives we considered (but did not fully develop), and the three alternatives we analyzed in detail. At the end of this chapter, table 3.2 compares how each of the alternatives addresses key issues, supports major programs, and achieves refuge goals.

## 3.2 Formulating Alternatives

### 3.2.1 Relating Goals, Objectives, and Strategies

The 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. All of the alternatives analyzed address the same goals.

The objectives are essentially incremental steps toward achieving a goal; they further define management targets in measurable terms. Typically, they vary among the alternatives, and 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 the alternative selected for the final CCP 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.

### 3.2.2 Developing Alternatives, Including the “No Action” Alternative

Over the course of several months, the core planning team and refuge staff held meetings and conference calls to identify a wide range of possible management objectives and strategies that could achieve our goals. After these were initially developed, we began the process of designing detailed management alternatives. Each management alternative is intended as an alignment of complementary objectives and strategies designed to meet refuge purposes, vision, and goals, and the Refuge System mission and goals, while responding to the issues and opportunities that arose during the planning process.

We grouped objectives that seemed to fit together in what we loosely term “alternative themes.” For example, we considered such themes as “enhanced biological and visitor services management” and “management with an emphasis on the regional role of the refuge.” After forming objectives into three management alternatives, we further evaluated how the objectives would interact and how well they would fulfill the refuge purposes

In this chapter, we fully analyze three alternatives that characterize different ways of managing the refuge over the next 15 years. As required by NEPA, we believe they represent a reasonable range of alternatives for achieving the refuge purpose, vision, and goals, and addressing the issues described in chapter 1. Unless otherwise noted, refuge staff would implement all actions.

Alternative A addresses the NEPA requirement of a “No Action” alternative, which we define as continuing current management. It describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting alternatives B and C. To better understand the scope and context embodied within the various alternatives, please see chapter 2, “Description of the Affected Environment,” for detailed descriptions of current refuge resources and programs.

Many of the objectives in alternative A do not strictly follow the guidance in the Service goals and objectives handbook, because we are describing current management decisions and activities that we established prior to that guidance. Our descriptions of those activities devolve from a variety of formal and informal management decisions and planning documents. Thus, the objectives in alternative A are fewer and more subjective than are those in alternatives B or C.

Alternative B, the Service-preferred alternative, combines the actions we believe would achieve most effectively 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. In addition, this alternative would 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.

Alternative C proposes a philosophy of cautious pursuit of restoration and conservation measures in light of the unknown implications of climate change within the life of the plan (15 years) and restoration of early successional upland habitats currently underrepresented on and around the refuge, but of importance to some of the focal species of concern identified by Service staff in development of the Draft Habitat Management Plan (appendix C). Alternative C also emphasizes the role of the refuge as a leader and technical resource in regional conservation and environmental education efforts.

### **3.3 Actions Common to All of the Alternatives**

All of the alternatives share some common actions. Some 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 require public review, but that we want to highlight in this public document.

All of the following actions are current practices or policies that would continue under all alternatives:

- 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

### 3.3.1 Adaptive Management

All of the alternatives 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 our final 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.

### 3.3.2 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.

### 3.3.3 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 2.8 Refuge Biological Resources of Chapter 2 “Affected 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 (EAB) is an invasive insect that has spread throughout portions of the northcentral and eastern U.S., including Pennsylvania. EAB was first identified in western Pennsylvania in 2007. A separate population was identified in central Maryland in 2003. EAB larvae feed on the tissues under the bark of ash trees, causing the death of branches and entire trees (PADCNR 2010). Since many of the floodplain forest communities of the refuge contain green ash as a dominant species, the location and expansion of EAB 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 (IPM) planning addresses the abilities and limitations of potential techniques including chemical, biological, mechanical, and cultural techniques. See additional discussion on IPM (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, spatterdock (also known as yellow pond lily) has expanded within the 145-acre impoundment to create a single-species population that vegetates managed mudflats 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 spatterdock populations within the impoundment and adjust water level management to limit spatterdock 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 (IPM)**

In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) 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. IPM 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 would 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 would be used unless considerations of persistence or other environmental or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the EPA in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by the EPA 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.

### 3.3.4 Monitoring and Abating Wildlife and Plant Diseases

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.

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:

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 Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, 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 another 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 National Wildlife Refuge Avian Influenza Surveillance and Disease Contingency Plan was approved in April 2007 and discusses methods for dealing with this disease (USFWS 2007).

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 to allow additional water into the impoundment to prevent an outbreak of this disease in the refuge's waterfowl and waterbirds.

#### **Chronic Wasting Disease**

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 National Wildlife Refuge was approved in October 2007 (USFWS 2007c) and discusses early detection and response to any potential CWD occurrence at the refuge.

#### **Epizootic Hemorrhagic Disease**

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 United States. 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.

### **3.3.5 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 (FOA) and Compatibility Determination (CD), we would need to complete a project-specific FOA and CD 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 2, we have allowed many research projects that meet these criteria. We expect additional opportunities to arise under any of the alternatives we propose in this draft CCP. 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 United States Geological Survey (USGS).
- (3) Facilitate appropriate and compatible research by providing compatible access and utilization of the refuge as a location for ongoing research.

### **3.3.6 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. Because projects are progressing outside the framework of this CCP, any decisions about when and how they will proceed will be the same under all alternatives.

The Service’s Chesapeake Bay Ecological Services (ES) 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 (NRDA) settlement on behalf of the 2006 Athos oil spill on the nearby Delaware River. Currently, the Chesapeake Bay ES 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 EPA is leading the multi-agency effort to complete the characterization and remediation of the Folcroft Landfill. At the time of this writing, the EPA finalized a legal agreement with a group of potentially responsible parties (PRPs) requiring them to perform the Remedial Investigation and Feasibility Study (RI/FS). 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 RI/FS for the Folcroft Landfill which is currently underway. The RI for the Folcroft Landfill was recently submitted to the EPA and is currently being reviewed. Once remediation is complete, the Service will manage these lands according to an approved plan. At that time, we would determine which public uses would be allowed.

### **3.3.7 Protecting Cultural Resources**

As a Federal land management agency, we are responsible for locating and protecting all historic resources, specifically archeological 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 all the alternatives, we will evaluate the potential for our management activities to impact archeological 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, regardless of the alternative implemented. That compliance may require any or all of the following: a State Historic Preservation Records survey, literature survey, or field survey.

### **3.3.8 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. Per the General Guidelines for Wildlife-dependent Recreation (Fish and Wildlife Service Manual 605 FW 1), we will continue to use the following criteria for a quality wildlife-dependent recreation program in developing refuge programs. According to Service policy, quality wildlife-dependent recreation

- (1) promotes safety of participants, other visitors, and facilities;
- (2) promotes compliance with applicable laws and regulations and responsible behavior;
- (3) minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan;

- (4) minimizes or eliminates conflicts with other compatible wildlife-dependent recreation;
- (5) minimizes conflicts with neighboring landowners;
- (6) promotes accessibility and availability to a broad spectrum of the American people;
- (7) promotes resource stewardship and conservation;
- (8) promotes public understanding and increases public appreciation of America's natural resources and our role in managing and conserving these resources;
- (9) provides reliable/reasonable opportunities to experience wildlife;
- (10) uses facilities that are accessible to people and blend into the natural setting; and,
- (11) uses visitor satisfaction to help to define and evaluate programs.

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 2, section 2.13). 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 (FOHR), and other volunteers will continue to help us expand these priority public use programs.

### **3.3.9 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 alternative B, the Service-preferred alternative. All existing findings of appropriateness and compatibility determinations will be updated for the alternative selected under the final CCP. These activities would be 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 should receive preferential consideration in refuge planning and management before the refuge manager analyzes other public uses for appropriateness and compatibility.

### **3.3.10 Activities Not Allowed**

The refuge location within the city of Philadelphia and neighboring communities of Delaware County makes it accessible to a variety of visitors. We have received requests for non-priority, non-wildlife-dependent activities that are typically not allowed on refuges. In appendix B, we formally propose that the following are

not appropriate on refuge lands: off-trail wildlife observation, bicycling off of designated areas, cycling events (such as tours and races), camping, commercial fishing, trapping, dog training and field trials, refuge entry after dark, pets off-leash, jogging offroad, picnicking, and swimming and sunbathing. Appendix B documents the refuge manager's justification for why they are deemed not appropriate or not compatible. Other ownerships nearby or elsewhere sufficiently provide most of those activities, so the lack of refuge access does not eliminate opportunities for those activities within the Philadelphia metropolitan area. 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.

### **3.3.11 Activities Allowed**

Some activities are already approved through an existing finding of appropriateness and a compatibility determination (CD). 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 CDs, which are included in appendix B for public review and comment. Appendix B details our proposals for all of those activities.

### **3.3.12 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 2 presents our levels of staffing and operating and maintenance funds for the refuge over the last 5 years.

#### **Permanent Staffing and Operational Budgets**

In all the alternatives, 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 will establish in the final CCP. We achieved many of our most highly visible projects since refuge establishment through special project funds that typically have a 1- to 2-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.

In all the alternatives, we would seek to fill any currently approved but vacant positions, which we believe are necessary to accomplish our highest priority projects. Alternatives B and C 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 (RONS) tables in appendix D. The alternatives also seek an increase in our maintenance staff, because they provide invaluable support to all program areas. Appendix C 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.

Under all proposed alternatives, we will continue to make incremental progress in upgrading appropriate facilities to ADA 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), Southeastern Pennsylvania Transportation Authority (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 2, 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. All of the alternatives would 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**

All of the alternatives will open the refuge for public use from official sunrise to sunset, 7 days a week, to 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.

#### **3.3.13 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 (WSA) as defined by the Wilderness Act. Therefore, we did not analyze further the refuge's suitability for wilderness designation. See appendix E 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.

#### **3.3.14 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 F). 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 would participate in that effort.

#### **3.3.15 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 summarized previously in Section 1.5, "Conservation Plans and Initiatives Guiding the Proposed Action," of chapter 1.

Under all alternatives, we will revise and finalize the HMP in conjunction with the final CCP. The annual habitat work plan (AHWP), an inventory and monitoring plan (IMP), an integrated pest management Plan (IPM), and the Visitor Services Plan (VSP) are also identified as high priority step-down plans to complete, regardless of the alternative selected for implementation. 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.

The alternatives schedule the completion of the following step-down management plans:

- Draft HMP will be finalized during the CCP process (see discussion below)
- Environmental Education Plan, drafted in 2010, will be finalized following CCP approval
- Law Enforcement Plan, drafted in 2010, will be finalized following CCP approval
- AHWP, annually after CCP approval (see discussion below)
- IMP, annually after CCP approval (see discussion below)
- Visitor Services Plan (VSP), drafted in 2010, will be finalized following CCP approval
- Facilities and Sign Plan, within 3 years of CCP approval
- Integrated Pest Management Plan (IPM), within 3 years of CCP approval
- Fishing Management Plan, within 3 years of CCP approval

#### **Habitat Management Plan**

A HMP for the refuge is the requisite first step toward achieving the objectives of goals 1 and 2, regardless of the alternative selected for implementation. For example, the HMP will incorporate the selected alternative's habitat objectives developed herein, and will identify "what, which, how, and when" actions and strategies would 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 draft CCP/EA and draft 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. As appropriate, we will incorporate the actions common to all alternatives into the HMP.

#### **Annual Habitat Work Plan and Inventory and Monitoring Plan**

The AHWP and IMP for the refuge are also priorities for completion upon CCP approval. Regardless of the alternative chosen, 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 AHWP that will outline specific management activities for that year. The IMP 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 IMP. 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 IPM plan will be completed within 3 years of CCP approval. The IPM supplements both the CCP and HMP with documentation on how to manage invasive or pest species. Along with a more detailed discussion of IPM techniques, the IPM 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 would be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects would be documented in "Chemical Profiles" in the forthcoming IPM document. Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as cropland and facilities maintenance would be approved for use on the refuge where there likely would 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.

#### **3.3.16 Additional NEPA Analysis**

For all major Federal actions, NEPA requires the site-specific analysis and disclosure of their impacts, either in an environmental assessment (EA) or in an environmental impact statement (EIS). NEPA categorically excludes other, routine activities from that requirement (see chapter 4, section 4.1.3 for some examples).

Most of the major actions proposed in the three alternatives and fully analyzed in this draft CCP/EA are described in enough detail to comply with NEPA, and would 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 draft 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 undergone the NEPA analysis process. Those environmental documents can be requested from refuge headquarters.

### **3.4 Alternative A: Current Management (No Action)**

In addition to the actions common to all, this alternative describes our current refuge programs on the 993 acres (currently owned in full fee title) for habitat management, fish and wildlife inventories and monitoring, administrative infrastructure and staffing, and visitor services. Although we intend this alternative to describe a “snapshot in time” of current management actions, we are including activities we have put in motion but are not in their final, desired state.

#### **3.4.1 Land Protection**

As we describe under the heading “Protecting Land” under “Common to All” above, we would 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.

#### **3.4.2 Habitat Management**

Our present habitat management program uses the strategy of adaptive management. This chapter presents the existing refuge habitat types in table 3.3 and across the refuge in map 3.1.

Under current management, we would continue to intensively manage refuge fee lands utilizing a combination of mowing, herbicide application, and other strategies to manage the 993 acres of freshwater tidal marsh, nontidal wetlands, coastal plain and floodplain forests, grasslands, and open waters owned by the Service. We would work with the Service’s Chesapeake Bay ES office to complete the 55-acre tidal marsh restoration project, but would otherwise maintain the existing 285 acres of freshwater tidal marsh currently owned. We would continue to manage the existing 34 acres of coastal plain forest and 252 acres of floodplain forest communities to provide healthy foraging and stopover habitat for migratory bird species and provide breeding habitat for the coastal plain leopard frog. No deer management efforts would be implemented, but we would continue to monitor the impacts of the deer herd on habitat structure and biodiversity. The refuge would continue to maintain the existing 72 acres of meadows and grasslands through a combination of mowing and targeted herbicide application. The refuge would continue to maintain the 200 acres of impoundments and 132 acres of Darby Creek within the refuge boundaries to provide habitat for a variety of aquatic resources.

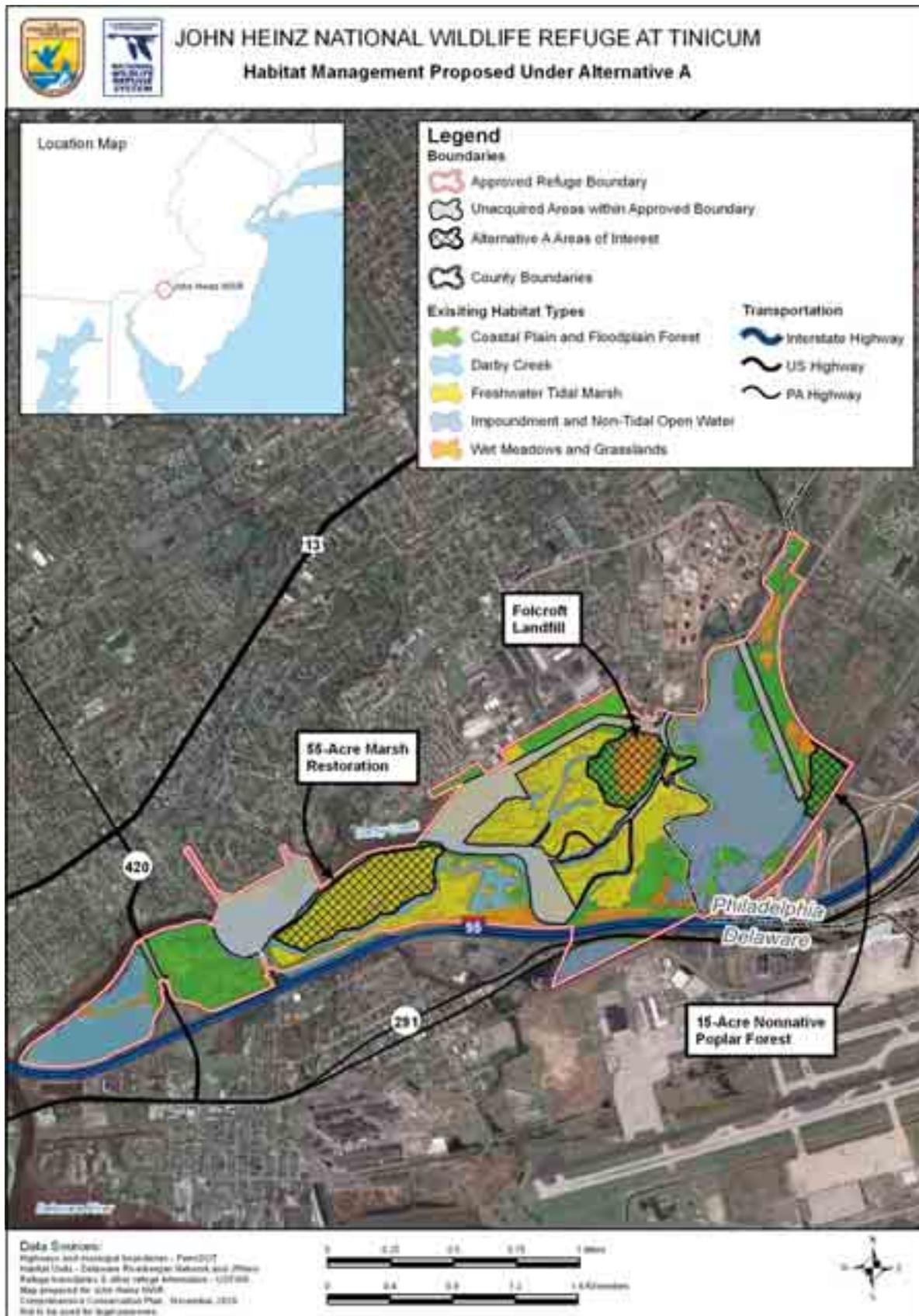
#### **3.4.3 Inventories and Monitoring**

Under current management, we are conducting baseline surveys and monitoring the results of selected management actions. In recent years, we have conducted breeding bird surveys, spring frog and toad call counts, marsh bird surveys, migratory and wintering waterfowl surveys, fish species diversity inventory, habitat monitoring, and initial surveys related to freshwater tidal marsh geomorphology and adaptation to climate change. We would continue that level of monitoring and inventory, modifying existing protocols, adding new ones, and dropping old ones as necessary to gain information to inform adaptive management decisions. As with all of our activities, the degree to which we can conduct monitoring and inventories depends on the availability of resources, including refuge funding and staff, and the contributions of partners and volunteers.

