Draft Restoration Plan and Environmental Assessment

For Addressing Injuries to Natural Resources on the Deep Fork National Wildlife Refuge by the City of Okmulgee, Okmulgee County, Oklahoma

and

Partial Settlement for Injuries from the Hardage-Criner Superfund Site in McClain County, Oklahoma

Trustees for Natural Resources:	Department of the Interior U.S. Fish and Wildlife Service State of Oklahoma Oklahoma Department of Wildlife Conservation
Legal Authority:	Federal Water Pollution Protection Act (Clean Water Act) (as amended) Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (as amended) Natural Resource Damage Assessment and Restoration (43 C.F.R. Part 11)
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Chapter One: Introduction

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, more commonly known as the federal "Superfund" law) [42 U.S.C. § 9601, *et seq.*], the Federal Water Pollution Control Act (CWA, commonly known as the Clean Water Act) [33 U.S.C. § 1251, *et seq.*], and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 C.F.R. Part 300] authorize States, federally-recognized Tribes, and certain federal agencies that have the authority to manage and control natural resources, to act as "trustees" on behalf of the public, and to restore, rehabilitate, replace, and/or acquire the equivalent to those natural resources harmed by the hazardous substance releases.

The United State Department of the Interior (DOI), represented by the U.S. Fish and Wildlife Service (Service), and the State of Oklahoma, represented by the Oklahoma Department of Wildlife Conservation (ODWC), as natural resource Trustees, have worked collectively to identify projects that will partially restore natural resources injured from releases of hazardous substances from two incidences: a Publicly Owned Treatment Works (POTW) facility release into the Deep Fork National Wildlife Refuge (City of Okmulgee, Okmulgee County, Oklahoma) and from the Hardage-Criner facility, an inactive hazardous waste landfill (City of Criner, McClain County, Oklahoma).

1.1 Purpose and Need

The purpose of this draft Restoration Plan/Environmental Assessment (RP/EA) is to promote expeditious and cost-effective restoration for natural resources injuries and lost environmental services resulting from hazardous substance releases to the Deep Fork National Wildlife Refuge (Refuge) and from the Hardage-Criner facility.

To fulfill this purpose, CERCLA provides a Natural Resource Damage Assessment and Restoration (NRDAR) process for developing restoration plans and pursuing implementation of restoration. In the case of the injuries from the Okmulgee and Hardage-Criner sites, cash settlements have been received by the Trustees, and the Trustees are now evaluating the best alternatives for restoration and are entering the process for involving interested parties in selecting restoration actions from a reasonable range of alternatives (43 C.F.R. Part 11).

This document is also intended to inform the public and solicit public comments on the proposed restoration activities. The Trustees believe that public input is vital to the restoration process and all comments received by the Trustees will be fully considered and, where applicable, incorporated into the Final Restoration Plan/Environmental Assessment. This document serves as an Environmental Assessment as required under the National Environmental Policy Act (NEPA) [42 U.S.C. § 4321 *et seq.*].

1.2 Background

The Refuge is located in Okmulgee, Oklahoma, and was established in 1993 to protect an important bottomland hardwood forest and emergent wetland habitat along the Deep Fork River (River) for the benefit of migratory birds and other native fish and wildlife species (USFWS 2000). On August 26, 2000, the City of Okmulgee's POTW released an undetermined amount of sewage and sewage sludge into Okmulgee Creek, a tributary of the River. A plume of raw sewage and sewage sludge migrated slowly downstream, due to low seasonal flow rates, into the River. This plume included ammonia in toxic quantities, as well as other unidentified hazardous substances. The plume caused mortality to fish, mussels, and other aquatic species along 11 miles of the River that flow through the Refuge (referred to in this document as the Site). The Trustees reached a negotiated settlement with the City of Okmulgee and damages were allocated for restoration purposes and past assessment costs (U.S. District Court 2006).

In addition to the damages from the Okmulgee release, the Service received a partial settlement from natural resources injuries occurring from the Hardage-Criner Superfund Site (Site) in McClain County, Oklahoma. The Hardage-Criner facility was a landfill that accepted industrial and hazardous wastes such as asbestos, cyanides, volatile organic compounds, and polychlorinated biphenyls (PCBs). Management of these wastes resulted in pesticides, solvents, alcohols, acids, metal sludges, and other substances contaminating surface water, groundwater, and surface soils which injured natural resources (i.e. migratory birds) that utilized the site (EPA 1990). In total, 18 to 20 million gallons of waste were logged into the Site (EPA 1986).

