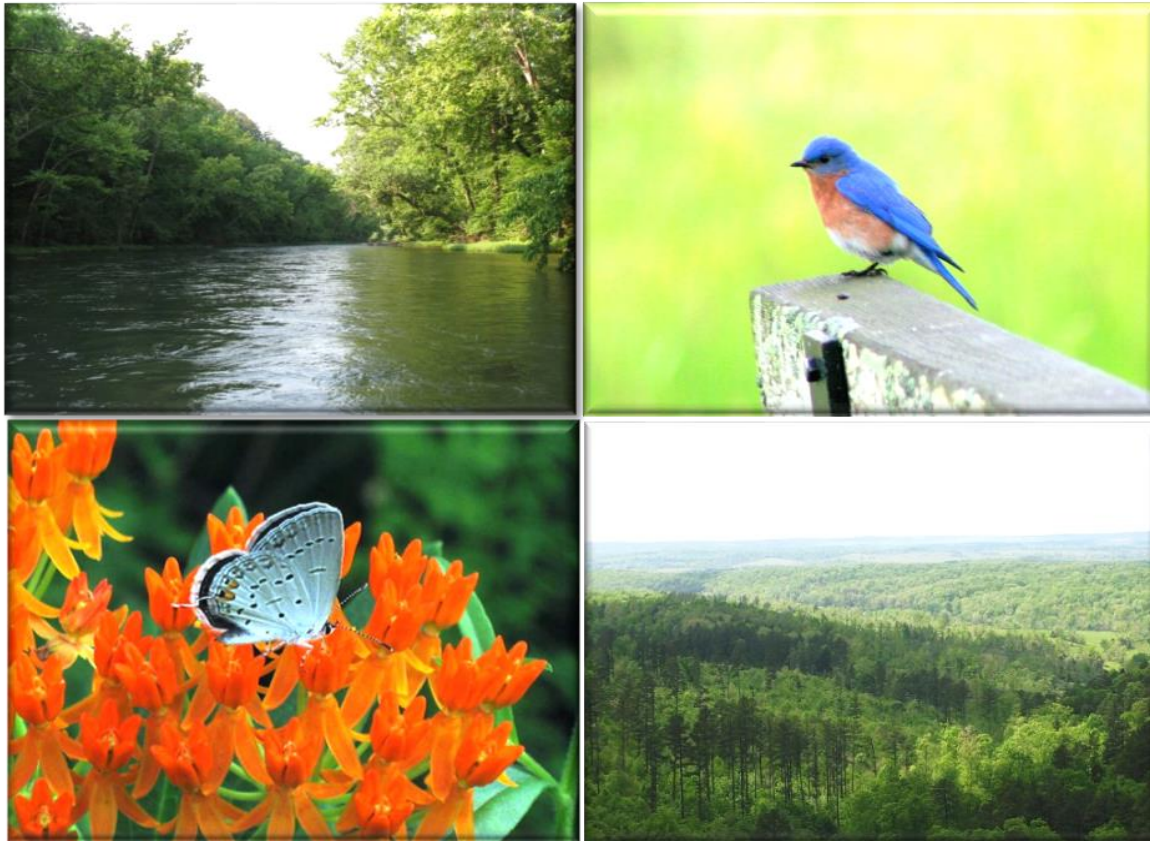


Herculaneum Lead Smelter Site Natural Resource Damage Assessment and Restoration Jefferson County, Missouri

Draft Restoration Plan/Environmental Assessment

July 16, 2019



Prepared by:



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

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List of Acronyms

CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CWA	Clean Water Act
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
MoDNR	Missouri Department of Natural Resources
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NRD	Natural Resource Damages
NRDAR	Natural Resource Damage Assessment and Restoration
RP/EA	Restoration Plan/Environmental Assessment
SEMORRP	Southeast Missouri Ozarks Regional Restoration Plan
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

From 1892 to 2013, lead and other heavy metals were smelted and refined at the Herculaneum Smelter. Lead and other metal ores were shipped to Herculaneum from the Old Lead Belt and Viburnum Trend Mining Districts of southeast Missouri. Releases of hazardous substances from transporting, smelting, and refining ore have adversely affected soil, wetlands, and associated wildlife on-site.