#### **3.4.4 Visitor Services**

The types of visitor service programs we provide would continue under the current management alternative. No major additions or changes in facilities would occur, except for ongoing upgrades to meet ADA-accessibility requirements and completion of an outdoor pavilion for environmental education. Each year, we host a series of environmental education programs throughout the school year. We also organize and provide at least 11 interpretive and outreach programs (five off the refuge and six on the refuge). Wildlife observation, walking/hiking, and participating in education and interpretive programs are the most popular public uses on the refuge. Hunting is, and would continue to

Map 3.1. Existing Habitats Comprising John Heinz National Wildlife Refuge at Tinicum Under Alternative A.



be, prohibited on the refuge, due to safety concerns and compliance with local regulations. We predict a slight increase in visitor numbers per year on the refuge, consistent with our observations of regional recreational trends.

Our current environmental education staff would continue to implement existing programs as resources and audience interest allows. Staff would continue to provide online curriculum and resources while pursuing ongoing alignment of programs with Pennsylvania academic standards and student standardized test requirements for all environmental education programs. Annually, the refuge would maintain partnerships with area schools that result in refuge visitation and student/educator engagement in environmental education programs. Volunteers and teachers would continue to directly lead educational programs on the refuge.

The refuge's interpretation efforts would continue to focus on maintaining existing access points and infrastructure, including trails, parking, and interpretive exhibits, kiosks, printed materials, the refuge Web site, and signage. Existing visitor services infrastructure and opportunities are presented in map 3.2. We would continue to host environmental art displays at the visitor center and complete the redevelopment of the existing example backyard habitat and installation of the webcam at the bald eagle's nest.

Based on refuge visitation estimates for 2001 through 2009, total visitation is increasing by approximately 3,000 visits per year. Using this figure, total refuge visitation is expected to increase to approximately 179,000 after 15 years.

#### 3.4.5 Refuge Administration

In this alternative, refuge staffing would remain at ten positions for the refuge: all of which would be stationed on the refuge except the current contaminants zone biologist position shared with (and stationed out of) Great Swamp NWR. Staff is located on the refuge within two separate facilities: law enforcement is located within an office and garage combination unit, while biological, visitor services, and administrative staff are located within the headquarters office at the visitor center. All staff share biological and visitor services responsibilities for the entire refuge.

The headquarters office would remain at the visitor center, and we would upgrade these facilities as necessary for safety, ADA accessibility, and utility over time as funding permits. We would maintain our present visitor service facilities as funds and staffing permit, but would construct no new ones, with the exception of an outdoor pavilion already in progress.

In the discussion that follows, we describe in detail the goals, objectives, and strategies that we would implement under alternative A.

#### 3.4.6 Goals, Objectives, and Strategies Under Alternative A

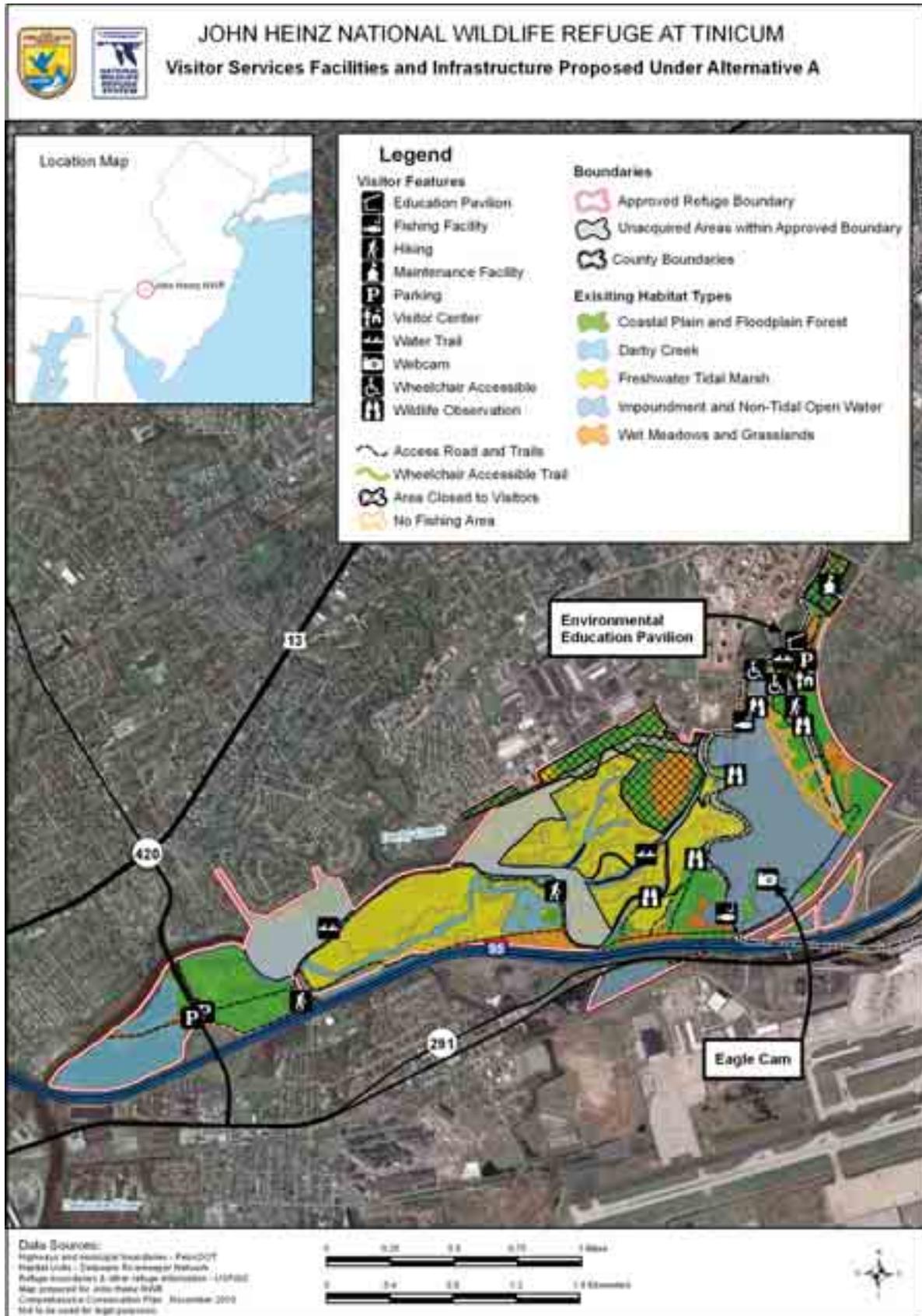
##### GOAL 1.

**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.

Map 3.2. Existing Visitor Services Facilities and Infrastructure at John Heinz National Wildlife Refuge at Tinicum Under Alternative A.



- Continue to develop memorandums of understanding (MOUs) or memorandums of agreement (MOAs) for in-holdings to allow for habitat management and law enforcement, where important for maintaining refuge resources and public safety.

**Objective 1.1**  
**Freshwater Tidal Marsh**

Over the next 15 years, continue to manage the existing 282 acres of freshwater tidal marsh to maintain a diverse assemblage of plant communities and breeding and migratory habitat suitable for waterbirds identified as species of conservation concern. Restore an additional 55 acres of freshwater tidal marsh that would be designed and managed to be dominated by native marsh vegetation including, but not limited to, wild rice (*Zizia aquatica*), spatterdock (*Nuphar lutea*), pickerelweed (*Pontederia cordata*), and tick-seed sunflower (*Bidens* spp.). Restored marshes would re-establish 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 (Mitsch and Gosselink 1993). Coastal marshes (including freshwater tidal marshes) are among the highest priority habitats within BCR 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 draft Habitat Management Plan 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.

About 60 acres of the refuge's tidal marsh are currently dominated by 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 would provide improved breeding site opportunities.

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.

Planned restoration for a 55-acre area dominated by phragmites would 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) would be addressed in development of this project. Planned marsh design would 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. 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 would help develop baseline data necessary for tracking the long-term trends in the hydrogeomorphology and vegetation composition of the marsh.

### 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.

*Within 5 years:*

- Work with the Service's Chesapeake Bay ES 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, spatterdock, and wild rice. Restored marshes would 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.

**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.

**Objective 1.2  
Coastal Plain and Floodplain  
Forests**

Over the next 15 years, maintain the existing 34 acres of coastal plain forest and 252 acres of floodplain forest communities to provide healthy foraging and stopover habitat for migratory bird species and provide breeding habitat for the coastal plain leopard frog.

**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 mile-wide 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 draft Habitat Management Plan (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 (ACJV) (USFWS 2008) both emphasize the

*Wood Thrush*

Bill Thompson

need 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 utilize forested areas for nest sites. For example, bald eagles (primarily associated with the impoundment and Darby Creek habitat) require forested areas for nesting sites. The short-eared owl (associated primarily with freshwater tidal marsh) is also known to nest in portions of the coastal and floodplain forests of John Heinz NWR.

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.

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 2011). 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 would 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 2. Potential effects of deer management and relation to Lyme disease are also discussed in chapter 4.

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 (FLiR) 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 would 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 2011).

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

### 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. No deer management control actions would be implemented.
- 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.

### Monitoring Elements

*Continue to:*

- Complete deer browse impact monitoring using established USDA Division of Wildlife Services protocols including the review of deer population densities, deer habitat characterization, tree regeneration analysis, and relative effects on human populations.
- Conduct annual population monitoring (flushing surveys) to evaluate deer population trends on the refuge. Utilize FLiR counts completed in January 2009 and 2010 to evaluate population levels and trends of flushing surveys.

### Objective 1.3 Darby Creek

Over the next 15 years, manage refuge inputs to Darby Creek to reduce contaminants, reduce stormwater impacts from the refuge, and provide spawning, nursery, foraging, and cover habitat for anadromous and catadromous fish populations and other Federal trust resources, including American eel, striped bass, blueback herring, hickory shad, and alewife.

### **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). Thus, improving water quality and restoring suitable channel morphology where possible is critical to maintaining healthy biological integrity, diversity, and environmental health (BIDEH) parameters that support fish species.

The NFHAP 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 NFHAP (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.

Several other waterfowl and wetland birds that are not State-listed, but identified as regional conservation priorities are also found on the refuge. Waterfowl like the American black duck, lesser scaup, and northern pintail as well as shorebirds like black-bellied plover, greater yellowlegs, and semipalmated sandpiper utilize open water habitats primarily along Darby Creek and the impoundment 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 2005).

As previously described in detail in chapter 2, section 2.6, 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.

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, tank farms, industrial sites, and communities, refuge staff annually reviews and updates the refuge's spill response and coordination plans.

### **Strategies**

*Continue to:*

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

- Coordinate with EPA and other stakeholders to close 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 ES 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.

#### **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.

## **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**

Manage the existing 145-acre impoundment and 55 acres of nontidal open water 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 red-bellied turtles, through a combination of water level management, wetland restoration, and invasive species control. To the extent practicable, these measures would include the following:

- (1) Annually support migratory shorebirds by maintaining a mix of shallow water (less than 6 inches water depth), mudflats with sparse vegetation (less than 10 percent cover), and mudflats with no vegetation, at times of peak migration (spring: May, and fall: mid-August through September).
- (2) Annually support migratory waterfowl by maintaining a mix of shallow (6 to 24 inches water depth) flooded vegetation (sedges, smartweeds, and pickerelweed) 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 red-bellied turtle by protecting hibernation, foraging, basking, and nesting habitat.

#### **Rationale**

As discussed in chapter 2, section 2.12 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 spatterdock, 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 would likely require some variation from the timing most adaptable 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 would 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 2, water level management of the 145-acre impoundment is currently difficult.

### 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—spatterdock (*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 Tincum Township to manage stormwater inputs into the impoundment and open waters along Long Hook Creek.
- Maintain existing wood duck and swallow nesting boxes primarily through volunteer assistance.

**Monitoring Elements***Continue to:*

- Support annual 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.

**Objective 2.2  
Grasslands and Wet Meadows**

Annually, maintain up to 72 acres of grasslands to create a mix of wet meadow, grassland, and forest opening habitats to sustain stopover foraging and cover for migratory landbirds where patch size and species diversity and structure yield stopover habitat benefits for migratory landbirds, as well as breeding habitat for resident amphibians (coastal plain leopard frog) where possible.

**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 would 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 coastal plain 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 McMenamain 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. As a result, the refuge (and those entities that manage the existing right-of-ways) would continue to maintain these portions of grassland for the foreseeable future.

### 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.

### 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.**

### Objective 3.1 Environmental Education

Annually, continue to provide approximately 30 environmental education programs and other resources for about 9,600 participants, that describe the habitats, wildlife, environment, and cultural resources of the refuge, describe the purpose of the refuge, and meet Pennsylvania educational standards and curriculum requirements to school groups and teachers as staff resources and audience interest allows.

### **Rationale**

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.

John Heinz NWR is particularly well-positioned to reach a large audience due to its location within the Philadelphia metropolitan area. 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 would 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 2 section 2.14, 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 elementary classes, summer camps,

and some interest from local college programs for architecture, wildlife, and environmental studies. Also, see appendix I (USGS Phase 1 Environmental Education Needs Assessment) for additional information on the refuge's current environmental education program.

### Strategies

*Continue to:*

- Pursue ongoing alignment of educational programs with Pennsylvania academic standards and student standardized test requirements.
- Annually, maintain at least three partnerships with area schools that result in refuge visitation and student and educator engagement in environmental education programs.
- Pursue alternative funding or grant programs for supporting transportation to facilitate field trips with interested schools.
- Utilize staff and volunteers to directly lead approximately 30 environmental education programs per year to reach about 8,200 students onsite and 1,200 students offsite.
- Provide online curriculum and other resources (e.g., loan boxes, field trip equipment) via the refuge Web site and links from partnering organizations.
- Maintain existing local natural history exhibits as part of visitor center displays.
- Maintain the existing natural history educational resource program including Web-based lesson plans, loan boxes, and equipment.

### Monitoring Elements

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).

## 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

Annually, provide an array of on and offsite environmental interpretation opportunities for up to 22,500 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 maintain 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.

In 2009, about 13,300 people participated in onsite interpretive programs at the refuge, which includes programs led by refuge staff, volunteers, and other partners. Another 4,800 participated in offsite refuge interpretive programs, including Web based programs. Because of the refuge's location and ongoing environmental interpretation programs, we anticipate increased participation in environmental interpretation over the 15-year life of the plan. While we are not sure what the increase would be under alternative A, based on data from 2001 through 2009 we anticipate an increase of 34 percent over the next 15 years, or approximately 17,700 onsite participants. We do not intend to increase our offsite environmental interpretation efforts, so predict this number would remain at about 4,800 offsite participants annually.

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 webcam near the nest site to allow the public to view the eagles up close and without disturbance via the internet.

### **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 webcam at the eagle's nest.
- Promote and participate in Service initiatives such as the National Junior Duck Stamp Program.

#### **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, type of activity, and participants engaged).

### **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 interpretive experience.

#### **Rationale**

As discussed in chapter 2 section 2.14, 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). Wildlife-dependent recreation is one of the largest draws for visitation at 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 an annual Fishing Derby, in addition to Family Fishing Days, both well-attended programs. Also available to visitors, free of charge, is the Rod Loaner program. Sponsored by Pennsylvania Fish and Boat Commission, 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, a Wildlife Photography Summer Camp, and a Birding and Fishing Summer Camp (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 webcam that would afford web browsers the opportunity to observe the refuge wildlife at their convenience. The installation of this webcam also creates new opportunities for education and interpretation with area schools and other environmental education programs.

### 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 ADA-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; and
  - \* providing brochures and other literature to support fishing and wildlife observation and photography on the refuge.
- Support hunting programs by facilitating Pennsylvania Game Commission hunter education classes as well as distributing Pennsylvania Game Commission 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; and
  - \* providing programs and camps designed specifically for families and youth, such as “Through the Lens,” Wildlife Photography Summer Camp, and Birding and Fishing Summer Camp.

### 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).

## 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

Continue collaboration with a variety of partners to 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. Our central location in Philadelphia 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.

The Friends of the Heinz Refuge (FOHR, Friends) 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 would continue to partner with FOHR 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 central location within the Delaware Estuary and close proximity to I-95 and other transportation routes (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 meetings, workshops, and events. The refuge sponsors a number of these meetings throughout the year.

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 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.