In 1992, the Service submitted a claim based on a continuing threat to migratory birds resulting from on- and off-site contamination of surface and ground water, surface soils, and North Criner Creek alluvium. Since the claim was brought during bankruptcy proceedings, it paid out very little. While not in close proximity to the Okmulgee Site (approximately 140 miles southwest), the Hardage-Criner settlement amount was not large enough to fund a restoration project on its own at that location. Therefore, the funds from the Hardage/Criner settlement will be joined with the Okmulgee settlement funds for restoration projects addressed in this document.

Chapter Two: Natural Resources and Services Affected by the Release

This section of the draft RP/EA addresses the natural resources affected by releases as a basis for understanding the type of restoration projects required. The following chapters identify restoration projects and identify how those projects will restore the affected natural resources and services.

2.1 Biological Resources

2.1.1 Okmulgee Release

The City of Okmulgee's POTW release contained levels of ammonia that were acutely toxic to freshwater mussels and fish in the River. The sewage release also contained biological solids and soluble pollutants that have a high chemical and biological oxygen demand, which in turn created low dissolved oxygen levels in the river. The high ammonia levels and low dissolved oxygen levels caused the mussel and fish mortalities.

Several native mussel species are known to exist on the Refuge. Freshwater (unionid) mussels are the most rapidly declining faunal group in the United States. Seventy-two percent of the 297 species and subspecies are listed as endangered, threatened, or of special concern (Williams *et al.* 1993). Over-harvesting, widespread habitat destruction, chronic pollution, land-use changes, and exotic species introductions have caused many mussel populations to decline or disappear (Strayer *et al.* 2004). Freshwater mussel species are ecologically and economically important in aquatic habitats. They comprise a significant portion of the total biomass in freshwater benthic communities, are important in nutrient cycling, and mix surficial sediments through bioturbation (Naimo 1995).

Following the sewage releases, the Service calculated the total mussel mortalities to be in the range of 7,253 - 10,659 individuals. Sixteen different mussel species, some with individuals up to 10 years of age, were found (Table 1 – Freshwater Mussel Species Mortalities On-Site). There were no state or federally-listed threatened, endangered, or candidate species found during the mussel kill investigation.

Table 1. Freshwater Mussel Species Mortalities On-Site	
Unionid Mussels	
Rock pocketbook *(Arcidens confragosus)*	Pistolgrip *(Tritogonia verrucosa)*
Threeridge (*Amblema plicata)*	Fawnsfoot (*Truncilla donaciformis)*
Wabash pigtoe (*Fusconaia flava)*	White heelsplitter (*Lasmigona complanata)*
Yellow sandshell (*Lampsilis teres)*	Pink papershell (*Potamilus ohiensis)*
Fragile papershell (*Leptodea fragilis)*	Giant floater *(Pyganodon grandis)*
Bleufer *(Potamilus purpuratus)*	Pondhorn *(Uniomerus tetralasmus)*
Pimpleback *(Quadrula pustulosa)*	Slough sandshell *(Lampsilis teres teres)*
Mapleleaf *(Quadrula quadrula)*	Washboard *(Megalonaias nervosa)*
Veneroid Clams	
Asian clam (exotic) (*Corbicula fluminea)*	
Long fingernail clam (native) (*Musculium transversum)*	

Fifty-nine species of fish have been identified from the river, streams, and reservoirs of the River basin; the Refuge provides vital feeding and spawning habitat for a variety of these species. The ODWC compiled an inventory on the fish mortalities and associated costs resulting from the release. This list included longnose gar, small mouth buffalo,

river carp sucker, flathead, channel catfish, madtoms, bluegill/sunfish, darters, minnows, and shiners totaling 168 fish (ODWC 2001).

2.1.2 Hardage-Criner Superfund Site

The source areas of contamination at the Hardage-Criner Site included a two acre main pit, drum mound (containing estimates of 10,000 to over 20,000 emptied barrels), and a 1.5 acre sludge mound. Other areas at the Site were used as temporary holding and mixing ponds which became contaminated during Site operations. A stream ran along the east side of the Site (about 400 feet east of the waste areas) which had been impounded to form a chain of three small lakes totaling approximately 6 acres. Another two acre pond was located approximately 1,500 feet west of the drum mound. Additionally, wastes from the Site entered into the alluvium of North Criner Creek creating a 1,000 foot long plume in the aquifer (EPA 1986).