Response activities to protect human health under the direction of the U.S. Environmental Protection Agency (EPA) have mainly focused on replacing residential yard soils contaminated by the facility and transport of concentrates to the site. The Missouri Department of Natural Resources (MoDNR) has overseen implementation of numerous other controls at the facility under the authority of other environmental laws, such as Clean Air Act, Clean Water Act, and the Missouri Metallic Minerals Waste Management Act.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), through the Natural Resource Damage Assessment and Restoration (NRDAR) process, natural resource Trustees are authorized to assess and recover damages resulting from injuries to natural resources attributable to hazardous substance releases. 40 U.S.C. § 9607 (f). The Trustees then utilize these recovered damages to plan and implement actions to restore, replace, rehabilitate, and/or acquire the equivalent of injured natural resources and the services they provide pursuant to a restoration plan. 40 U.S.C. § 9611(i). The Trustees in this case, the State of Missouri, acting through Missouri Department of Natural Resources and the United States Department of the Interior acting through U.S. Fish and Wildlife Service, developed this Draft RP/EA in accordance with CERCLA Section 111(i) and its implementing regulations (43 C.F.R. § 11.93) to inform the public as to the types and amount of restoration that are expected to compensate for injuries to natural resources and the services they provide associated with the releases of heavy metals from the facilities at the Herculaneum Smelter in Jefferson County, Missouri. As explained more fully herein, restoration actions identified in this Draft RP/EA will be implemented either by Potentially Responsible Parties, as per the terms of a Consent Decree filed concurrently with the publication of this document, or by the NRDAR Trustees.

Under the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321 *et seq.*), federal agencies must identify and evaluate environmental impacts that may result from federal actions. This Draft RP/EA describes the purpose and need for action, identifies potential restoration alternatives, including a No Action alternative, summarizes the affected environment, and describes the potential environmental consequences of proposed restoration activities. The alternatives described and evaluated in this Draft RP/EA include the Trustees preferred alternative, Joachim Creek Properties Transfer and Protection (Alternative B), Enhancement of Existing Public Lands for Wildlife Habitat (Alternative C), Acquisition, Protection, and Enhancement of Wildlife Habitat (Alternative D). The Trustees are soliciting comments on this Draft RP/EA, and will address any public comments received in preparing a Final RP/EA wherein the Trustees will identify the Selected Restoration Alternative(s).

1. Introduction

This Draft Restoration Plan (RP)/ Environmental Assessment (EA) (Draft RP/EA) has been prepared by the Trustees for the Herculaneum Lead Smelter Site to address natural resources injured and ecological services lost due to releases of hazardous substances, including lead, cadmium, and zinc, from the Herculaneum Lead Smelter Site in Jefferson County, Missouri. Releases of hazardous substances from the property into nearby air, surface water, groundwater, and soil have resulted in potentially harmful exposure of terrestrial and aquatic biota to contaminants. The Trustees for these natural resources involved in development of this document are the U.S. Department of the Interior acting through the U.S. Fish and Wildlife Service, and the State of Missouri, acting through the Missouri Department of Natural Resources (collectively, “Trustees”).

In keeping with its purpose, this Draft RP/EA:

- Describes the natural resource injuries and losses that are known or likely to have occurred as a result of the release of hazardous substances at or from the Herculaneum Lead Smelter Site;
- Identifies and evaluates restoration alternatives considered for achieving the restoration goal of restoring, replacing, rehabilitating, or acquiring the equivalent of the injured natural resources, including a No Action alternative;
- Identifies the Preferred Alternative that the Trustees are proposing to use in implementing restoration to compensate for the natural resources injuries and losses that are known or likely to have occurred; and
- Includes an Environmental Assessment, discussing the affected environment and potential environmental consequences and cumulative effects associated with the alternatives

This Draft RP/EA has been developed in accordance with 43 C.F.R. § 11.93 and the National Environmental Policy Act (NEPA, 42 U.S.C. § 4321 *et seq.*) (NEPA) to inform the public as to the types and scale of restoration to be undertaken to compensate for injuries to natural resources. The Trustees are soliciting comments on this Draft RP/EA, and will address comments in preparing a final RP/EA wherein the Trustees will identify the Selected Restoration Alternative.