### **Monitoring Elements**

- Complete annual evaluations and summaries of partnership efforts and roles that the refuge has played in regional conservation through those partners/ events.
- Provide opportunities for monitoring and research partnerships with universities and other academic institutions around the Philadelphia metropolitan area.

## Objective 6.2 Outreach and Partnerships

Continue community outreach by conducting or sponsoring at least three outreach programs or events each year, maintaining partnerships with at least ten organizations, and providing regular updates on refuge programming and events through local media outlets, thereby increasing community understanding and appreciation of the refuge's significance to natural resource conservation, its contribution to the Refuge System, and garner additional support for refuge programs.

### Rationale

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.

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 refuge's Friends organization—the Friends of the Heinz Refuge—is critical to this goal. The Friends provide support to refuge staff by staffing the visitor center gift shop, organizing and participating in volunteer-led programs, and assisting in community outreach.

### 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 SCA
  - \* 600 volunteers from Big Brother/Big Sister
  - \* 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.

### Monitoring Elements

Complete annual evaluations and summaries of partnership and outreach efforts and resulting benefits to refuge (increased visitation, awareness, or understanding).

### **3.5 Alternative B: Increased Restoration and Increased Focus on Urban Youth (Service- preferred Alternative)**

Alternative B represents an extension and progression of refuge programs. Under alternative B, we would 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. Programs provided by our visitor services program would be expanded and target the Service's regional priorities for engaging the public. We would 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.

#### **3.5.1 Land Protection**

As we describe under the heading "Protecting Land" under "Common to All" above, we would 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.

#### **3.5.2 Habitat Management**

Under alternative B, habitat management would 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 would increase management resources for controlling or eliminating invasive species, restoring freshwater tidal marsh, and monitoring and adapting to climate change.

Forest habitat restoration would be expanded under this alternative as well. This alternative 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. This alternative would also initiate a deer management program. Controlling the size of the resident deer herd would 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 would 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.

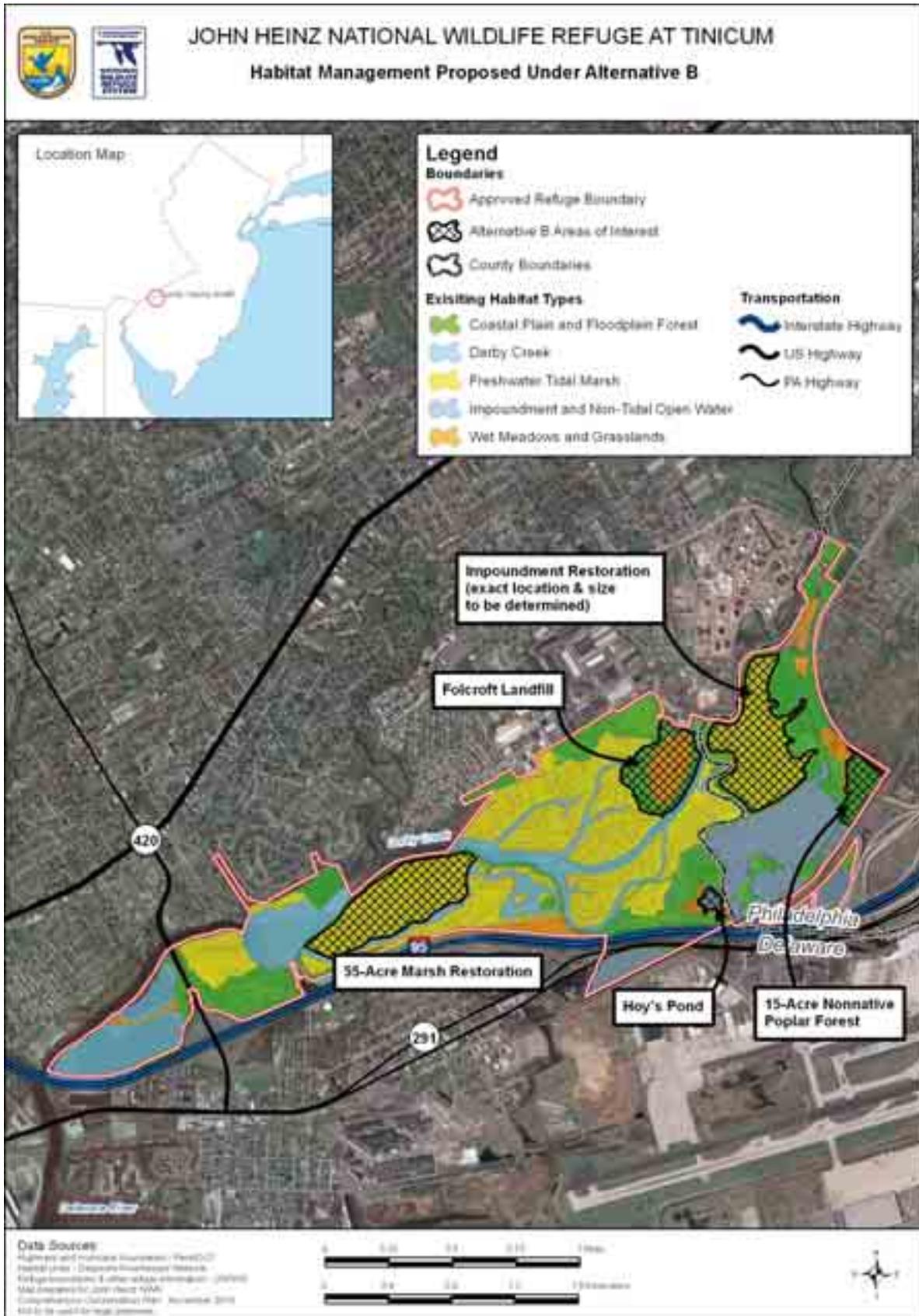
Habitat types and management proposed under alternative B are displayed on map 3.3.

#### **3.5.3 Inventory and Monitoring**

As with alternative A, we would continue existing monitoring and inventory efforts as long as they continue to provide useful information that would inform us about the effectiveness of habitat management, habitat adaptation to climate change, and we have the necessary resources to accomplish them. We would 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 would also continue to seek ways to reduce our management costs for establishing and maintaining monitoring protocols.

We would expand our inventory and monitoring under alternative B 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 would be monitored throughout the life of this CCP. We would also expand biological inventories and monitoring projects to improve our knowledge and understanding of species that utilize the refuge.

Map 3.3. Proposed Habitats Comprising John Heinz National Wildlife Refuge at Tinicum Under Alternative B.



### **3.5.4 Visitor Services**

Under alternative B, we would expand existing opportunities for five of the six priority public uses, with an emphasis on expanding our environmental education program. Map 3.4 presents the current and proposed public use facilities under alternative B. We would 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 education centers around the Philadelphia metropolitan area.

Environmental interpretation would also be updated and improved under alternative B. Refuge interpretive infrastructure such as signs, kiosks, and displays would be improved and updated, and additional kiosks would be added. We would 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 would also provide more programs and materials in different languages and for disabled visitors.

Because of our efforts to expand programs and facilities under this alternative, we expect total refuge visitation to increase the most under alternative B. 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.

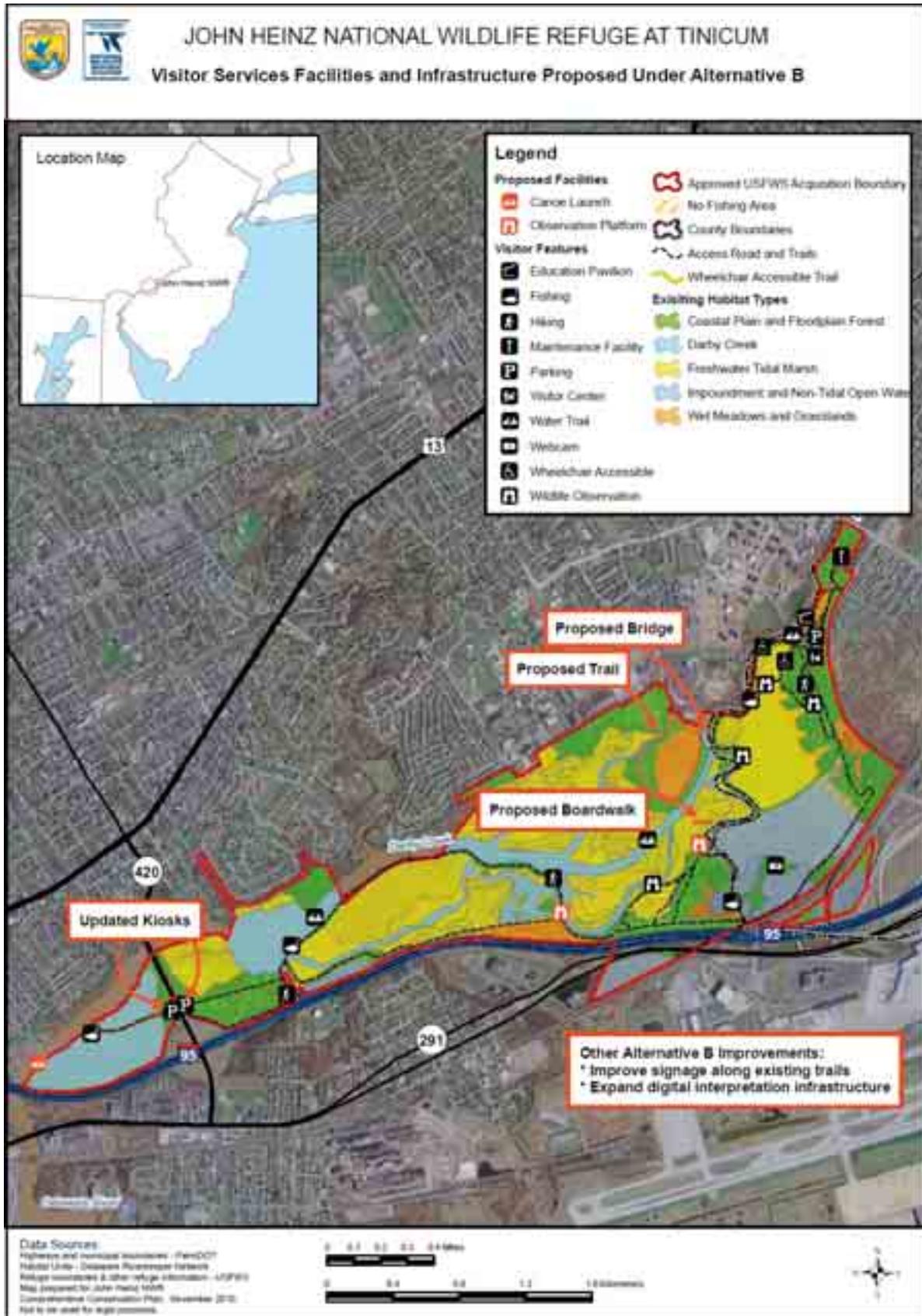
In expanding opportunities for compatible wildlife-dependent recreation, we hope to contribute to communities and businesses around the refuge, both in terms of health and well-being, and economically. We would join other agencies and organizations to promote connecting children with nature. A growing 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 would contribute to the growing national initiative to reconnect children with nature.

### **3.5.5 Refuge Administration**

Under this alternative, we would 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 would base any increases in staffing on available sources of funding, and would 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 K for conceptual design plan). Under current management, maintenance and law enforcement are housed in a separate building located approximately a 0.25 miles from the visitor center and refuge's administrative offices. Expanding existing offices to collocate all staff would allow the refuge to achieve the regional priority of housing all refuge programs under the same roof to improve cross-program coordination. As with alternative A, all other facilities would be maintained and upgraded to meet safety and accessibility requirements over the 15-year life of the plan.

Map 3.4. Proposed Visitor Services Infrastructure and Facilities at John Heinz National Wildlife Refuge at Tinicum Under Alternative B.



### 3.5.6 Goals, Objectives, and Strategies Under Alternative B

#### 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:**

In addition to strategies in alternative A:

- 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 NGO's 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 exiting 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 would be dominated by native marsh vegetation including, but not limited to, wild rice (*Zizia aquatica*), spatterdock (*Nuphar lutea*), pickerelweed (*Pontederia cordata*), and tick-seed sunflower (*Bidens* spp.). Restored marshes would re-establish 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

The conservation significance of freshwater tidal marsh has been previously described under Objective 1.1 in alternative A. 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. While we considered habitat restoration to be of primary importance, 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.

The uncertainties of climate change impacts could have a major impact on the size and type of wetlands that comprise Tinicum Marsh in the future. Most notably, sea level rise and a corresponding increase in salinity levels can result in a variety of alterations in Tinicum Marsh as we know it. SLAMM (Sea Level Affecting Marshes Model) 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).

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 alternative B, we would pursue additional restoration of freshwater tidal marsh with the understanding that (a) restoration of existing degraded systems to freshwater tidal marsh would 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 would be able to apply adaptive management to marsh areas in light of actual changes in sea level rise and salinity.

As a result, setting up long-term monitoring stations within the refuge would be critical to the ongoing protection of Tinicum Marsh. As previously described under objective 1.1 in alternative A, 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 would be incorporated into the Service's region-wide 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.

### **Strategies**

In addition to strategies in alternative A:

- Work with Philadelphia International Airport management to conduct an assessment of wildlife hazards prior to implementing wetland restoration projects on the refuge. The assessment would 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:*

- Develop an assessment and prioritization list of potential freshwater tidal marsh wetland restoration projects on the refuge in accordance with the refuge's Habitat Management Plan and the Restoration Management Plan for the Lower Darby Creek.
- Identify and implement where feasible adaptive management strategies appropriately 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 Tincum 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**

In addition to strategies outlined in alternative A:

*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**

The conservation significance of coastal plain and floodplain forests has been described previously under objective 1.2 in alternative A. These forest communities provide diverse habitat required 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, would help maximize the biological potential available on the refuge for these species that stopover during migration or breed within this habitat type.

Under alternative B, we would implement recommendations within the Deer Management Plan, once finalized, to reduce the deer herd over the course of several years to a level that would allow adequate regeneration of native plants and benefit the habitat and other wildlife on the refuge. We would 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.

We would also begin large scale restoration of the 15-acre forest area currently dominated by the nonnative gray poplar. We would 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. As noted in alternative A, coastal plain forests are a State and globally rare community type that provides valuable habitat components for species of conservation concern. The long-term success of this habitat and corresponding intensity of management is directly related to the size and impacts of resident deer populations.

As stated under alternative A, objective 2.2, grasslands existing on the refuge are too small to provide breeding habitat for grassland species of regional conservation concern. By allowing these areas to transition to coastal plain and floodplain forest, these areas would 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 life of this CCP (15 years). Instead, we aim at creating an early successional forest habitat in transition to eventually becoming a mature coastal plain forest.

### **Strategies**

In addition to strategies outlined in alternative A:

*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 7.7 acres of existing cool-season grass meadows to at least 50 percent cover by early successional coastal plain forest species near the 10-acre marsh restoration site and an additional 0.6 acres within the grasslands restored as part of the oil spill wetland mitigation site.

#### **Monitoring Elements**

- Continue to monitor deer browse impacts using APHIS 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**

As noted, under alternative A, objective 1.3, Darby Creek provides habitat that supports a diverse assemblage of fish species on the refuge.

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. Under alternative B, we would continue to support the variety of ongoing efforts to monitor basic water quality parameters within Darby Creek.

We would 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 would 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 would 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**

In addition to strategies outlined in alternative A:

- 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**

In addition to strategies outlined in alternative A:

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 red-bellied turtles, through a combination of water level management, wetland restoration, and invasive species control.

To the extent practicable, these measures would include:

- (1) Annually support migratory shorebirds by maintaining a mix of shallow water (less than 6 inches water depth), mudflats 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 red-bellied turtle by protecting hibernation, foraging, basking, and nesting habitat.

**Rationale**

The impoundment is, and continues to be, the focal point of the refuge for many visitors and wildlife. As noted, under alternative A, objective 2.1, the 145-acre impoundment, when we are able to manage as intended, provides habitat for numerous migratory landbirds, shorebirds, shallow wading waterbirds, and waterfowl.

However, as noted in alternative A, there are numerous challenges to adequately manage the impoundment to the specific water levels required for optimal use by various bird groups during their migration. For these reasons, under this alternative, we would 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 3-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 would cause a corresponding decrease within the freshwater tidal marsh. In addition, some areas of the impoundment are important habitat for other species of conservation concern, for example the State-listed red-bellied turtle. Therefore, we would complete a survey and analysis of both habitats to better inform the extent and location of marsh restoration within the impoundment.

As under alternative A, the other open water areas (the 5-acre Hoys Pond and the 16-acre pond) would 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 would not invest resources into long-term management of these areas. We would 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

The same as strategies outlined in alternative A except:

*Within 5 years of plan approval:*

- Begin to phase out existing wood duck and swallow nesting boxes. Maintain 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 and habitat enhancement of the remaining impoundment area (see strategies under objective 1.1 for additional details).

### Monitoring Elements

In addition to strategies outlined in alternative A:

- 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 red-bellied 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.

**Objective 2.2  
Grasslands and Early  
Successional Habitats**

- Explore coordination with Pennsylvania Fish and Boat Commission for potential red-eared slider removal.

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**

As noted, under alternative A, objective 2.2, the wet meadows and grasslands of the refuge provide foraging and stopover habitat for migratory landbirds, as well as breeding habitat for the coastal plain leopard frog.