Migratory waterfowl were known to use the habitat on and surrounding the Hardage-Criner facility. As referenced in EPA's Record of Decision for the Hardage-Criner Site in 1986, it is indicated that contamination of the food-chain pathway by lead, chromium, pesticides, and PCBs at the Site pose long-term hazards (EPA 1986). In addition, a preliminary Natural Resource Survey (PNRS), conducted by the Service in 1985, indicated a high probability that migratory waterfowl would utilize the area during part of the year (USFWS 2000b), especially during spring and fall migrations through Oklahoma (USFWS 1985).

2.2 Surface Water Resources

The River within the Refuge was contaminated during the Okmulgee release with untreated sewage and sewage sludge containing acutely toxic ammonia levels, other hazardous substances, and a high chemical/biological oxygen demand (CBOD). The CBOD was sufficient to eliminate oxygen in the water column long after the more acutely toxic effects of ammonia would have dissipated.

Approximately 11 miles of riparian habitat of the River has been impacted by the sewage releases. The Refuge has not fully recovered from the sewage releases in 2000 due to subsequent non-permitted releases into the River and the lag time necessary to regain biological equilibrium (i.e. recovery period). Since restoration of River water quality is essential for successful wildlife and recreational activities on the Refuge, it is vital that the water quality issues are addressed in the restoration alternatives.

The primary pathway of contamination at the Hardage-Criner site was contaminated groundwater discharging into surface water through seeps but also contamination in the surface water itself. The PNRS showed the incidence of pollutants in the ponds located in the immediate area of the disposal pits. Later sampling by EPA revealed the presence of 1,1 dichloroethylene, 1,2 dichloroethylene, 1,1 dichloroethane, 1,1,2 tri-chloroethylene, tetra-chloroethylene, and bis (2-chloroethyl) ether in these ponds (USFWS 2000b).

2.3 Resource Services

Both the Refuge and the landscape surrounding the Hardage-Criner Site provide habitat for migratory birds. The Refuge ecosystem consisting of bottomland hardwood forest, in particular, is a complex community of aquatic and terrestrial biota. Bottomland hardwood forests are valuable ecosystems that provide a variety of environmental services such as habitat, hydrologic buffering, and improvement of water quality (Kozlowski 2002). The forest and floodplain improves and purifies the water of the River by removing silt and debris, and recharging the groundwater reserves. The vegetation in bottomland forests filter out contaminants that may be contained in agricultural or stormwater runoff before they enter the River. Additionally, each time the River overflows its banks, the waters deposit additional rich, alluvial soils throughout the bottomland hardwood forests. This enables the nutrients to deposit on the forest floor while providing clearer water to flow back into the River channel.

A study prepared by the Lower Mississippi Valley Joint Venture reported that 328,700 acres (about 15 percent) of the original eastern Oklahoma bottomland hardwoods forests remain. Habitat fragmentation of these forests has been attributed to channelization or stream alteration (i.e. developing reservoirs), mineral exploration, urban expansion, and agriculture (Forsythe and Aldrich 1989). Habitat fragmentation of bottomland forests and the corresponding degradation to animal and plant populations has become an increasing focus, especially the role that bottomland forest fragmentation plays in the decline of some migratory bird populations (Sallabanks *et al.* 2000, Askins *et al.* 1990, Faaborg *et al.* 1995).

The environmental services provided by the bottomland hardwood forests and wetlands on the Refuge improve the water quality of the River for the benefit of aquatic and terrestrial wildlife as well as the public. The loss of biomass and diversity of aquatic wildlife in the River from the hazardous substance releases has reduced prey availability for migratory birds and potentially other wildlife species that forage there. This indicates an interruption in the Refuge's resource services. Additionally, recreational activities, such as hunting and fishing, provided by the Refuge have been reduced due to the decline in water quality and the loss of aquatic wildlife.

The Hardage-Criner Site provided habitat for a variety of wildlife, including observed sightings of woodpeckers, doves, meadow larks, common egrets, cattle egrets, mockingbirds, Northern bobwhite quail, turtles, and frogs. The loss of these species from on-site contamination would result in a reduction of biodiversity, as well as interruption in resource service flows in the area.