1.1. Relationship to the Southeast Missouri Regional Restoration Plan

In 2014, the Trustees produced the [Southeast Missouri Ozarks Regional Restoration Plan](#) (SEMORRP), which provides a process framework governing the approach for restoration project identification, evaluation, selection and implementation. In the SEMORRP, the Trustees selected Alternative D as the Preferred Alternative (see Section 3.5, pages 23 and 24 of SEMORRP for a description), where the Trustees will consider a combination of primary and compensatory restoration actions and projects to accomplish restoration goals at or near the

site(s) of injury¹. This Draft RP/EA tiers (40 CFR 1502.20, 40 CFR 1508.28, and 43 CFR 46.140) from and incorporates by reference (40 CFR 1502.21 and 43 CFR 46.135) portions of the SEMORRP for expediency and efficiency, as appropriate. Tiering is permissible under NEPA provided that the future proposed activity is within the range of alternatives and nature of potential environmental consequences considered in the programmatic document. Specific sections of the SEMORRP are identified, including a brief summary description of the incorporated material, where incorporation by reference is used below. The proposed activities associated with this restoration plan are in alignment with the goals of the SEMORRP, and compliant with the Preferred Alternative selected in the SEMORRP.

1.2. Purpose and Need for Restoration

As described in Section 2 of the SEMORRP, the Trustees developed the SEMORRP to identify a preferred alternative to restore injured natural resources and to establish criteria for selecting projects to implement such restoration alternatives in the Southeast Missouri Lead Mining District. The Trustees selected Alternative D, which included a combination of restoration activities to accomplish restoration goals at or near the sites of injury. The purpose of this Draft RP/EA is to address natural resources injured and ecological services lost due to releases of hazardous substances, including lead and other metals, at and from the Herculanum Lead Smelter Site that includes the smelter, a waste water treatment plant and the slag storage area, areas adjacent to the haul roads, the aerial deposition zone and a portion of Joachim Creek. The need for this Draft RP/EA is to describe the restoration actions or projects that have been proposed in the Consent Decree (CD) among the United States and State of Missouri, The Doe Run Resources Corporation, Buick Resource Recycling Facility, LLC, and the Homestake Lead Company of Missouri (the “Consent Decree”) relating to the Herculanum Lead Smelter Site². This plan identifies the Trustees’ proposed action to restore, rehabilitate, replace and/or the equivalent of natural resources, including migratory birds and their habitat, and the services those resources provide, that have been injured from releases of hazardous substances.

1.3. Restoration Goals

Based on the nature of the natural resource injuries and losses, the restoration goals listed below were identified by the Trustees and guided development of this plan. These goals are in

¹ SEMORRP at Section 1.2 (p. 5) states: “Sites outside of the defined boundary of the SEMORRP may be considered for restoration activities under this plan if the events giving rise to a NRDAR claim are connected by political, jurisdictional, or previously delineated hazardous substances release boundaries (e.g. the Herculanum Smelter Site in northeast Jefferson County is adjacent to the SEMO boundary, and may be included within the SEMORRP at a future time).”

² A separate draft Restoration Plan/Environmental Assessment is available for proposed restoration actions or projects relating to the other facilities covered by the Consent Decree, including: Viburnum Mine and Central Mill complex, Casteel Mine, Buick Mine and Mill, Brushy Creek Mine and Mill, Fletcher Mine and Mill, Sweetwater Mine and Mill, West Fork Mine and Mill, the Magmont Mine and Mill, the Buick Smelter, Buick Resource Recycling Facility (formerly the Buick Smelter), and Glover Smelter.

alignment with project types described under the Preferred Alternative of the SEMORRP.

Goal 1: to enhance or restore degraded terrestrial habitat, particularly those supportive of migratory birds and sensitive species; and

Goal 2: enhance and protect, via land transfer or acquisition, the conservation value of upland or aquatic habitats supportive of species injured by hazardous substances originating from the Herculaneum Lead Smelter.

1.4. Natural Resource Trustee Authority

Under federal law, the Trustees are authorized to act on behalf of the public to assess injuries to natural resources and services resulting from the release of hazardous substances into the environment. The Natural Resource Damage Assessment and Restoration (NRDAR) process allows Trustees to pursue claims against responsible parties for monetary damages based on these injuries in order to compensate the public. The goal of this process is to plan and implement actions to restore, replace, or rehabilitate the natural resources that were injured or lost as a result of the release of a hazardous substance, or to acquire the equivalent resources or the services they provide (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq.; 43 C.F.R. § 11).