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 would be damaged by tree or shrub roots if the area was allowed to succeed to forest. Likewise, the Folcroft Landfill area would 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 alternative B, areas where we have identified the least habitat benefit due to a combination of maintenance needs, patch size, and current species composition would 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 alternative B, objective 1.2, we would 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 alternative, we would cease regular mowing and promote the conversion of these to early successional forest and scrub-shrub habitat. This change in management would 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 would 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 would be enhanced under this alternative through 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 alternative, where possible, we would 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

In addition to strategies outlined in alternative A:

*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

- Same as strategy outlined in alternative A.

## 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 described in alternative A, objective 3.1 and elsewhere in this document, environmental education is one of the establishing purposes of John Heinz NWR. 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 Pennsylvania schools. Opportunities to support State educational standards are not limited to the study of the environment and ecology. In addition to the items outlined under “Actions Common to All Alternatives” and those under alternative A, this management alternative 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 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.

Under this alternative 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 would hire additional refuge staff and would recruit and train additional volunteers. To ensure high quality delivery of the new refuge programs, we would 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 as well as 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 alternative, we would 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 alternative, the visitor services plan would identify, define, and prioritize audiences. It would also identify themed messages and topics that would 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 would 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 would: 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-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 would 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 would also hire an additional maintenance worker to help maintain visitor facilities to support programs if resources allow (see appendix D for proposed staffing chart).
- Pursue alternative funding or grant programs 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, website, social media, displays, etc.) to accurately communicate the environmental education components available to the public.

**Monitoring elements:**

- Determine which schools or school districts would 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 curricula 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 would

- (1) focus on urban schools (grades K-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; and
- (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<sup>1</sup>. Given its location partially within the city of Philadelphia, 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-12) within the Philadelphia school district alone (Philadelphia School District 2011). Friends of Heinz Refuge also offers grants to schools to pay for bussing. Given the important opportunity that John Heinz NWR has for working with students from urban settings, the refuge would focus limited staff and volunteer time towards working directly with students from urban schools (grades K-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 curricula into school curricula; 2) school participation in the program over many years, and 3) refuge staff working with students multiple times in a year.

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<sup>1</sup> The U.S. Census Bureau defines a major metropolitan area as containing a population of one million or more people.

Repeated visits help students gain confidence with nature, foster a connection between students and the refuge, and increase the chances that students would feel a sense of stewardship towards the environment.

Since every school has different needs, refuge staff and volunteers would 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 would 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 would focus on environmental education programming at the refuge but would use offsite programs to develop long-term relationships with urban schools. In addition, this programming would be designed in accordance with the visitor services plan with well defined themes and topics, and with an evaluation system in place. All programming would 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 CCP 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 lesson plans that would enhance environmental education curricula that are 1) consistent with themed messages and topics identified in the visitor services plan (once developed), 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 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 CCP approval:*

- Continue to develop and expand course curricula 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 5 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 would

- 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 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; and
- 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 would include a variety of groups such as: students that are from outside of the local urban area, non-traditional K-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 would be focused on priority urban youth audiences, environmental education programming for other youth audiences would focus on more teacher-led programs with less direct involvement from staff and trained volunteers. Ultimately, our goal would 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 would work directly with these audiences.

To support teachers' environmental education efforts within their classrooms, the refuge would 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. Curricula developed to reach priority urban youth would 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 would 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 CCP approval:*

- Develop a set of days dedicated to programming for scouts and other youth 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.

### **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**

Under alternative B, we would build upon our existing programs (alternative A) 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 would 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 would 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 would help us reach these additional goals.

Improving the quality self-guided services, signs, and facilities would 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 alternative B. 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 under this alternative. When coupled with the addition of digital technology, such as a cellular phone tour or podcast, we would open a broad array of new interpretive options for visitors.

**Strategies**

In addition to strategies outlined under alternative A:

*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 would specify themed messages that would be consistent among the different programs and would prioritize audiences. Themes would describe refuge management and its relationship to habitats and wildlife and would 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.
- Re-orient 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, 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 EPA 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, utilizing its habitat 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, type of activity, and participants engaged).

**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 noted in objective 5.1 under alternative A, 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. By improving signs to direct visitors, promoting compatible recreational use, and expanding recreational infrastructure, we would encourage wildlife-dependent recreational use and seek participation by up to 170,000 visitors annually.

According to surveys conducted as part of the Pennsylvania State Comprehensive Outdoor Recreation Plan (PA SCORP), 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 re-evaluating compatible recreational uses as part of this comprehensive conservation planning process (see appendix B).

Under this alternative, we would begin improvements in wildlife-dependent recreation by ensuring enforcement of inappropriate or non-compatible uses. We would upgrade and expand the onsite directional signs to better guide users, pedestrian traffic, and parking for cars and bicycles. In particular, we would work with the Pennsylvania Department of Transportation 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 would 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 infrastructure in order 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 would be focused on improving observation of wildlife within Tinicum Marsh, improved trails and additional boardwalks would increase access to those observation areas. Access to Tinicum Marsh via waterways and water trails would be improved under this alternative as well. We would 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

In addition to strategies outlined under alternative A:

*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).

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

### Rationale

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.

## Objective 5.2 Evaluate Possibility of Providing Deer Hunting Opportunities

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 would 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 would 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, would 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 PGC to see if a detailed analysis of a deer hunt program is warranted.
- If warranted, partner with 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) would be considered in this evaluation, and there would be additional opportunities for public involvement before a final decision would 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 refuge and visitor center currently provide a meeting place for conservation-related groups, meetings, and workshops. Under alternative B, we would 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 National Wildlife Refuge System.

In addition to providing facilities for conservation-related meetings by agencies and organizations from around the region, we would 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, National Wildlife Refuge System, and garner additional support for refuge programs.

### **Strategies**

In addition to strategies mentioned under alternative A:

*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 would inform refuge management and would 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 comprehensive conservation plan cannot be fulfilled without the continued and diverse benefits the refuge receives from its partnering organizations, businesses, and agencies. The range of partnerships and outreach activities we currently participate in is detailed under alternative A, objective 6.2.

Under alternative B, we would 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 would 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**

In addition to strategies outlined in alternative A:

*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 3 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.

### **Monitoring Elements**

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

### **3.6 Alternative C: Delayed Restoration with Increased Focus on Regional Role in Higher Education in Conservation and Research**

Alternative C is similar to alternative B in its approach to refuge administration and facilities. It differs substantially, however, from alternatives A and B in its habitat management approach as well as areas of emphasis for education and interpretive programs.

#### **3.6.1 Land Protection**

As we describe under the heading “Protecting Land” under “Common to All” above, we would 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.

#### **3.6.2 Habitat Management**

Under alternative C, habitat management would focus on restoring degraded forests and specific grassland areas to a scrub-shrub habitat type. Shrub-dominated habitats are not found anywhere on the refuge currently and it would support a variety of species of conservation concern. Similar to alternative B, we would also focus a large degree of habitat management resources towards invasive species management, freshwater tidal marsh restoration, and monitoring for climate change adaptation.

Tidal marsh restoration in alternative C would be delayed to allow for additional data collection and sea level rise analysis prior to initiation of future marsh restoration efforts. Forest management would continue invasive species control and monitoring the impacts of high deer populations. However, alternative C would convert a 15-acre stand dominated by a nonnative gray poplar to a scrub-shrub dominated habitat. This alternative would also initiate a deer management control program. Proposed changes in habitat management under alternative C are displayed in map 3.5.

#### **3.6.3 Inventory and Monitoring**

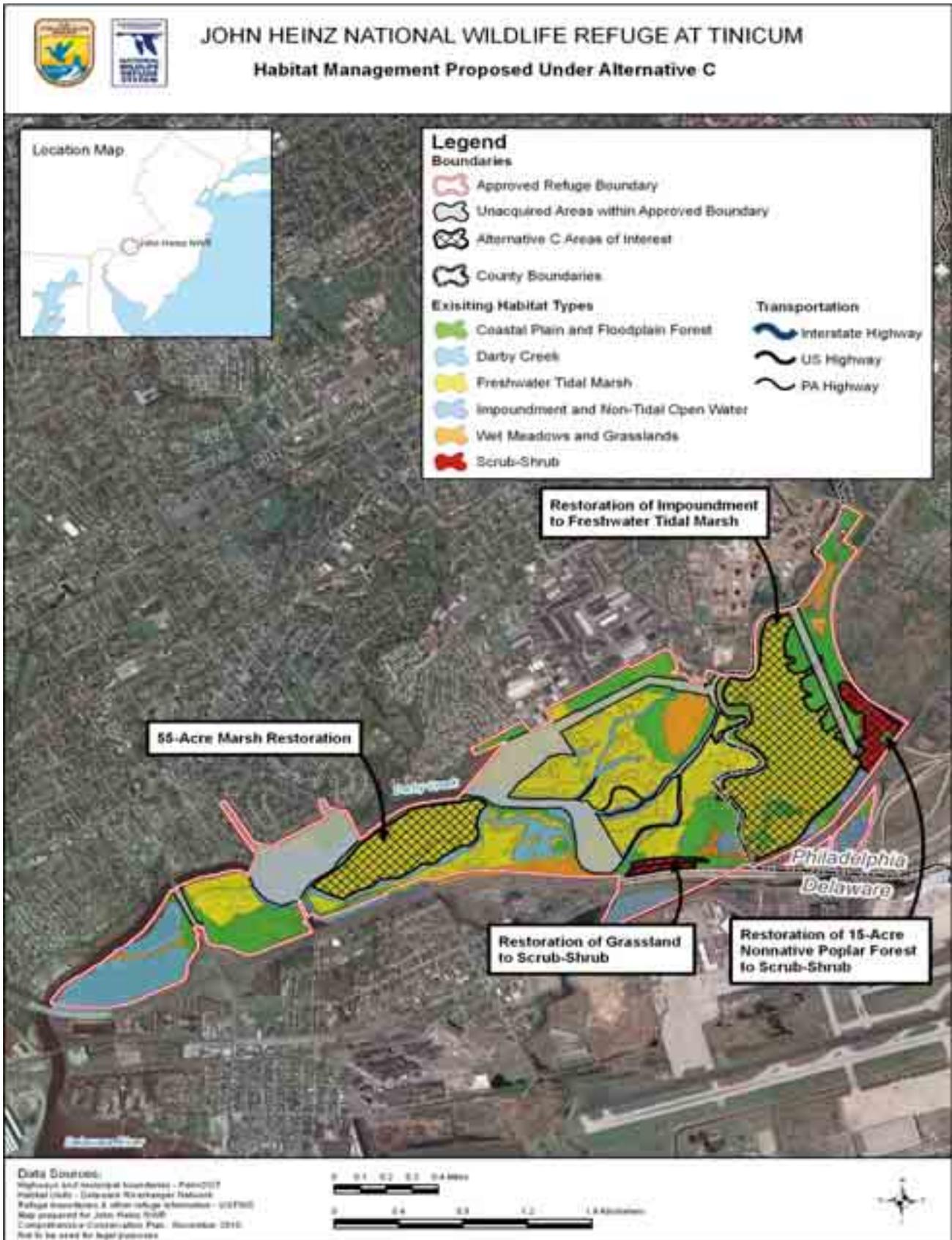
Similar to alternative B, we would continue existing monitoring and inventory efforts as long as they continue to provide useful information that would inform us about the effectiveness of habitat management, habitat adaptation to climate change, and we have the necessary resources to accomplish them. We would 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 would also continue to seek ways to reduce our management costs for establishing and maintaining monitoring protocols.

#### **3.6.4 Visitor Services**

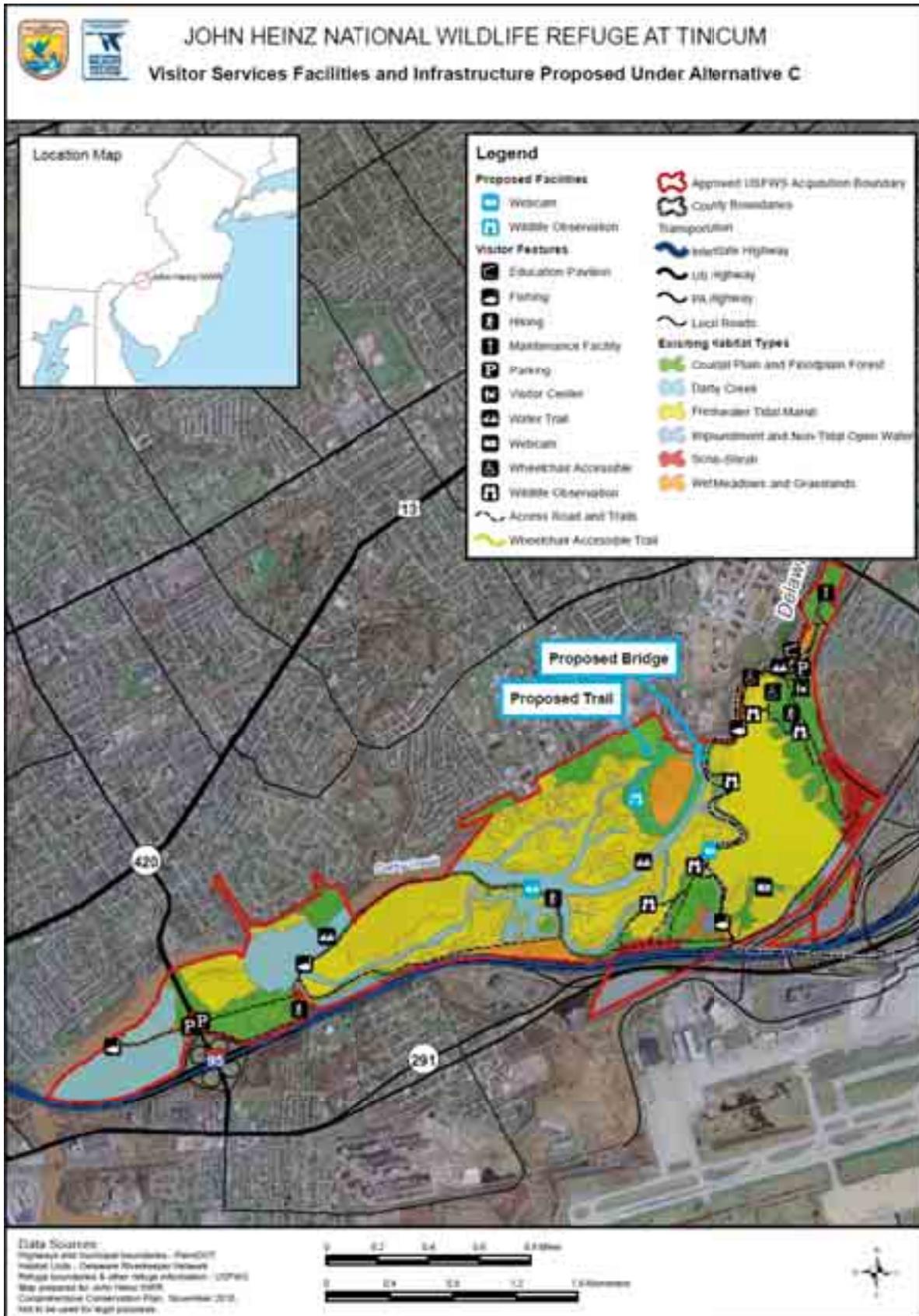
Under alternative C, we would expand existing opportunities for all six priority public uses at John Heinz NWR. Map 3.6 presents the current and proposed public use opportunities under alternative C.

Similar to alternative B, we would use the results of the Environmental Education Stakeholder Needs Assessment (Wells and White 2011) to complete the visitor services plan and develop environmental education programs. However, under alternative C, environmental educational programming would focus on providing high school, college, and post-graduate level environmental education focused on encouraging and training the next generation of conservation professionals and environmentally concerned citizens.

Map 3.5. Proposed Habitats Comprising John Heinz National Wildlife Refuge at Tinicum Under Alternative C.



Map 3.6. Proposed Visitor Services Infrastructure and Facilities at John Heinz National Wildlife Refuge at Tinicum Under Alternative C.



Environmental interpretation infrastructure would also be expanded under alternative C. Infrastructure components such as trails, boardwalks, viewing platforms, and a shuttle service are considered as more intensive alternatives for encouraging and directing interpretation as compared to alternative B.

We expect total onsite visitation to be intermediate between alternatives A and B, at about 183,000 visits per year. Because of the expansion in programs (i.e., hunting and expanded environmental education) and infrastructure, we expect visitation to be a bit higher compared to alternative A. Because the hunt program would need to be limited, and under alternative C we would not place as much effort into expanding onsite environmental education and interpretation as we would under alternative B, total visitation is expected to be slightly lower than estimated under alternative B.

### 3.6.5 Refuge Administration

Similar to alternative B, we would add five positions under alternative C. These positions are the same as those proposed under alternative B with one exception. Because we would not pursue as much active management and restoration throughout the life of the plan and would increase our reliance on partners to conduct research and monitoring on the refuge, we propose another Park Ranger position to assist with visitor services instead of the biological technician (see appendix D).

Under alternative C, the refuge would upgrade and expand its existing visitor center to allow co-location of most refuge programs. Maintenance staff would continue to have offices within the existing garage facility. The facility proposed under this alternative would also allow for expansion of interpretive displays. All other facilities would be maintained and upgraded to meet safety and accessibility requirements over the 15-year life of the plan.

In the section that follows, we describe in detail the goals, objectives, and strategies we would implement under alternative C.