Chapter Three: Restoration Alternatives

In accordance with NRDAR and NEPA regulations, 43 C.F.R. Part 11 and 40 C.F.R. Parts 1500 – 1508, the Trustees evaluated several alternatives for restoration before choosing a preferred alternative. The term "restoration" is defined in the NRDAR regulations as "…actions undertaken to return an injured resource to its baseline

condition, as measured in terms of the injured resource's physical, chemical, or biological properties or the services it previously provided…" [40 C.F.R. § 11.14(ll)]. Because activities associated with restoration may include "restoration, rehabilitation, replacement, and/or acquisition of equivalent resources," the term restoration is used in this document to include any of these activities.

3.1 Restoration Goals and Objectives

Restoration planning provides a connection between injury and restoration. CERCLA requires the federal government to promulgate regulations for developing natural resource damage claims. The NRDAR regulations [40 C.F.R. § 11.82] outline restoration planning, providing that the restoration plans consider ten factors when evaluating and selecting among the possible alternatives to restore injured natural resources. The factors below are part of the criteria that the Trustees considered in evaluating alternatives and selecting the preferred alternative.

- Technical feasibility;
- The relationship of the costs of the alternative to the expected benefits;
- Cost-effectiveness;
- The results of actual or planned response actions;
- The potential for additional injury resulting from the proposed actions;
- The natural recovery period;
- Ability of the resources to recover with or without alternative actions;
- Potential effects of the action on human health and safety;
- Consistency with relevant federal, state, and tribal policies; and
- Compliance with applicable federal, state, and tribal laws.

3.2 Alternatives Carried Forward for Detailed Analysis

Restoration should occur in as close proximity to the injury site as possible. All restoration projects occur within the Deep Fork Refuge proposed acquisition boundaries. In accordance with NRDAR and NEPA regulations, the Trustees considered a reasonable range of restoration alternatives. Although restoration actions for the following alternatives will not equivocally replace the natural resources and environmental services injured from the releases, the Trustees believe that these restoration projects will provide comparable services to those lost.

In accordance with the assessment and National Environmental Policy Act (NEPA) regulations, the Trustee considered a reasonable range of restoration alternatives before selecting the preferred alternative. The alternatives considered are categorized as:

- Alternative A: No Action/Natural Recovery;
- Alternative B: Restoration of Native Mussel Species;
- Alternative C: Land Acquisition and Enhancement for Wildlife Habitat (Preferred Alternative); and
- Alternative D: Activities to Enhance Conservation of Wildlife Habitat.

3.2.1 Alternative A: No Action/Natural Recovery

The No Action/Natural Recovery alternative is the baseline against which the other alternatives can be compared. Under this alternative, no restoration actions (on-site or off-site) would be taken to compensate for the loss of natural resources and services to the public. The natural resources and services would be left to return to baseline conditions through natural processes.

3.2.2 Alternative B: Restoration of Native Mussel Species into the Deep Fork River

The Trustees suggest an alternative for the restoration of the mussel species lost or injured from the sewage releases. This alternative would include propagating several mussel species that are known to inhabit the impacted area in an off-site facility, re-introducing the species through physical placement into specified sections of the River and monitoring their progress/success for a minimum of five years. The specified sections would be located in a unit of the River on the Refuge which is in proximity to where the hazardous substance releases occurred. Similar mussel propagation has been successful in the surrounding states and can be economically feasible.

3.2.3 Alternative C: Land Acquisition and Enhancement for Wildlife Habitat – Preferred Alternative

The Refuge was created to protect bottomland hardwood forest used as habitat for migratory birds. Although the release of hazardous substances injured aquatic species and habitat, migratory birds need both aquatic and terrestrial habitats to be successful in foraging and reproductive activities. Protection of bottomland forests within the riparian corridor and floodplain conserves other wildlife species during harsh climatic periods by serving as migration corridors during droughts or other stresses (Sparks 1995). The acquisition and enhancement of habitat in the bottomland hardwood forests, and in the larger Central Flyway migratory route, is imperative to protecting the aquatic and terrestrial species which inhabit this ecosystem.

Approximately 75 – 100 percent of the potential properties to be purchased are located in the River floodplain. These lands act as buffers to protect the health of the River and therefore protect the health of the aquatic and terrestrial organisms inhabiting the Refuge. They are considered to be critical riparian corridors. This restoration project would consist of a purchase of bottomland hardwood properties from willing sellers, or a placement of easement agreements, to be managed for wildlife uses and habitat. Various forms of habitat enhancement could be implemented to increase the property's ability to function as productive bottomland hardwood habitat. This includes fencing the property for grazing management, removal of exotic or invasive species through chemical or mechanical means, replanting with native herbaceous species, and/or prescribed burning to assist in habitat management.

Since most property available for purchase resides within the Refuge's acquisitional boundaries, it is likely that the Service's Refuge personnel would manage the newly

acquired property. However, it may be possible that other land managers associated with the River (e.g., the State of Oklahoma or a non-governmental organization) could retain responsibility for the new property in the future.

3.2.4 Alternative D: Activities to Enhance Conservation of Wildlife Habitat

Education and public awareness are an essential part of any restoration project. The Refuge currently has programs that are focused on educating school children on subjects such as habitat, wetland functions, wildlife behavior, plant and animal identification, outdoor sports, and a variety of other subjects. The Trustees propose several projects which would create educational areas, not only for school children but adults as well, to increase their understanding of habitat conservation and to promote awareness of the impacts from hazardous materials on natural resources. Such educational programs will lead to overall conservation of resources through modification of visitor behavior through direction of use to avoid sensitive or recovering habitats.

Examples of potential educational opportunities include constructing more trails on the Refuge for public viewing of wildlife, constructing an outdoor pavilion with amenities that would provide a shelter for visitors and students during inclement weather and constructing additional trails and signs to enhance the public's understanding of the Refuge, its natural resources, and public benefits.

3.3 Summary of Potential Restoration Alternatives

Table 2 - Potential Restoration Alternatives outlines the restoration alternatives with the greatest potential to restore the natural resources lost or injured and/or to provide additional resource services to compensate the public for resource losses pending their recovery.

Table 2. Potential Restoration Alternatives

Alternative	**Project Description**
Alternative A: No Action/Natural Recovery	Allows for natural processes to occur at the Site without additional restoration
Alternative B: Restoration of Native Mussel Species	Propagate native mussels to replace into the impacted area of River
Alternative C: Land Acquisition and Enhancement for Wildlife Habitat – **Preferred Alternative**	Purchase land/acquire conservation easements for larger contiguous habitat for wildlife and protection of water quality
Alternative D: Activities to Enhance Conservation of Wildlife Habitat	Construct outdoor pavilion for educational purposes and inclement weather
	Construct additional trails and interpretive opportunities

Chapter Four: Environment Affected by Restoration Alternatives

Because injuries occurred on the River which flows through the Refuge, all of the restoration alternatives currently proposed would occur on or adjacent to the Refuge. The following descriptions focus on this geographical area.

4.1 Physical Characteristics of the Refuge

The bottomland hardwood forest community of the Deep Fork River is a complex, diverse, and interrelated association of vegetation and wildlife, created and maintained by periodic, natural flooding. Years of human development have significantly modified this dynamic floodplain ecosystem. Historically, the vast bottomland hardwood ecosystem of eastern Oklahoma encompassed an estimated 2.2 million acres. By the early 1980's, roughly 85 percent of these floodplain forests had been cleared or inundated by reservoirs (Forsythe and Aldrich 1989). Much of the remaining habitat occurred in small, isolated tracts that were of little value to wildlife. The Refuge was established to help preserve one of the last contiguous tracts of bottomland hardwood forests in the state of Oklahoma and to act as a crucial link for waterfowl migrating along the Central Flyway.

4.2 Vegetation

The Refuge is comprised of regenerating bottomland forests, drained and natural wetlands, agricultural lands, and some upland hardwood forest and prairie. The Refuge supports regenerated, variable-aged stands of oak, pecan, hickory, elm, river birch, and willow, with an understory of shrubs, vines, forbs, and grasses. Most of the hardwoods are less than 50 years old.