### 3.6.6 Goals, Objectives, and Strategies Under Alternative C

#### 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:**

In addition to strategies in alternative A:

- Explore construction of a sound barrier along I-95 to reduce sound impacts on birds, amphibians, and other wildlife.

#### Objective 1.1 Freshwater Tidal Marsh

Over the next 15 years, maintain and improve the existing 282 acres of freshwater tidal marsh by reducing the amount of area dominated by phragmites from 24 acres (12 percent) to less than 10 acres (5 percent), and reestablish greater than 80 percent coverage of native marsh plant species in areas of phragmites reduction. Monitor for effects of climate change prior to developing restoration plans for up to 263 acres of freshwater tidal marsh, including the 145-acre impoundment area. Restored marsh areas would be dominated by native marsh vegetation, and would contain less than 5 percent areal coverage of invasive plant species.

#### Rationale

Alternative C is similar to previous alternatives in that we would continue to protect the existing Tinicum Marsh and pursue restoration of additional tidal

marsh acreage. The difference in alternative C, versus alternative B, is the timing and extent of that additional restoration. This alternative recognizes that climate change projections (and specifically sea level rise predictions) are still in a state of fluctuation as models and their considerations become more and more complex, as noted in the rationale discussion of alternative A, objective 1.1. Because of this uncertainty, freshwater tidal marsh management under this alternative is largely focused on establishing, collecting, and monitoring long-term data trends within Tinicum Marsh in order to improve our projections and evaluation of potential sea level rise prior to implementing marsh restoration projects.

Ultimately, under this alternative, we intend to restore the 145-acre impoundment to freshwater tidal marsh. Since the protection of Tinicum Marsh is one of the highest management priorities put forth by the original legislated purposes, we are considering the full restoration of this area. Historic maps indicate the existing impoundment was once covered by wetlands, presumably freshwater tidal marsh, as recent as the early 20th century. While the impoundment does provide important habitat benefits when managed effectively, that type of management is challenging and is likely to become more difficult with projected changes in climate. Additionally, many of the same species of conservation concern that use the impoundment benefit from freshwater tidal marsh habitat. In light of the uncertainty of sea level rise projections and our general evaluation and monitoring approach under alternative C, restoration of the 145-acre impoundment would not occur until sometime near the end of this CCP lifespan (15 years), or perhaps longer if uncertainty still exists. This restoration would be designed and implemented based on updated sea level rise information and monitoring on the refuge. Any plan to restore the impoundment will require additional NEPA analysis and public involvement.

### Strategies

In addition to strategies outlined in alternative A, objective 1.1 we would:

- Control nonnative, invasive species focused primarily on phragmites 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 2 years of plan approval:*

- Develop an assessment and prioritization list of potential freshwater tidal marsh wetland restoration projects on the refuge in accordance with the refuge's Habitat Management Plan and the Restoration Management Plan for the Lower Darby Creek.
- Initiate partnerships with regional agencies and non-governmental organizations within the Landscape Conservation Cooperative to support stream, wetland, and riparian restoration and fish barrier removal projects directly connected to refuge habitats and within Darby Creek watershed.
- Support restoration of a large patchwork of habitats not directly connected to the refuge, but within the Landscape Conservation Cooperative for migratory birds and other species in order to enhance migratory stopover habitat as opportunities arise.

#### *Within 5 years of plan approval:*

- Focus climate change management on making the refuge a regional focal point for research and information related to climate change impacts such as sea level rise, species migrations, and other landscape-scale impacts.
- Utilize regional-scale habitat models to evaluate changes in habitat or species distributions based on changes in climatic conditions. Observe changes in species or habitats and verify model results.

*Within 15 years of plan approval:*

- Reevaluate tidal marsh management and proposed restoration projects based on climate change data collection at the refuge and improved regional analysis of climate change trends.
- Conduct a wildlife hazard assessment prior to implementation of wetland restoration projects to evaluate the potential impacts on wildlife of concern to Philadelphia International Airport.
- After conducting monitoring of the 145-acre impoundment, develop and implement a detailed plan to restore the impoundment to freshwater tidal marsh, consistent with the results of the monitoring.

#### **Monitoring Elements**

*Continue to:*

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

*Within 5 years of plan approval:*

- Monitor and adapt marsh restoration projects to climate change impacts to the extent practical.

*Within 15 years of plan approval:*

- Evaluate effects and climate trends over the course of the plan and determine thresholds for particular adaptive actions based on updated projections.
- Use climate change monitoring data and regional models and analyses of climate change trends to develop restoration plans for restoring 145-acre impoundment to tidal marsh and for other tidal marsh areas.

#### **Objective 1.2 Coastal Plain and Floodplain Forests**

Over the next 15 years, manage and maintain up to 287 acres of coastal plain and floodplain forests to increase native herbaceous and shrub species diversity and richness. This includes converting 15 acres of existing forest dominated by nonnative poplar to an early successional scrub-shrub habitat. The net changes of these alterations and additions would result in approximately 1 acre of additional forest habitats compared to alternative A.

The 287 acres of coastal plain and floodplain forest communities would be managed 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/sapling cover by 10 percent, and at least a 15 percent reduction in areal coverage of herbaceous, nonnative, invasive species as compared to levels inventoried in 2005.

#### **Rationale**

Forest management under alternative C is focused primarily on implementation of a deer management program in order to reduce the high population densities noted in the discussion of alternative A, objective 1.2. Here, the deer management controls implemented would be initiated through a limited hunting program (e.g., a youth or handicapped-accessible hunt) with wildlife control specialists being utilized as supplemental controls as needed to effectively reduce deer population densities. Implementation of a controlled hunt would make one of the priority public uses available in this urban area. However, the hunt program would be limited to ensure public safety, and minimize conflicts with other priority public uses. Also, any controlled hunt on the refuge would be consistent with State and

local regulations and laws. As outlined in chapter 4, section 4.1.3, “Management Actions Not Analyzed in Detail,” we would need to conduct additional NEPA” analysis and public involvement after we have evaluated and developed a more detailed plan. We would also need to complete additional Service documentation including a compatibility determination for the hunt program.

Under this alternative, we would restore the 15-acre stand of nonnative gray poplar to a scrub-shrub dominated habitat type. Scrub-shrub or early successional habitat is currently not available within the refuge. By converting the nonnative and invasive dominated canopy to a native shrub-dominated community, we would enhance stopover and potential breeding sites for migratory songbirds and allow for improved long-term control of invasive species through periodic (once every 3 to 5 years) brush cutting and clearing of this area.

Due to the focus on deer management implementation and forest to scrub-shrub conversion, invasive species control efforts would be reduced to focus primarily on the prevention of new introductions and incorporation of biological controls for long-term management. By implementing these other management actions, we hope to increase the re-establishment of native species which would provide competition to increase the effectiveness of our long-term invasive species control strategies.

### **Strategies**

In addition to strategies identified under alternative A:

*Within 2 years of plan approval:*

- Focus control of nonnative, invasive species on preventing new invasions. Conduct regular species surveys and regional distribution research.

*Within 10 years of plan approval:*

- Implement a limited deer hunting program, consistent with State and local regulations and laws (e.g., youth hunt, handicapped-accessible archery hunt), with supplemental use of wildlife control specialists as necessary to reduce and then maintain populations as recommended in the USDA-APHIS Deer Management Plan and document the effects of deer population control efforts on forest regeneration and plant species richness and diversity within established monitoring plots.
- Identify low quality areas of floodplain forest and implement conversion to coastal plain forests through selective cutting and re-planting in order to improve wildlife foraging and nesting habitat and restoration of priority plant communities (i.e., State or globally rare).
- Explore use of refuge as a test site for new USDA biological controls related to invasive plant species.

### **Monitoring Elements**

In addition to strategies outlined under alternative A:

- Within 2 years of CCP approval, develop a comprehensive Early Detection Rapid Response Plan to survey and detect newly established invasive species and immediately address control or eradication of newly detected populations.
- Within 2 years of deer management initiation, document effects on vegetation species richness and diversity within established monitoring plots.

### **Objective 1.3 Darby Creek**

Over the next 15 years, increase the refuge’s involvement with regional partners to identify and reduce water quality impacts, reduce contaminants, and provide spawning, nursery, foraging, and cover habitat for Federal trust fish and wildlife species, including American eel, striped bass, blueback herring, and alewife.

### Rationale

This alternative is similar to alternative B, objective 1.3, but with an increased focus on participation in local and regional efforts to monitor and improve water quality along Darby Creek, tributaries draining directly to the refuge, and adjacent creeks and rivers that are biologically connected to the refuge. Whereas alternative B focuses primarily on onsite opportunities for water quality monitoring and improvement projects, under this alternative we would work more closely with partners on a regional or watershed-scale to improve water quality.

Monitoring of the three tributaries draining into Tinicum Marsh (Hermesprota Creek, Muckinipattis Creek, and Stony Run) would be initiated by the refuge in order to improve our understanding of how these tributaries affect onsite water quality. These three tributaries to Darby Creek are generally not monitored due to their location in the watershed (near the mouth of Darby Creek within the tidal zone). As such, we do not have a full understanding of how they contribute to the environmental health of the refuge or watershed.

### Strategies

In addition to strategies outlined in alternative A:

*Within 5 years of plan approval:*

- Play an active role in local, State, and Federal partnerships and initiatives in order to improve water quality and reduce contaminants within the Darby Creek watershed, and consequently, the refuge.

### Monitoring Elements

In addition to strategies outlined in alternative A:

*Within 2 years of plan approval:*

- Organize a regional network of monitors to evaluate water quality along waterways directly draining to the refuge (Darby Creek, Hermesprota Creek, and Muckinipattis Creek) as well as additional creeks within the vicinity of the refuge such as Crum Creek, Raccoon Creek, and Stony Creek.

*Within 5 years of plan approval:*

- Install a network of water quality monitoring equipment on the refuge along Darby Creek to implement long-term and continuous monitoring of salinity, DO, 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

Within 15 years of plan approval, develop a plan to restore all of the 145-acre impoundment to freshwater tidal marsh. Over the course of the plan, maintain 35 acres of nontidal open water 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 red-bellied turtles, through a combination of water level management, wetland restoration, and invasive species control.

### Rationale

As noted under objective 1.1, the impoundment management under alternative C is focused on the eventual restoration of the entire 145-acre impoundment to freshwater tidal marsh. In the meantime, we would continue to attempt water control management in a way that improves available habitat for migratory birds throughout the spring and fall migrations. Effective water level management in the 145-acre impoundment is difficult due to shallow groundwater and more regular flooding of the impoundment. The projected trends in sea level

rise will likely make these challenging conditions more pronounced in the coming decades.

We understand that the impoundment is often the focal point of many visitors' experience of the refuge due to its proximity to the refuge entrance and visitor center. However, this area was historically wetland—presumably freshwater tidal marsh—as indicated by several historic maps of the site and its surroundings. Because the conversion of this prominent landscape feature on the refuge would be a complex and costly undertaking, complicated by projected effects of climate change, we envision a large component of the next 15 years being devoted to the feasibility, evaluation, design, and preparation required for such a large-scale and high-visibility restoration. In the end, restoration of this area would improve our protection of Tincum Marsh and our interpretation of its unique resources, and would hopefully serve as an example of how to incorporate climate change data into habitat restoration planning and implementation.

The Service's policy on managing for biological integrity, diversity, and environmental health encourages the restoration of habitats based on known historic conditions and composition where practical. Restoration of the 145-acre impoundment would address this management directive by restoring the historic condition (pre-1930s) of this area as freshwater tidal marsh.

As discussed in alternative A, the other nontidal open waters located on the refuge are of minimal habitat value for aquatic species. Under this alternative, we would undertake a series of habitat enhancement projects (such as revegetation or addition of artificial cover structures) in order to improve conditions for fish and other aquatic species. These efforts could provide benefits to both wildlife-dependent recreation as well as minor improvements for species such as the red-bellied turtle.

### Strategies

Until the 145-acre impoundment is restored to tidal marsh:

- Control nonnative, invasive species affecting the impoundment and nearby open water habitats when they spread over 5 percent (3.5 acres) of areal coverage across the impoundment. Control through a combination of herbicide application, mechanical controls, and water level manipulation treatments where feasible and cost-effective.
- Control the aggressive native species, spatterdock (*Nuphar lutea*), when it spreads across greater than 10 percent (7.25 acres) of areal coverage. Control through a combination of herbicide application, mechanical controls, and water level manipulation treatments where feasible and cost-effective.
- 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.
- Maintain existing dike system in order to prevent and minimize structural damage to the dike and access road sustained 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.
- Work with Tincum Township to address flood control concerns associated with removal of the impoundment.

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

*Within 2 years of plan approval:*

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

*Within 5 years of plan approval:*

- Initiate the feasibility, data collection, design, and regulatory discussions for restoration of the 145-acre impoundment to freshwater tidal marsh restoration.

*Within 10 years of plan approval:*

- Improve habitat availability within Hoys Pond and the 16-acre pond for fish, reptiles, amphibians, and small mammals through completion of various habitat enhancement projects.

*Within 15 years of plan approval:*

- Complete restoration plan and begin restoration of the 145-acre impoundment to freshwater tidal marsh.

### **Monitoring Elements**

*Continue to:*

- Complete current fisheries inventory of Hoys Pond and the 16-acre pond on refuge lands.
- Support annual volunteer frog monitoring.
- Monitor water quality (temperature, pH, and dissolved oxygen) and water level fluctuations within the impoundment throughout the year to maintain water quality for biological productivity until restoration to tidal marsh.
- Conduct weekly inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance within the impoundment. Utilize 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 during spring and fall migration.

*Within 5 years of plan approval:*

- 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 of open water, managed mudflat, and tidal marsh habitats.
- Evaluate water quality inputs from neighboring stormwater drainage discharging onto refuge lands and initiate development of improvement measures, such as redirecting stormwater inputs from Philadelphia International Airport to Long Hook Creek.
- With partners, conduct baseline red-bellied 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.

### **Objective 2.2 Grasslands and Wet Meadows**

Over the life of the plan, convert up to 14 acres of existing grasslands to scrub-shrub habitat and manage the remaining 57 acres to create a mix of native grasses, forbs with no greater than 5 percent bare ground, and so that nonnative, invasive species comprise less than 10 percent of the total areal cover.

### Rationale

In contrast to alternatives A and B, grassland management under this alternative is focused on supplemental conversion of selected areas to a scrub-shrub dominated habitat type. When coupled with the scrub-shrub conversions proposed under the forest management objective within this alternative, we would have established a considerable amount of conversion acreage that would provide a new habitat type not currently available on the refuge.

Areas selected for conversion were based on evaluation of species composition, patch size, ownership, and presence of utilities or infrastructure. Many of the existing grasslands within the refuge are within utility right-of-way corridors (some of which are not owned by the Service) that limit the potential options for habitat management. An existing 7.7 acre cool-season grass meadow located near the recent 2009 marsh restoration site (located southwest of the existing wildlife observation blind overlooking Tinicum Marsh) is one such area targeted for conversion due to its low existing species diversity and proximity to I-95. Another area highlighted for conversion is up to 6 acres of the meadow known as Frog Pond—located along the eastern boundary of the refuge. Much of this area is surrounded by coastal plain or floodplain forest and/or dominated by cool-season grasses and invasive species such as phragmites.

Existing grassland areas would continue to be enhanced through nonnative, invasive species control and supplemental seeding/planting as necessary to achieve our biological goals. Some grassland is currently dominated by cool-season grasses such as orchardgrass and fescue species. These species tend to promote habitat for small mammals, but provide little structure for ground-nesting birds, migratory landbirds, or amphibians. In addition, as discussed in objective 2.2 under alternative B, tall fescue often hosts an endophyte that can have detrimental effects on small mammals or other herbivorous species. Where possible, the refuge would continue its efforts to restore warm-season grasses and native flowering species to these areas.

Some areas of Folcroft Landfill may be converted to scrub-shrub as well. However, final determination of what areas (if any) are suitable would be determined once the site is remediated and released.

### Strategies

*Continue to:*

- Annually mow to maintain 57 acres of grassland habitats.
- Control nonnative, invasive species affecting wet meadow and grassland habitats, (e.g. Japanese honeysuckle, purple loosestrife, mile-a-minute vine, and multiflora rose) through a combination of herbicide application, hand pulling, and mowing.
- Promote warm-season grass establishment in areas previously dominated by cool-season grasses.

*Within 5 years of plan approval:*

- Remove all 15 acres of the nonnative poplar stand and manage a shrub-scrub early successional habitat to promote habitat diversification for migratory landbirds.
- Cease annual mowing of 9 acres of existing grasslands targeted for successional transition into a scrub-shrub dominated habitat type.
- Install supplemental plantings using volunteers within the grasslands surrounding the visitor center to enhance species diversity with no greater than 5 percent bare ground, and so that nonnative, invasive species comprise less than 10 percent of the total areal cover.

*Within 10 years of plan approval:*

- Initiate conversion of up to 14 acres of grassland habitats (7.7 acres of existing cool-season grass meadows near the 10-acre marsh restoration site, an additional 6 acres either near Frog Pond or on Folcroft Landfill, and 0.6 acres near the oil spill mitigation site) to allow succession into shrub-scrub habitat. Continue to maintain shrub-scrub habitat as a new, long-term management routine.