4.3 Resident and Migratory Birds

The River floodplain is biologically diverse and provides habitat for many migrating and wintering waterfowl, including mallards, blue-winged teals, shovelers, pintails, and wood ducks. During the fall migration, and during winter, the bottomland forests are essential resting and refuge habitat, and provide important energy food sources (Forsythe and Aldrich 1989). The Refuge serves as a vital migratory stopover, breeding, and nesting area for many non-game bird species as well. A variety of resident and migratory songbirds also depend on the Refuge for habitat.

4.4 Wildlife Species

Resident wildlife species that are typically found on the Refuge include white-tailed deer, turkey, gray and fox squirrels, swamp rabbits (one of the last remaining areas where they occur in Oklahoma), reptiles, and amphibians. There are also a variety of furbearer species, including raccoons, coyote, and beaver, whose populations are among the highest in Oklahoma.

The American burying beetle (ABB) (*Nicrophorus americanus*), a federally-listed endangered species since 1989, has been known to occur in portions of Okmulgee County and may potentially inhabit the Refuge. Four state species of concern inhabit the Refuge, including the river otter, Bell's vireo, alligator snapping turtle, and the northern scarlet snake (USFWS 2000). These wildlife species also have been potentially affected by the sewage releases. The reduction in biomass and diversity of aquatic biota in the River has decreased the availability of prey and has potentially affected the species inhabiting the Refuge.

4.5 Surface Water Resources

The 34-mile reach of the River that flows through the Refuge has never been subjected to flood control measures. This gives the floodplain the ability to absorb floodwaters and associated debris as well as slowing down their velocities. These temporarily flooded forests, characterized by oxbow lakes, sloughs and marshes, provide excellent and sometimes crucial habitat for waterfowl to forage and nest (USFWS 2000). Most of the Refuge lies within the River floodplain with approximately 80 percent of the Refuge flooding at least once a year, except in very dry periods.

The potential native mussel restoration projects are proposed in an area of the River that is approximately 1- 4 feet deep, approximately 65 – 80 feet wide, with a muddy substrate consisting of mostly fine grained sediments (i.e. sand and clays) and intermittent areas of rocks and gravel. The proposed restoration projects would be located within the impacted 11 miles of River.

4.6 Cultural Resources

There are six documented archeological sites on the Refuge. The Service will consult with the Oklahoma State Historic Preservation Officer (SHPO), and the Oklahoma State Archeologist to comply with the National Historic Preservation Act to prevent adverse impacts from occurring to those sites. Where physical disturbances will occur in undisturbed areas during project implementation, the Service will provide information regarding actual project placement to the SHPO for review. Should sensitive, historic sites occur within the initial impact zone of a project site, the project will be modified according to recommendations from the SHPO to avoid adverse impacts.

Circulation of this NEPA environmental document is not intended to satisfy the requirements of the National Historic Preservation Act (NHPA). For each individual project that will be completed as part of the Restoration Plan, the Service will consult with the SHPO, the Oklahoma State Archeologist, and federally recognized Indian Tribes, as set forth under Section 106 of the NHPA.

4.7 Socioeconomic Resources

The Refuge serves over 35,000 visitors annually. Over 15,000 visitors use the Refuge for wildlife observation and hiking, while approximately 20,000 visitors use the Refuge for

hunting and fishing activities. The estimated economic benefit to the community is approximately $350,000 annually.

The River flows into Lake Eufaula approximately 15 miles downstream of the southernmost boundary of the Refuge. The River provides vital functions for Lake Eufaula by providing the necessary water, nutrients, fisheries habitat, sediment transport, and flood control. This provides further recreational and economic benefit to the human communities who use the lake area. Lake Eufaula is also a significant water supply lake for many municipalities.

Chapter Five: Environmental Consequences

Each alternative has been examined for potential impacts to environmental resources, as described below. Potential impacts resulting from the alternatives are discussed in Table 3 - Summary of Environmental Consequences by Alternative.

5.1 Alternative A: No Action/Natural Recovery

Under this alternative, no direct action(s) would be taken to restore injured natural resources or compensate for lost services resulting from the incidence of hazard substance releases either on or off-site. Instead, full recovery of the injured natural resources to baseline conditions would rely on natural processes. There also would be no improvements to compensate the public for the interim service loss resulting from the releases. Furthermore, no environmental benefits would be realized from the allocated damages and the Trustees would not be fulfilling their obligations as natural resource trustees. While implementation of this alternative would have no project impacts, failure to restore injured resources is not acceptable to the Trustees.

5.2 Alternative B: Restoration of Native Mussel Species

Propagation of native mussel species and release to the River would help restore the functions of a healthy bottomland hardwood ecosystem by restoring biodiversity to the impacted areas and providing bio-monitors for any future water quality issues in the River. Since the impacted stretch of the River is a former habitat of many mussel species, it is believed that the restoration area would provide suitable habitat for the successful reintroduction of propagated mussels. The health and functionality of the River is directly tied to the health and functionality of the surrounding bottomland hardwood forest ecosystem. If the River demonstrates healthy freshwater mussel populations, then the River itself and the surrounding riparian corridor likely would also be healthy.

Minor disturbances would occur when physically placing the juvenile mussels into the River. Such disturbances would be related to potential downstream turbidity during placement of mussels in the stream substrate, and possible disturbances to fishing activities. However, only one or two persons would be placing the mussels into the River and disturbances would occur for a short amount of time. Given their short duration and

minimal nature, the Trustees anticipate that disturbances would not significantly affect the Refuge environment.

5.3 Alternative C: Land Acquisition and Enhancement for Wildlife Habitat – Preferred Alternative

Acquiring property along the River corridor would benefit the Refuge by acting as a filter for contaminants, pesticides, and livestock wastes, thus increasing water quality in the River. In addition, the acquisition and protection of property would create a more contiguous tract of habitat for wildlife to migrate, forage and breed. While enhancement projects such as fencing, and removal of exotic or invasive species through chemical application may cause temporary disturbance, these impacts are considered to be short term and not significant. Adverse impacts caused by planting and/or prescribed burning would be considered in Refuge planning and compliance documents which include impact analyses for each of these tasks. Many of these proposed activities have been addressed in the Refuge's Comprehensive Conservation Plan (CCP) and associated Environmental Assessment approved in 1999 (USFWS 1999). Planning and compliance documents would be prepared for any planned activities not addressed in the CCP.

Impacts to biological resources (e.g. terrestrial and aquatic wildlife, including migratory birds) may occur from disturbances during construction activities, erosion between the removal of exotic/invasive species and re-colonization of native, hardwood species, and public use of the Refuge. However, these adverse impacts would be minimized by best management practices, such as temporally spacing the actions during times of least sensitive use by birds (non-nesting periods), visitors (off-season), and the use of erosion control structures (e.g., hay bales, silt screens, etc).

Since this alternative provides a means for protecting and enhancing bottomland hardwood habitat from agriculture or other development activities, the potential for some negative socioeconomic impacts could occur due to changes in economic activity through the transfer of land ownership from private to public and/or restrictions on public access. However, since the acquisition of land is for conservation purposes, the Trustees believe that the potential negative impacts from the transfer of ownership would be outweighed by the positive, beneficial effects of gaining additional Refuge habitat. Implementation of this alternative would not adversely impact the environment.

This alternative was evaluated regarding its impacts to biological resources, specifically fish and wildlife species listed under the Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA), and is also common to the following alternative. Because the proposed restoration activities would occur within an area known to be bald eagle habitat, surveys would need to be done before any restoration activities can be planned or implemented to ensure that the restoration actions would not result in adverse impacts occurring to this species.

Because the proposed restoration activities also coincide within the same county as documented populations of the ABB, surveys would need to be done before any

restoration activities can be implemented to ensure that the restoration actions would not adversely affect the ABB. If ABBs are located in the restoration area, upon consultation with the Service, significant impacts may be avoided by removing the species from the project area by using protocols set forth in the USFWS conservation approach for the species (USFWS 2005).

5.4 Alternative D: Activities to Enhance Conservation of Wildlife Habitat

This alternative compensates the public for lost use through the creation of educational infrastructure for wildlife viewing and access points in the Refuge. This alternative contributes benefits by providing the public opportunities to learn and understand the Refuge ecosystem while promoting conservation activities for migratory birds and threatened and endangered species.

Public use facilities at the Refuge include existing and potential trails, roads, a boardwalk, an overlook, and a photo blind. Possible impacts from the public using these facilities include trampling of vegetation, erosion, littering, increased wildlife disturbance, and dust and noise from the roads. These activities can be minimized by educating the public about the sensitivity of the Deep Fork ecosystem and the need to respect wildlife resources and the environment. Other best management practices such as providing signage or pamphlets that demonstrate the effects of noise, litter, and trampling on vegetation will significantly reduce adverse impacts to the Refuge from public use.