#### **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.**

#### **Objective 3.1 Environmental Education**

Over the 15 year life of the plan, provide an environmental education program with specific themes and learning objectives for up to 11,000 students onsite annually. The program would focus on higher-level conservation education, with lessons and resources that describe the habitats, wildlife, environment, and cultural resources of the refuge, describe the purpose of the refuge, and meet Pennsylvania educational standards and curriculum requirements for students and teachers

#### **Rationale**

Environmental education is one of the original establishing purposes of John Heinz NWR as highlighted in alternative A, objective 3.1. Compared to alternative A, alternative C would expand the existing suite of programs we provide to elementary, middle, and high school students from across southeastern Pennsylvania.

As discussed under alternative B, objective 3.1, 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; Wells and White 2011). Similar to alternative B, under this alternative, we would 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. However, in contrast to alternative B, this alternative would emphasize providing environmental education to college-aged and conservation professional development. We envision the courses and the professional training model embodied by institutions such as the Pennsylvania Institute for Conservation Education or the Humboldt Institute. Since neither of the education centers are located near the refuge, we do not anticipate that programming provided under the refuge's programs would compete with the services provided by these institutions. We would work with other conservation educators throughout the region to ensure that programming provided at the refuge does not compete with other opportunities existing throughout the region, but that would complement other programs.

Under alternative C, we would also build upon our existing programs (alternative A) to incorporate a greater emphasis on cultural resources of the Tinicum and Philadelphia area as it relates to the habitats and their conservation. We

would use the recent cultural history of the 19th and 20th centuries to highlight the changing perception of wetlands, utilization for resources, and resource conservation. With its long history of dike construction, ditching, dredging, filling, transportation building (rail, road, and air travel), to the preservation by local citizens, the refuge has a history of culturally driven land changes worth sharing through educational programming.

### **Strategies**

In addition to strategies identified under alternative A:

*Within 5 years of plan approval:*

- Continue to provide environmental education programming to at least 150 elementary, middle, and high school classes.
- Work with partners and use results of Environmental Education Stakeholder Needs Assessment Phase II to incorporate results into visitor services planning.
- Explore the creation of a field school for higher conservation education similar to the programs offered at the Pennsylvania Institute for Conservation Education or the Humboldt Institute.
- Pursue formal adoption of refuge programs as part of curriculum by at least three schools, including one college or community college.
- Define education standards applicable to MicroLife program and pursue certification of credits for K-12 schools.
- Expand educational programs related to the history of wetland conservation and the environmental movement's role in resource protection, highlighting the citizen-led preservation of Tinicum Marsh.
- Expand web-based information, exhibits, and programs related to land protection efforts surrounding Tinicum Marsh by providing at least three new web-based educational tools.

*Within 10 years of plan approval:*

- Explore potential for shuttle, tram, boat, or bus tour programs to improve access to and education about Tinicum Marsh.

### **Monitoring Elements**

- Annually complete an evaluation summary of environmental education opportunities provided (e.g., number of programs, events, and outreach efforts) and their utilization (e.g., number of visits, schools, teachers, and students engaged).

## **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 environmental interpretation infrastructure to accommodate up to 22,500 onsite participants. Expand web-based opportunities for visitors, students, and area residents. New and expanded interpretation program and facilities would emphasize the refuge's natural and cultural resources and its contribution to conserving those resources in the Delaware Estuary.

### Rationale

The importance of environmental interpretation has been outlined in objective 4.1 within alternatives A and B previously. Under this alternative, we would continue to provide the interpretive opportunities and programming currently available. In contrast to alternative B, this alternative focuses on maintaining existing interpretive programming while expanding infrastructure to aid in both onsite and web-based interpretation. Under this alternative, we expect a similar increase in active, onsite participation

Onsite improvements would include remodeling of the visitor center to expand interpretive exhibits. Updated and expanded interpretive facilities would improve displays as well as improve accessibility needed when accommodating the additional visitation expected over the next 15 years.

Incorporating web-based exhibits and tools is also important to our interpretive program. We would install a series of webcams at various points of interest such as the bald eagle nest, Tinicum Marsh, Darby Creek, and the visitor center in order to create opportunities for offsite interpretive interest and promote visitation.

### Strategies

In addition to strategies identified under alternative A:

*Within 2 years of plan approval:*

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

*Within 5 years of plan approval:*

Install additional webcams at points of interest such as Tinicum Marsh, the visitor center, and Darby Creek.

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

*Within 10 years of plan approval:*

- Work with the EPA 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 upon site release.
- 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 and signs and brochures in braille.
- Remodel the visitor center to allow expansion of interpretive exhibits.

### Monitoring Elements

Complete a yearly evaluation summary of environmental interpretation opportunities provided (number of programs, events, outreach efforts provided) and their utilization (number of visits, type of activity, and participants engaged).

## 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

Over the next 15 years, improve accessibility for priority public uses, provide an array of wildlife-dependent recreation opportunities to visitors, and expand infrastructure and facilities necessary to provide a quality interpretive experience.

### **Rationale**

As previously noted in alternatives A and B, wildlife-dependent recreation accounts for the largest number of visitation to the refuge. As with alternative B, we would expand our existing network of recreation opportunities throughout the refuge. However, the specific mechanisms by which we provide those new and expanded opportunities varies considerably.

This alternative would pursue other methods of introducing visitors to Tincicum Marsh. Much of the marsh and adjacent trails are over 2 miles from the visitor center, making them inaccessible for many visitors due to time availability or ability. We would pursue alternative transportation via a bus, shuttle, or tram to transport visitors to the trail network found within the central portions of the refuge. This service would allow reliable transportation to and from these central portions of the refuge and the visitor center.

As with alternative B, we also would improve access via water trails to Tincicum Marsh. However, unlike alternative B, here we propose offering an opportunity for a commercial partnership to develop and operate guided boat tours to improve access to Darby Creek and Tincicum Marsh. The benefits of this would reduce the need for Service staff operation and maintenance as well as limit the amount of additional infrastructure proposed under alternative B.

### **Strategies**

In addition to strategies identified under alternative A:

*Within 10 years of plan approval:*

- Establish a series of alternative means for which visitors can better access wildlife-dependent recreation opportunities in or around Tincicum Marsh. Potential options to explore include the following:
  - \* Create a transportation shuttle, tram, or bus to transport visitors from the visitor center to Tincicum Marsh.
  - \* Consider commercial partnership to develop small non-motorized boat access to Tincicum Marsh and water trails.
- Explore the feasibility of constructing a pedestrian bridge or other means of safe pedestrian crossing over State Highway 420.
- Initiate a youth or handicapped accessible archery hunting program in conjunction with deer management control efforts.
- Develop a canoe/kayak launch site on refuge to facilitate wildlife observation and photography

### **Monitoring Elements**

Annually complete a yearly 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).

Within 10 years, evaluate and implement a quality deer hunt program in partnership with the Pennsylvania Game Commission.

### **Rationale**

As discussed under alternative B, objective 5.2, PGC is interested in expanding hunting opportunities in Pennsylvania. In particular, there is interest in the

## **Objective 5.2 Implement a Deer Hunt Program**

refuge providing opportunities for a limited youth hunt or hunt for people with disabilities, consistent with State and local regulations. Under this alternative, we would develop and implement a limited deer hunt to provide this priority public use on the refuge and to help control the refuge's deer population. 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.

As discussed under alternative B, objective 6.3, hunting would 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 the refuges.

#### **Strategies**

*Within 10 years of CCP implementation:*

- Partner with PGC to develop a limited deer hunt program on the refuge consistent with State and local regulations and laws. This process would include additional NEPA compliance and environmental documentation. Other alternatives, including no action (i.e., no hunting) would be considered in this evaluation, and there would be additional opportunities for public involvement before a final decision would 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 coordination center for climate change research, as well as coastal plain habitat conservation and management, and tidal marsh restoration through collaboration with a variety of partners. Through this, we would foster appreciation of the refuge's regional significance to natural resource conservation, its contribution to the Refuge System, and garner additional support for refuge programs.

#### **Rationale**

The refuge plays an important role in regional conservation by providing a facility to house meetings, workshops, and seminars related to conservation and environmental protection. Alternative C embodies an approach that promotes the Service and National Wildlife Refuge System as an important regional contributor to conservation. We would utilize the location of the refuge and expertise of the refuge and other Service program staff to develop regional workshops, offer seminars and presentations, and sponsor technical forums. These events would be targeted for the regional conservation community using the refuge as a central location for facilitation and networking.

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 visual and acoustic buffer, while some properties could also provide additional habitat buffers for refuge lands where applicable.

### Strategies

In addition to strategies identified under alternative A:

*Within 15 years of plan approval:*

- Establish facilities and programs to promote the refuge (and its staff) as a regional focal point for climate change research, coastal plain habitat conservation and management, and tidal marsh restoration through participation in regional workshops, offering seminars and presentations, and sponsoring technical forums.
- Work with Philadelphia International Airport to conduct wetland mitigation, restoration, and land acquisition both on and off the refuge.
- Use relationships developed through the refuge's new field school for higher conservation education to encourage research and promote the refuge's role as a regional focal point for studying the effects of climate change.
- Work with academic institutions to encourage climate change research that would inform refuge management, and would 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.

### Monitoring Elements

- Complete a yearly evaluation summary of partnership efforts and roles that the refuge has played in climate change research, coastal plain habitat conservation and management, and tidal marsh restoration.

## Objective 6.2 Outreach and Partnerships

Within 15 years of CCP approval, increase community outreach by conducting or sponsoring at least three outreach programs or events each year, and provide regular updates on refuge programming and outreach to surrounding businesses and communities to increase refuge visitation.

### Rationale

Partnerships under alternative C would mirror much of what is currently underway within alternative A. Where this alternative differs is that much of the partnership involvement would be directed towards working closely with the Friends of the Heinz Refuge to assist in outreach and partnership development. By working with the Friends organization, we can expand the level of outreach we pursue by working with area residents and businesses to garner support and interest in the refuge.

Related to this strategy, we would develop a series of standalone displays for area hotels and businesses. These displays would encourage visitation, inform interested individuals about the refuge, and provide directions to and from the refuge. We would work closely with the Friends, Philadelphia International Airport, and surrounding businesses to sponsor such displays.

### Strategies

In addition to strategies identified under alternative A:

*Within 5 years of plan approval:*

- Work with the Friends group to expand their pursuit of local partnerships to increase public interest and visitation to the refuge.

- Develop a stand-alone photo display for local hotels and the Philadelphia Airport that can be updated annually or seasonally.

#### Monitoring Elements

- Complete a yearly evaluation summary of partnership and outreach efforts and resulting benefits to the refuge (increased visitation, awareness, or understanding).

*Within 10 years of plan approval:*

- Establish at least one partnership with local universities to implement public use surveys and complete user analysis.

### 3.7 Comparison of Alternatives

The following tables display the comparison of alternatives A through C as discussed throughout this chapter. Table 3.1 illustrates the difference in acreage and habitat types between alternatives. Table 3.2 is a comparison of strategies discussed throughout the chapter between alternatives A through C.

**Table 3.1. Summary of Habitat Acreage by Alternative**

<b>Acreages By Alternatives</b>			
<b>Habitat</b>	<b>Alternative A (acres currently owned and managed)</b>	<b>Alternative B Preferred Alternative (total acres within acquisition boundary)</b>	<b>Alternative C (total acres within acquisition boundary)</b>
Coastal Plains and Floodplain Forest	286.2	313.5	287.1
<i>Floodplain Forest</i>	<i>236.9</i>	<i>261.2</i>	<i>243.9</i>
<i>Coastal Plain Forest</i>	<i>34.2</i>	<i>52.3</i>	<i>43.2</i>
<i>Nonnative Gray Poplar Forest</i>	<i>15.0</i>	<i>0.0</i>	<i>0.0</i>
Darby Creek	132.4	204.2	204.2
Freshwater Tidal Marsh	282	454.8	544.8
<i>Native species Freshwater Tidal Marsh</i>	<i>221.6</i>	<i>426.6</i>	<i>522.1</i>
<i>Phragmites-dominated Tidal Marsh</i>	<i>60</i>	<i>22.7</i>	<i>22.7</i>
Impoundment and Nontidal Open Water	200.6	123.1	35.4
<i>145-Acre Impoundment</i>	<i>144.2</i>	<i>72.1*</i>	<i>0.0</i>
<i>Ponds and Other Nontidal Open Water</i>	<i>56.4</i>	<i>56.4</i>	<i>35.4</i>
Wet Meadows and Grasslands	71.6	63.9	57.2
Scrub-Shrub	0.0	0.0	30.9
Developed Land	21.2	34.2	34.2
<b>Sum**</b>	<b>993.6</b>	<b>1193.7</b>	<b>1193.7</b>

*\*Actual acreage would vary depending on final outcome of restoration feasibility study and design.*

*\*\*Summary acreages included are based on GIS data used for planning purposes. The refuge is authorized to acquire up to 1,200 acres based on approvals outlined in Public Law 92-326. June 30, 1972.*

3.7 Comparison of Alternatives

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<b>Refuge Staffing and Administration</b>		
<p>Maintain existing ten positions and types of staff resources. See existing organization chart in appendix D.</p>	<p>Increase staff by up to five positions to achieve levels outlined by the national staffing model, including:</p> <ol style="list-style-type: none"> <li>1. Biological Technician (GS-5/7)</li> <li>2. Administrative Assistant (GS-5/7)</li> <li>3. Shared Zone Outreach Coordinator (Visitor Services) (GS-11)</li> <li>4. Maintenance Worker (GS-5/6/7)</li> <li>5. Park Ranger – Volunteer Coordinator/ Education Specialist (GS-5/7/9)</li> </ol>	<p>Increase staff by up to five positions to achieve levels outlined by the national staffing model, including:</p> <ol style="list-style-type: none"> <li>1. Administrative Assistant (GS-5/7)</li> <li>2. Shared Zone Outreach Coordinator (Visitor Services) (GS-11)</li> <li>3. Maintenance Worker (GS-5/6/7)</li> <li>4. Park Ranger – Volunteer Coordinator/Education Specialist (GS-5/7/9)</li> <li>5. Park Ranger – Environmental Education (GS-5/7/9)</li> </ol>
<b>Refuge Buildings and Facilities</b>		
<p>Maintain existing facilities and complete planned improvements and upgrade appropriate facilities to ADA standards.</p> <p>Complete construction of outdoor pavilion.</p>	<p><i>In addition to alternative A:</i></p> <p>Expand existing facilities to accommodate additional staff and collocate all refuge programs within the same facility.</p>	<p><i>In addition to alternative A:</i></p> <p>Remodel existing facilities to provide co-location of most refuge programs (except maintenance) and expansion of environmental education and interpretation facilities.</p>
<b>Strategies that Apply to All Objectives under Goals 1 and 2</b>		
<p>Recruit, hire and train, interns, volunteers, and students under the student assistance programs to assist with aspects of biological management such as invasive species control and biological monitoring.</p> <p>Support Friends of Heinz NWR to assist with biological management such as invasive species control.</p> <p>Continue to develop MOU's or MOA's on in-holdings to allow for habitat management and law enforcement where important for maintaining refuge resources and public safety.</p>	<p><i>In addition to alternative A:</i></p> <p>Work with PENNDOT and Philadelphia International Airport to evaluate effects of traffic and airport noise on refuge wildlife to determine if a sound barrier is warranted. If warranted, explore determine location(s), design(s), types(s) of appropriate barriers.</p> <p>Within 7 years of plan approval, coordinate with partners to conduct plant and animal species inventories and monitoring to update information on refuge populations.</p>	<p><i>In addition to alternative A:</i></p> <p>Explore construction of a sound barrier along I-95 to reduce sound impacts on birds, amphibians, and other wildlife.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 1. COASTAL PLAIN ECOLOGICAL COMMUNITIES</b>                      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.</p>		
<p><i>Responds to Issues: Biological connectivity, potential climate change impacts, invasive species, deer management, tidal marsh restoration, water quality, and environmental hazards</i></p>		
<p><b>Objective 1.1 Freshwater Tidal Marsh</b></p>		
<p>Continue to protect and manage existing 282 acres of marsh. Improve 55 acres of this existing freshwater tidal marsh.</p>	<p>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.</p>	<p>Protect and manage existing 282 acres of tidal marsh and improve 55 acres of this existing habitat. Monitor for effects of climate change before restoring approximately 263 additional acres of tidal marsh.</p>
<p>Provide technical support to regional corridors and restoration efforts upon request and to targeted projects, such as:</p> <ol style="list-style-type: none"> <li>1. Tinicum Township/Long Hook Creek Connection/Restoration</li> <li>2. Philadelphia International Airport</li> </ol>	<p><i>In addition to strategies outlined in alternative A:</i></p> <p>Work with Philadelphia International Airport management to conduct an assessment of wildlife hazards prior to implementing wetland restoration projects on the refuge.</p>	<p><i>Same as alternative A, plus:</i></p> <p>Work with Philadelphia International Airport management to conduct an assessment of wildlife hazards prior to implementing wetland restoration projects.</p> <p>Support restoration of a large patchwork of habitats not directly connected to the refuge, but within the Landscape Conservation Cooperative for migratory birds and other species</p> <p>Initiate partnerships with regional agencies and organizations within the LCC to implement stream, wetland, and riparian restoration and fish barrier removal projects directly connected to refuge habitats and within Darby Creek watershed.</p> <p>Support restoration of large patchwork habitats not directly connected to the refuge, but within the LCC for migratory birds and other species in order to enhance migratory stopover habitat.</p>