5.5 Cumulative Impacts

Although the restoration actions for the alternatives would not equivocally replace specific natural resources injured from the releases, the Trustees believe that the restoration projects would provide comparable services for the trust natural resources that were lost or injured. With the exception of the No Action/Natural Recovery Alternative, each of the proposed alternatives focuses on the protection and restoration of natural resources and services associated with the Refuge. However, there is the potential for cumulative impacts to occur from the projects and activities on or near the Refuge.

While no specific projects are currently known for areas upstream of the proposed projects, activities such as mechanically removing invasive species, prescribed burning, and maintaining trails and roads frequently occur on the Refuge and surrounding properties as part of the overall wildlife management program. Implementation of other projects upstream of the proposed projects could cause sedimentation and erosion that would be additive to the downstream proposed project site(s). To prevent the impacts of erosion and turbidity from the combined activities adversely effecting resources, management actions such as silt fencing or screening, hay bale placement, seasonal timing for prescribed burns, and limiting personnel access into the River during project implementation would be implemented to greatly reduce silt loading and maximize dilution capabilities. Additionally, these management practices also would shorten the duration the River is exposed to sediments. Therefore, the potential impacts from the

upstream activities combined with the potential project impacts would not cause significant, negative cumulative environmental effects.

5.6 Summary of Environmental Impacts by Alternative

The information in Table 3 - Summary of Environmental Consequences by Alternative summarizes the consequences from implementing each alternative. The Trustees will use this analysis to select the preferred alternative and ultimately, the preferred restoration project(s).

5.7 Coordination with the Public

Public review is an important component of the restoration planning process. The Trustees will provide the public with the opportunity to comment for a 30-day period. Comments must be received by the due date to be considered part of the official record and will be incorporated into the final restoration plan and environmental assessment. This document will be advertised in the Tulsa World and Okmulgee Daily Times and will also be available on the USFWS website at:

http://www.fws.gov/southwest/es/oklahoma/Documents/Contaminants/OkmulgeeRP_EA_08_09_07D.pdf

Comments or questions should be sent to the attention of:
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Table 3. Summary of Environmental Consequences by Alternative				
Attributes	**Alternative A** (No Action/Natural Recovery)	**Alternative B** (Propagate native mussels)	**Alternative C **** (Acquisition/enhancement)	**Alternative D** (Educational opportunities)
Bottomland Hardwood Habitat	Natural recovery	Does not address	Preserve and enhance existing habitat	Does not restore habitat
Wetlands associated with Bottomland Hardwood	Natural Recovery	Increased water quality through bioturbation, filtration	Preserve and enhance existing habitat	Does not restore habitat
Aquatic Habitat	Natural recovery	Increase of biomass in the River	Increase in habitat (where present)	Does not restore habitat
Fish and Mussel Resources	Populations would remain unbalanced	Increase in diversity of mussel populations; may be limited by success rate	Increase in protection, potential increase in populations	Protection of fish and mussel resources through education
Wildlife Resources	Does not address wildlife resources	Increase in prey availability	Increase in protection, potential increase in populations	Protection of wildlife resources through education
Threatened and Endangered Species	Does not address these species	Increase of biomass in River for prey base	Increase in continuous land for migration corridor	Increase awareness of species and associated habitat
Surface Water	No protection of water quality	Increased water quality through bioturbation, filtration	Protection of surface water in acquisitional area	Protection of surface water through education
Socioeconomic Issues	No compensation for interim resource service losses	Increase in water quality, aquatic, & terrestrial species biological diversity	Enhance local economy through additional recreational opportunities; decrease in development opportunities	Increases awareness of hazardous waste releases, conservation of Refuge habitats
Recreational Use	No enhancement or increase in recreational opportunities or facilities	Does not address	Potential increase in recreational opportunities	Enhancement or increase of recreational facilities or opportunities
Cumulative Impacts	Does not restore Refuge ecosystem	Increased diversity of native mussels but not wildlife communities; does not address entire ecosystem	Restore and enhance bottomland hardwood ecosystem, protection from further development	Protection of natural resources on Refuge through education; does not directly restore injured habitat
**** Preferred Alternative**				

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