3.7 Comparison of Alternatives

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 1. COASTAL PLAIN ECOLOGICAL COMMUNITIES (cont.)</b>            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.</p>		
<p><i>Responds to Issues: Biological connectivity, potential climate change impacts, invasive species, deer management, tidal marsh restoration, water quality, and environmental hazards (cont.)</i></p>		
<p><b>Objective 1.1 Freshwater Tidal Marsh (cont.)</b></p>		
<p>Use existing biological datasets to guide species and habitat management restoration.</p> <p>Participate in environmental emergency action plans (e.g., Spill Prevention and Control Plans) as appropriate to protect Darby Creek, open water, and tidal marsh wetlands on refuge lands.</p>	<p><i>In addition to alternative A:</i>            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.</p>	<p><i>In addition to alternative A:</i>            Focus climate change management on making the refuge a regional focal point for research and information related to climate change impacts such as sea level rise, species migrations, and other landscape-scale impacts.</p> <p>Utilize regional-scale habitat models to evaluate changes in habitat or species distributions based on changes in climatic conditions. Observe changes in species or habitats and verify model results.</p>
<p>Continue to support ongoing research related to sea level rise, marsh accretion rates, and nitrogen removal capacity within tidal marsh.</p>	<p><i>In addition to alternative A:</i>  <u>Within 5 years:</u>            Monitor and adapt marsh restoration projects to address effects of climate change to the extent practical.</p> <p>Identify and implement where feasible adaptive management strategies to minimize potential impacts of a changing climate.</p> <p>Partner with local universities and regional researchers to define a baseline monitoring plan that continues monitoring for climate change impacts within the existing marsh.</p> <p><u>Within 10 years:</u>            Begin to evaluate the feasibility of expanding the refuge’s acquisition boundary to address rising sea level caused by climate change.</p>	<p><i>In addition to alternative A:</i>            Re-evaluate tidal marsh management and proposed restoration projects based on climate change data collection at the refuge and improved regional analysis of climate change trends.</p> <p>Monitor and adapt marsh restoration projects to climate change impacts to the extent practical.</p> <p>Use climate change monitoring data and regional models and analyses of climate change trends to develop restoration plans for restoring 145-acre impoundment to tidal marsh and for other tidal marsh areas.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 1. COASTAL PLAIN ECOLOGICAL COMMUNITIES (cont.)</b>                      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.</p>		
<p><i>Responds to Issues: Biological connectivity, potential climate change impacts, invasive species, deer management, tidal marsh restoration, water quality, and environmental hazards (cont.)</i></p>		
<p><b>Objective 1.1 Freshwater Tidal Marsh (cont.)</b></p>		
<p>Complete restoration of funded 55-acre restoration site in cooperation with Chesapeake Bay ES office and other partners.</p> <p>Continue annual aerial spray treatments to control 10 to 15 acres of phragmites-dominated tidal marsh.</p>	<p><i>The same as alternative A, plus:</i>                      Pursue funding for additional marsh restoration projects and complete marsh restoration as funding allows.</p> <p>Control nonnative, invasive species when populations exceed greater than 5 percent areal coverage across freshwater tidal marsh.</p> <p><u>Within 5 years:</u>                      Develop a prioritized list of potential habitat restoration projects on the refuge.</p> <p><u>Within 10 years</u>                      Work with partners to complete a study evaluating the environmental effects of restoring about half of the 145-acre impoundment to freshwater tidal marsh.</p> <p>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.</p> <p><u>Within 15 years:</u>                      Begin restoration of a 27-acre wetland area dominated by degraded floodplain forest.</p> <p>If we choose to pursue restoration, work to obtain funding for restoration plan developed for the 145-acre impoundment. Implement restoration plan if funding is obtained.</p>	<p><i>The same as alternative A, plus:</i>                      Develop an assessment and prioritization list of potential freshwater tidal marsh wetland restoration projects on the refuge.</p> <p>Control nonnative, invasive species when populations exceed greater than 5 percent areal coverage across the existing 282 acres of freshwater tidal marsh.</p>
<p><b>Objective 1.2 Coastal Plain and Floodplain Forests</b></p>		
<p>Maintain the existing 34 acres of coastal plain forest and 252 acres of floodplain forest communities to provide healthy foraging and stopover habitat for migratory bird species and provide breeding habitat for the coastal plain leopard frog.</p>	<p>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</p>	<p>Manage and maintain up to 287 acres of coastal plain and floodplain forests to increase native herbaceous and shrub species diversity and richness to provide healthy foraging and stopover habitat for migratory bird species and provide breeding habitat for the coastal plain leopard frog.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 1. COASTAL PLAIN ECOLOGICAL COMMUNITIES (cont.)</b>                      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.</p>		
<p><i>Responds to Issues: Biological connectivity, potential climate change impacts, invasive species, deer management, tidal marsh restoration, water quality, and environmental hazards (cont.)</i></p>		
<p><b>Objective 1.2 Coastal Plain and Floodplain Forests (cont.)</b></p>		
<p>Install occasional tree plantings to close canopy gaps and supplement poor regeneration due to deer browse pressure.</p> <p>Reforest naturally occurring canopy gaps within the 15-acre stand of nonnative poplar with native tree species as opportunities arise.</p>	<p>Adapt a long-term management plan for forest habitats to create mixed-age stands of hardwood species identified for coastal plain and floodplain target communities.</p> <p>Initiate phased restoration of 15 acres of nonnative poplar-dominated forest to establish a successional trajectory towards coastal plain and/or floodplain forest communities.</p> <p>Restore 8.3 acres of existing grasslands to at least 50 percent cover by early successional coastal plain forest species.</p>	<p>Identify low quality areas of floodplain forest and implement conversion to coastal plain forests to improve wildlife foraging and nesting habitat and restoration of priority plant communities</p> <p>Remove all 15 acres of nonnative poplar from the refuge and manage a shrub-scrub or other early successional habitat to promote habitat diversity.</p>
<p>Invasive species control same as common to all.</p>	<p><i>In addition to common to all:</i>                      Incorporate biological control methods for invasive species where available and feasible (e.g., mile-a-minute weed, purple loosestrife).</p>	<p><i>Same as alternative B, plus:</i>                      Develop a comprehensive Early Detection Rapid Response Plan to survey and detect newly established invasive species and immediately addresses those populations through the appropriate control measure. Refer to appendix B of the HMP for more detailed information.</p> <p>Prioritize control efforts primarily on preventing new invasions. Conduct regular species surveys and regional distribution research.</p> <p>Explore use of refuge as a test site for new USDA biological controls related to invasive plant species.</p>
<p>Finalize the Deer Management Plan.</p> <p>Continue annual population monitoring to evaluate deer population trends on the refuge.</p> <p>Complete deer browse impact monitoring using established deer exclosures and USDA-APHIS protocols.</p>	<p><i>In addition to alternative A:</i>                      Continue ongoing deer browse impact monitoring utilizing established deer exclosures and USDA-APHIS protocols.</p> <p>Reduce and then maintain resident deer populations through the use of wildlife control specialists.</p> <p>Document extent of regeneration in flora richness and diversity within established monitoring plots.</p>	<p><i>In addition to alternative A:</i>                      Implement a limited hunting program (e.g., youth hunt) with supplemental use of wildlife control specialists as necessary to control the deer population.</p> <p>Within 2 years of deer management initiation, document effects on vegetation, species richness, and diversity within established monitoring plots.</p>
<p>Continue to restrict public access to eagle nesting areas during the breeding season.</p> <p>Limit public access to areas utilized by other rare species during their breeding seasons.</p>	<p><i>Same as alternative A.</i></p>	<p><i>Same as alternative A.</i></p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 1. COASTAL PLAIN ECOLOGICAL COMMUNITIES (cont.)</b>                      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.</p>		
<p><i>Responds to Issues: Biological connectivity, potential climate change impacts, invasive species, deer management, tidal marsh restoration, water quality, and environmental hazards (cont.)</i></p>		
<p><b>Objective 1.3 Darby Creek</b></p>		
<p>Manage refuge inputs to Darby Creek to protect water quality and provide habitat for Federal trust resources, particularly aquatic species.</p>	<p><i>Same as alternative A</i></p>	<p>Over the next 15 years, increase the refuge’s involvement with regional partners to identify and reduce water quality impacts, reduce contaminants, and provide spawning, nursery, foraging, and cover habitat for Federal trust fish and wildlife species.</p>
<p>Support volunteer-based water quality monitoring along Darby Creek, completed as resources allow.</p> <p>Maintain existing partnerships to assess and manage for water quality improvements impacting the refuge.</p> <p>Complete installation of a water quality monitoring unit along Darby Creek on the refuge to implement long-term and continuous monitoring.</p> <p>Annually, review and refresh staff in contaminant spill response calls and emergency protection measures.</p> <p>Continue coordination with EPA and other stakeholders to close hazardous sites and minimize environmental health impacts.</p> <p>Continue support of occasional and ongoing research to evaluate fish tissue surveys, contaminant level accumulation, and other environmental impacts of environmental hazards.</p>	<p><i>Same as alternative A, plus:</i></p> <p>Install a network of water quality monitoring equipment along Darby Creek on the refuge to implement long-term and continuous monitoring of salinity, DO, pH, temperature, flow rate, and other parameters.</p> <p>Where feasible, install stormwater management systems, such as vegetated swales or rain gardens to minimize stormwater runoff from the refuge and surrounding lands.</p>	<p><i>Same as alternative B, plus:</i></p> <p>Organize a regional network of monitors to evaluate water quality along waterways directly draining to the refuge as well as additional creeks within the vicinity of the refuge.</p> <p>Play an active role in local, state, and Federal partnerships and initiatives in order to improve water quality and reduce contaminants within the Darby Creek watershed, and consequently, the refuge.</p> <p>Install a network of water quality monitoring equipment along Darby Creek on the refuge to implement long-term and continuous monitoring.</p>
<p><b>Goal 2. Open Waters and Grassland Habitats</b>                      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.</p>		
<p><i>Responds to Issues: Invasive species, tidal marsh restoration, water quality, environmental hazards, and grassland management</i></p>		
<p><b>Objective 2.1 145-Acre Impoundment and Other Open Waters</b></p>		
<p>Manage existing 145-acre impoundment and 55 acres of nontidal, open water to provide habitat for shorebirds, waterfowl, and wading birds while maintaining essential habitat for other freshwater species of management concern, such as red-bellied turtles.</p>	<p>Manage about 67 acres of impoundment and 57 acres of nontidal open water (ponds) to enhance habitat available for shorebirds, waterfowl, and wading birds during migration periods while maintaining essential habitat for other freshwater species of management concern, such as red-bellied turtles.</p>	<p>Within 15 years of plan approval, develop a plan to restore all of the 145-acre impoundment to freshwater tidal marsh. Maintain 35 acres of nontidal open water to enhance habitat available for shorebirds, waterfowl, and wading birds during their peak migration periods while maintaining essential habitat for other freshwater species of management concern, such as red-bellied turtles.</p>

3.7 Comparison of Alternatives

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 2. OPEN WATERS AND GRASSLAND HABITATS (cont.)</b>            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.</p>		
<p><i>Responds to Issues: Invasive species, tidal marsh restoration, water quality, environmental hazards, and grassland management (cont.)</i></p>		
<p><b>Objective 2.1 145-Acre Impoundment and Other Open Waters (cont.)</b></p>		
<p>Control nonnative, invasive species affecting the impoundment and nearby open water habitats when they spread over 5 percent of areal coverage across the impoundment.</p> <p>Control the aggressive native species spatterdock when it spreads across greater than 10 percent of areal coverage.</p> <p>Continue annual frog monitoring.</p>	<p><i>Same as alternative A.</i></p>	<p><i>Same as alternative A.</i></p>
<p>Continue to attempt seasonal drawdowns to create freshwater mudflats and stimulate annual moist-soil vegetation to benefit migrating birds.</p> <p>Maintain existing dike system and water control structure.</p>	<p><u>Within 5 years:</u>            Inventory species and habitat use of the current 145-acre impoundment and freshwater tidal marsh to evaluate benefits of open water, managed mudflat, and tidal marsh habitats.</p> <p><u>Within 15 years:</u>            If we determine restoration is desirable, work with partners to complete and implement a restoration plan to restore part of the 145-acre impoundment to freshwater tidal marsh as described under objective 1.1.</p>	<p>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 of open water, managed mudflat, and tidal marsh habitats.</p> <p>After 10 years, evaluate most current sea level rise trends and explore feasibility of the restoration of the 145-acre impoundment to freshwater tidal marsh restoration.</p> <p>Restore all of the 145-acre impoundment to freshwater tidal marsh. Until restoration occurs, continue to maintain impoundment as in alternative A.</p>
<p>Continue closures of water control structure into the impoundment during forecasted storm events to minimize stormwater discharge and pollution inputs into the impoundment.</p> <p>Continue partnership with Tinicum Township to manage stormwater inputs and open waters along Long Hook Creek.</p>	<p><i>In addition to alternative A:</i>            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.</p>	<p><i>In addition to alternative A:</i>            Work with Tinicum Township to address flood control concerns associated with removal of the impoundment.</p> <p>Evaluate water quality inputs from neighboring stormwater drainage discharging onto refuge lands and initiate development of improvement measures, such as redirecting stormwater inputs from Philadelphia International Airport to Long Hook Creek.</p> <p>Partner with Tinicum Township to manage stormwater inputs into the impoundment and open waters along Long Hook Creek.</p>
<p>Maintain existing wood duck and swallow nesting boxes.</p>	<p><u>Within 5 years:</u>            Begin to phase out existing wood duck and swallow nesting boxes. Maintain a minimum number of boxes for interpretive purposes.</p>	<p><i>Same as alternative B.</i></p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 2. OPEN WATERS AND GRASSLAND HABITATS (cont.)</b>            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.</p>		
<p><i>Responds to Issues: Invasive species, tidal marsh restoration, water quality, environmental hazards, and grassland management (cont.)</i></p>		
<p><b>Objective 2.1 145-Acre Impoundment and Other Open Waters (cont.)</b></p>		
<p>Monitor water quality parameters (e.g., temperature, pH) and water level fluctuations in impoundment.</p> <p>Continue migratory bird surveys for landbirds, waterbirds, and waterfowl.</p> <p>Complete fisheries inventory of isolated ponds on refuge lands.</p>	<p><i>In addition to alternative A:</i></p> <p>Conduct weekly 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.</p> <p>With partners, conduct baseline red-bellied turtle inventory surveys within 5 years. Create a long-term monitoring program within the impoundment, open water areas, and the freshwater tidal marsh to determine forage, hibernaculum, and nesting sites.</p> <p><u>Within 5 years:</u></p> <p>Explore opportunities for reducing turtle nest predation through predator trapping, predator relocating, or other measures.</p> <p>Explore coordination with Pennsylvania Fish and Boat Commission to remove red-eared sliders.</p>	<p><i>Same as alternative B, plus:</i></p> <p>Improve habitat availability within isolated pond for fish, reptiles, amphibians, and small mammals through completion of various habitat enhancement projects.</p> <p>Monitor water quality (temperature, pH, and dissolved oxygen) and water level fluctuations within the impoundment throughout the year to maintain water quality for biological productivity until restoration to tidal marsh.</p> <p>With partners, conduct baseline red-bellied 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.</p>
<p><b>Objective 2.2 Grasslands and Early Successional Habitats</b></p>		
<p>Annually, manage 72 acres of grassland habitats to sustain stopover foraging and cover for migratory landbirds.</p> <p>Continue to maintain vernal pool and wet meadow habitat for amphibian breeding and grassland bird stopover habitat.</p> <p>Continue to promote warm-season grass establishment in areas previously dominated by cool-season grasses.</p> <p>Annually, conduct frog call surveys with volunteers to document breeding areas and adjust management as needed.</p>	<p>Annually, manage 64 acres of grassland and wet meadows to create stopover foraging and cover habitat for migratory landbirds.</p> <p><i>Same as alternative A, except:</i></p> <p><u>Within 5 years:</u></p> <p>Cease annual mowing of 8.3 acres of existing grasslands targeted for successional transition into a scrub-shrub dominated habitat.</p> <p>Begin supplemental plantings within the grasslands surrounding the visitor center to enhance species diversity.</p> <p>Install stormwater management systems, such as vegetated swales or rain gardens to minimize stormwater runoff from the refuge and surrounding lands.</p> <p>Work with utilities to discuss feasibility of converting portions of utility right of ways to additional shrub-scrub habitat.</p> <p><u>Within 15 years:</u></p> <p>Complete habitat management planning on Folcroft Landfill within 2 years of site remediation and release.</p>	<p>Over the life of the plan, convert up to 14 acres of existing grasslands to shrub-scrub habitat and manage the remaining 57 acres to create a mix of native grasses</p> <p>Allow 14 acres of grassland habitats to succeed to shrub-scrub habitat. Maintain as scrub-shrub habitat.</p> <p>Restore up to 15 acres of forested areas currently dominated by nonnative poplar to shrub-scrub habitats.</p> <p>Maintain 57 acres of existing grassland habitat.</p> <p>Install supplemental plantings in grasslands around visitor center to enhance diversity.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 3. ENVIRONMENTAL EDUCATION</b>                      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.</p>		
<p><i>Responds to Issues: Environmental, conservation-related history, and cultural resource education</i></p>		
	<p><b>Management actions that apply to all objectives under alternative B, goal 3:</b></p> <p>Within 2 years of CCP approval, complete the refuge’s visitor services plan.</p> <p>Use the visitor services plan and the results of the Environmental Education Stakeholder Needs Assessment Phase II Report to guide the refuge’s environmental education program focusing on urban schools (grades K-12).</p> <p>If resources allow, hire two additional outreach and environmental education and interpretation staff to help expand the environmental education program and meet the projected increase in visitation.</p> <p>Pursue alternative funding or grant programs for supporting transportation to and from the refuge for interested and qualifying schools and groups.</p> <p>Update and incorporate all appropriate media (brochures, website, social media, displays, etc.) to accurately communicate the environmental education components available to the public.</p> <p>Determine which schools or school districts would 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.</p> <p>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).</p> <p>Work with environmental education partners to monitor and assess the efficacy of new environmental education curricula and materials. Modify the curricula as needed to ensure content is meeting identified priorities.</p>	

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 3. ENVIRONMENTAL EDUCATION (cont.)</b>                      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.</p>		
<p><i>Responds to Issues: Environmental, conservation-related history, and cultural resource education (cont.)</i></p>		
<p><b>Objective 3.1 Environmental Education</b></p>		
<p>Staff and volunteers continue to directly lead about 30 educational programs for the refuge, reaching about 8,200 students onsite and 1,200 students offsite.</p> <p>Continue ongoing alignment of programs with PA academic standards (student standardized test requirements).</p> <p>Annually, maintain at least three partnerships with area schools that result in refuge visitation and student/ educator engagement in environmental education programs.</p> <p>Continue to pursue alternative funding or grant programs for supporting transportation to/from the refuge from schools.</p> <p>Continue to provide online curriculum, loan boxes, and other resources.</p> <p>Annually complete an evaluation summary of environmental education opportunities provided.</p>	<p>Over the 15 year life of the plan, provide a quality environmental education program focusing on urban youth, reaching about 16,000 students onsite, and 2,400 students offsite per year.</p> <p><u>Within 7 years:</u>                      Maintain relationships and programming with area schools that currently visit the refuge for environmental education.</p> <p>Offer at least 12 workshops annually that focus on teaching teachers how to implement refuge environmental education programs.</p> <p>Work with local teachers, school administrators, and other environmental education partners to develop lesson plans that would enhance environmental education curricula.</p> <p>Review and evaluate existing components (e.g., loan boxes, 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.</p> <p>Identify local urban schools and school districts and create a prioritized list of at least 15 of these schools.</p> <p>Use our relationship with the Interboro School District as a model to help develop long-term relationships with at least three additional local urban school systems from our prioritized list.</p> <p>Expand use of alternative funding or grant programs for transportation to and from the refuge for schools.</p> <p>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.</p>	<p>Provide an environmental education program with specific themes and learning objectives for up to 11,000 students annually. The program would focus on higher-level conservation education, with lessons and resources that describe the habitats, wildlife, environment, and cultural resources of the refuge, describe the purpose of the refuge, and meet Pennsylvania educational standards</p> <p><i>Same as alternative A, plus:</i>                      Continue to provide environmental education programming to at least 150 elementary, middle, and high school classes.</p> <p>Use results of Environmental Education Stakeholder Needs Assessment Phase II to incorporate results into visitor services planning.</p> <p>Explore creation of a field school for higher conservation education similar to the programs offered at the Pennsylvania Institute for Conservation Education or the Humboldt Institute.</p> <p>Pursue formal adoption of refuge programs as part of curriculum by at least three schools, including one college or community college.</p> <p>Expand educational programs related to the history of wetland conservation and the environmental movement's role in resource protection, highlighting the citizen-led preservation of Tinicum Marsh.</p> <p>Expand web-based information, exhibits, and programs related to land protection efforts surrounding Tinicum Marsh by providing at least three new web-based educational tools.</p> <p>Explore potential for shuttle, tram, boat, or bus tour programs to improve access to and education about Tinicum Marsh.</p>

3.7 Comparison of Alternatives

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 3. ENVIRONMENTAL EDUCATION (cont.)</b>            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.</p>		
<p><i>Responds to Issues: Environmental, conservation-related history, and cultural resource education (cont.)</i></p>		
<p><b>Objective 3.1 Environmental Education (cont.)</b></p>		
	<p><u>Within 15 years:</u>            Continue to develop and expand course curricula 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.             After new programs have been in place for 5 years, assess feasibility of developing an official Service survey to evaluate effectiveness of programs.</p>	
<p><b>Objective 3.2 Environmental Education for Other Use Audiences</b></p>		
<p>All included under objective 3.1</p>	<p>Over the 15 year life of the plan, provide a quality environmental education program that would include programs for other youth audiences, increase student participation in refuge programs by these groups to 8,000 student visits per year.</p>	<p>All included under objective 3.1</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 3. ENVIRONMENTAL EDUCATION (cont.)</b>            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.</p>		
<p><i>Responds to Issues: Environmental, conservation-related history, and cultural resource education (cont.)</i></p>		
<p><b>Objective 3.2 Environmental Education for Other Use Audiences (cont.)</b></p>		
	<p><i>We would continue to:</i>            Provide educational activities, curriculum, and other resources on the refuge Web site.</p> <p>Continue to offer at least 12 workshops annually that focus on teaching teachers how to implement refuge environmental education.</p> <p><u>Within 7 years:</u>            Work with environmental education partners to expand the teachers' workshops to include additional programming based on the results of the Environmental Education Stakeholder Needs Assessment Phase II report and actions outlined within the visitor services plan.</p> <p>Evaluate and modify or expand, if appropriate, loan boxes and teaching equipment and supplies.</p> <p>Review and evaluate existing components 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.</p> <p><u>Within 15 years:</u>            Develop a set of days dedicated to programming for scouts and other youth groups.</p> <p>Formalize partnerships with youth organizations such as Big Brother Big Sister Program, 4H, YMCA.</p>	

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 4. INTERPRETATION</b>                      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.</p>		
<p><i>Responds to Issues: Existing exhibits and interpretive facilities; diversity of user groups; refuge accessibility</i></p>		
<p><b>Objective 4.1 Environmental Interpretation</b></p>		
<p>Annually, provide onsite and offsite environmental interpretation opportunities for up to 22,500 visitors, students, and area residents.</p> <p>Continue to maintain existing access points and infrastructure, including trails, parking, and interpretive exhibits, kiosks, printed materials, and signage.</p> <p>Maintain ongoing updates to the refuge Web site.</p> <p>Annually, host 100 volunteer-led guided nature walks and programs.</p> <p>Annually, host at least six conservation-oriented and/or wildlife-dependent interpretive events.</p> <p>Annually, conduct at least five offsite environmental interpretation programs.</p> <p>Continue to host environmental art displays at the visitor center as opportunities arise.</p> <p>Work with partners and volunteers to develop and present programs for non-school audiences such as for families, libraries, festivals, and scout groups that support the mission and goals of the Service.</p> <p>Complete the redevelopment of the existing example backyard habitat.</p> <p>Complete installation of the webcam at the eagle’s nest.</p> <p>Promote and participate in Service initiatives such as the National Junior Duck Stamp Program.</p>	<p>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.</p> <p><i>Same as alternative A, plus:</i></p> <p>Identify key user groups utilizing the refuge and compile a list of associated organizations, businesses, and affiliations potentially interested in learning more about the refuge through interpretive events and programs.</p> <p>Improve directional trail, regulatory, and interpretive signage.</p> <p>Create more interactive exhibits suitable to younger visitors (2 to 8 year olds).</p> <p>Develop new camp programs and expand number of camps offered to at least 12 per year.</p> <p>Complete the refuge’s visitor services plan, including an environmental interpretation component.</p> <p>Develop events and programs tailored to targeted audiences incorporating themes from the visitor service plan. Host these events between November and May to encourage use during these slower months.</p> <p>Develop at least two interpretive materials in other languages (e.g., Spanish) to help increase our effectiveness at reaching out to non-English speaking audiences.</p> <p>Develop at least three interpretive materials and programs specifically designed for people with disabilities (e.g., guided bird song tours of the refuge, signs and brochures in braille).</p>	<p>Over the life of the plan, expand environmental interpretation infrastructure to accommodate up to 22,500 onsite participants. Expand web-based opportunities for visitors, students, and area residents.</p> <p><i>Same as alternative A, plus:</i></p> <p>Begin to phase out existing wood duck and swallow nesting boxes. Maintain a minimum number of boxes for interpretive purposes.</p> <p>Remodel the visitor center to allow expansion of interpretive exhibits.</p> <p>Develop interpretive trail system, observation tower, and pedestrian bridge to improve access to Folcroft Landfill upon site release.</p> <p>Install additional webcams at points of interest such as Darby Creek and Tinicum Marsh, or visitor center.</p> <p>Develop at least two interpretive materials in other languages (e.g., Spanish) to help increase our effectiveness at reaching out to non-English speaking audiences.</p> <p>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.</p> <p><i>Within 10 years:</i></p> <p>Work with the EPA to develop an interpretive plan for the Folcroft Landfill including public use features such as interpretive trail system, observation tower, and pedestrian bridge to develop access to upon site release.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 4. INTERPRETATION (cont.)</b> 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.</p>		
<p><i>Responds to Issues: Existing exhibits and interpretive facilities; diversity of user groups; refuge accessibility (cont.)</i></p>		
<p><b>Objective 4.1 Environmental Interpretation (cont.)</b></p>		
	<p>Re-orient the existing displays and expand exhibits in a way that promotes exploration of exhibits and longer viewing time by visitors.</p> <p>Update all refuge displays, kiosks, signage, and trail system to support a more digital interpretive infrastructure applicable to urban youth and technology-ready visitors.</p> <p>Improve access to and interpretation of Tinicum Marsh.</p> <p>Develop a series of programs and travelling exhibits on specific topics targeted to particular groups and events.</p>	
<p><b>GOAL 5. WILDLIFE-DEPENDENT RECREATION</b> <i>Provide quality, wildlife-dependent recreation that allows a diversity of visitors to connect with nature in the outdoors.</i></p>		
<p><i>Responds to Issues: Desire for recreational access improvements; compatible use</i></p>		
<p><b>Objective 5.1 Wildlife Dependent Recreation</b></p>		
<p>Continue to provide visitors with the opportunity to engage in wildlife-dependent recreation opportunities such as fishing, wildlife observation, and photography.</p> <p>Maintain existing fishing piers (including ADA compliant fishing pier) and bank access for fishing.</p> <p>Maintain existing equipment loans (e.g., binoculars), photography blinds, viewing telescopes, hiking trails, water trails, and viewing platforms.</p> <p>Provide brochures and other literature to support fishing and wildlife observation and photography on the refuge.</p> <p>Support hunting programs by facilitating Pennsylvania Game Commission hunter education classes and distributing State hunting publications.</p> <p>Complete installation of bald eagle nest webcam.</p> <p>Have staff and volunteers guide programs including bird and plant walks, photography events, and providing programs and camps designed specifically for families and youth including.</p>	<p>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.</p> <p><i>In addition to alternative A:</i></p> <p>Improve wildlife-viewing and photography by expanding enforcement of non-compatible trail uses.</p> <p>Improve signage to direct pedestrian bicycle traffic and parking as well as hiking accessibility.</p> <p>Construct a self-serve contact station at State Road 420.</p> <p>Construct fishing access points, boardwalks, and additional bird and photography blinds.</p> <p>Explore opportunities to connect to regional bicycle trails and greenways to encourage non-motorized visits to refuge.</p> <p>Construct a boardwalk into Tinicum Marsh.</p> <p>Based on the visitor service plan, construct additional fishing access points bird and photography blinds, and canoe/kayak boat launch.</p> <p>Partner with neighboring marinas and boat launches to institute organized boat tours of Tinicum Marsh, upon request.</p>	<p>Over the next 15 years, improve accessibility for priority public uses and provide an array of wildlife-dependent recreation opportunities to visitors and expand infrastructure and facilities necessary to provide a quality interpretive experience.</p> <p><i>In addition to alternative A:</i></p> <p>Establish a series of alternative means for which visitors can better access wildlife-dependent recreation opportunities in or around Tinicum Marsh. Potential options to explore include:</p> <ol style="list-style-type: none"> <li>1. Create a transportation shuttle, tram, or bus to transport visitors from the visitor center to Tinicum Marsh.</li> <li>2. Consider commercial partnership to develop paddling access to Tinicum Marsh and water trails.</li> <li>3. Explore bridge or other options for safe pedestrian crossing of SR 420.</li> <li>4. Develop a canoe/kayak launch site on refuge to facilitate wildlife observation and photography.</li> </ol>

3.7 Comparison of Alternatives

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<b>GOAL 5. WILDLIFE-DEPENDENT RECREATION (cont.)</b>		
<i>Provide quality, wildlife-dependent recreation that allows a diversity of visitors to connect with nature in the outdoors.</i>		
<i>Responds to Issues: Desire for recreational access improvements; compatible use</i>		
<b>Objective 5.2 Potential Deer Hunt Program</b>		
None	<p>Evaluate opportunities for providing a quality deer hunt program in partnership with Pennsylvania Game Commission.</p> <p>Initiate preliminary public scoping and detailed conversations with PGC to see if a detailed analysis of a deer hunt program is warranted.</p> <p>If warranted, partner with PGC to evaluate in detail a proposal to provide opportunities for deer hunting on the refuge consistent with State and local regulations and laws.</p>	<p><u>Within 10 years:</u></p> <p>Evaluate and implement a quality deer hunt program in partnership with Pennsylvania Game Commission.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 6. OUTREACH AND PARTNERSHIPS</b>            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.</p>		
<p><i>Responds to Issues: Need to protect refuge resources through collaborative actions; Need to promote refuge education and interpretive programs.</i></p>		
<p><b>Objective 6.1 Role of Refuge in Regional Conservation</b></p>		
<p>Continue collaboration with a diversity of partners on regional habitat issues and instill values of habitat conservation and environmental stewardship.</p> <p>Work with Philadelphia International Airport to conduct wetland mitigation, restoration, and land acquisition both on and off the refuge.</p> <p>Provide a facility for regional conservation-related meetings, workshops, and activities, upon request.</p> <p>Provide opportunities for monitoring and research partnerships with academic institutions in the area.</p>	<p><i>In addition to alternative A:</i></p> <p>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.</p> <p>Annually host and lead at least two national or regional workshops related to climate change and other topics supporting the refuge goals.</p> <p>Work with academic institutions to encourage climate change research that would inform refuge management, and would support regional and global initiatives.</p> <p>Study adjacent and nearby areas, including potential expansions to the refuge’s acquisition boundary to determine ways the refuge can adapt to climate change.</p> <p>Explore opportunities to assess and evaluate ecosystem services provided by the refuge habitats through collaboration.</p> <p>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.</p>	<p>Within 15 years of CCP approval, establish the refuge as a regional coordination center for climate change research, as well as coastal plain habitat conservation and management, and tidal marsh restoration through collaboration with a variety of partners.</p> <p><i>In addition to alternative A:</i></p> <p>Establish facilities and programs to promote the refuge (and its staff) as a regional expert related to climate change research, as well as coastal plain habitat conservation and management, and tidal marsh restoration.</p> <p>Work with Philadelphia International Airport to conduct wetland mitigation, restoration, and land acquisition both on and off the refuge.</p> <p>Use relationships developed through the refuge’s new field school for higher conservation education to encourage research and promote the refuge’s role as a regional focal point for studying effects of climate change.</p> <p>Work with academic institutions to encourage climate change research that would inform refuge management, and would support regional and global initiatives.</p> <p>Study adjacent and nearby areas, including potential expansions to the refuge’s acquisition boundary to determine ways the refuge can adapt to climate change.</p>

Alternative A Current Management	Alternative B Service-preferred Alternative	Alternative C
<p><b>GOAL 6. OUTREACH AND PARTNERSHIPS (cont.)</b>                      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.</p>		
<p><i>Responds to Issues: Need to protect refuge resources through collaborative actions; Need to promote refuge education and interpretive programs. (cont.)</i></p>		
<p><b>Objective 6.2 Outreach and Partnerships</b></p>		
<p>Continue community outreach by conducting or sponsoring at least three outreach programs or events each year and providing updates on refuge programs and events through local media outlets.</p> <p>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.</p> <p>Continue close partnership with Friends of the Heinz Refuge to support the refuge mission and management activities.</p> <p>Maintain weekly updates to the refuge information station 1670 AM.</p> <p>Continue close partnership with local print and broadcast media to reach diverse audience through multiple channels.</p>	<p><i>In addition to alternative A:</i></p> <p>Develop a specialized partnership with Fort Mifflin and Bartram’s Gardens to co-schedule and promote events and programs.</p> <p>Implement at least three examples of cross-referencing and publishing of workshops and events with partnering organizations.</p> <p>Work with at least three hotels around the airport to install a display advertising the refuge as a visitor destination to promote visitation.</p> <p>Work with PENNDOT, SEPTA, and Philadelphia International Airport to provide displays, brochures and information identifying the refuge as a visitor destination.</p> <p>Develop partnerships with PENNDOT, SEPTA, and Philadelphia International Airport to improve the visibility and transportation connections to the refuge.</p> <p>Expand media outreach into online social networking and modern technology communications.</p>	<p><i>In addition to alternative A:</i></p> <p>Within 15 years of CCP approval, increase community outreach by conducting or sponsoring at least three outreach programs or events each year, and provide regular updates on refuge programming and outreach to surrounding businesses and communities.</p> <p>Work with the Friends group to expand their pursuit of local partnerships to improve interest and visitor access.</p> <p>Develop a standalone photo display for local hotels that can be updated annually or seasonally.</p> <p>Establish at least one partnership with local universities to implement public use surveys and complete user analysis.</p>