A Trustee Memorandum of Understanding (MOU) was executed in April 2004, formalizing this collaborative process between DOI and the State of Missouri for NRDAR.

1.5. Overview of the Herculaneum Lead Smelter Site

1.5.1 Site History

The Herculaneum Lead Smelter facility, owned by Doe Run Resources Corporation, is located in the City of Herculaneum, Jefferson County, Missouri, along the Mississippi River, adjacent to the confluence of the Mississippi River and Joachim Creek. The property covers approximately 35 acres with an adjacent 24 acre area used for storing slag, a glassy waste product of the metallurgical smelting process. The smelter continuously operated as a primary lead smelter for over 120 years, from 1882 until 2013. During the operation of the smelter, pollutants, including lead, were frequently emitted in the form of stack emissions and aerially deposited in surrounding areas.

Regulatory response actions at and near the Herculaneum smelter have focused on the reduction of threats to human health. There have been numerous response actions attempting to control or remove contamination and reduce exposure to humans and the environment. An Administrative Order on Consent between the U.S. Environmental Protection Agency (EPA), Missouri Department of Natural Resources (MoDNR), and Doe Run, effective May 29, 2001, required new controls on air emissions, remediation of lead-contaminated residential yards, and investigation and stabilization of a contaminated slag pile. In a separate order between the MoDNR and Doe Run, effective September 25, 2001, several actions were required to reduce

fugitive dust emissions from the facility and dust emissions from trucks leaving the facility. In 2011, a Consent Decree between the United States, State of Missouri, and Doe Run, documented the agreement by Doe Run to permanently cease smelting operations at the facility, and cease delivery of lead sulfide ore concentrates, sintering operations, and sulfuric acid plant operations by the end of 2013. As of the date of this draft RP/EA, there are no response activities in the location of the proposed restoration projects identified in this restoration plan.

1.6. Summary of Proposed Settlement Agreement

A proposed settlement agreement among the Trustees and Doe Run Resources Corporation³ was documented in a consent decree, which was lodged with the federal court and open for a thirty (30) day public comment period concurrent with this Draft RP/EA. A Notice of Availability for the Consent Decree and draft RP/EA was published in the Federal Register. Under the terms of the proposed settlement, the Trustees will provide covenants not to sue to Doe Run Resources Corporation for NRD under CERCLA, the Clean Water Act (CWA), and applicable state laws. During the public comment period, the proposed consent decree will be available for public review and comment at <https://www.justice.gov/enrd/consent-decrees>.

For the Herculanum Smelter Site, Doe Run may either 1) donate approximately 105 acres located in Jefferson County (the “Joachim Creek Properties”) to a Trustee- designated entity with a conservation easement enforceable by the State of Missouri and the United States, on behalf of DOI (Alternative B); or 2) pay the Trustees approximately \$200,000 with which the Trustees will implement restoration actions as identified herein (Alternatives C and D).

1.7. Public Participation

Public participation and review is an integral part of the restoration planning process, and is specifically required in the CERCLA NRDAR regulations (*e.g.*, 43 C.F.R. §11.81(d)(2)). In addition, NEPA and its implementing regulations require that federal agencies fully consider the environmental impacts of their proposed decisions and that such information is made available to the public.

The Draft RP/EA will be open for public comment for 30 days from the date of publication of the Notice of Availability in the Federal Register. After consideration of public comments, and if the RP/EA is approved and the CD entered, the Trustees will implement the selected alternative(s) described herein. The Trustees will address public comments and will document responses to those comments as part of the final RP/EA. Interested individuals, organizations, and agencies may submit comments by writing or emailing:

³The negotiations were solely with Doe Run because the other defendants to the Consent Decree: Buick Resources Recycling Facility and the Homestake Lead Company of Missouri are not potentially responsible parties for the Herculanum Lead Smelter Site.

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Copies of this document are available online at:

<https://www.fws.gov/Midwest/es/ec/nrda/SEMONRDA/index.html>

and

<https://dnr.mo.gov/env/hwp/sfund/nrda.htm>

Physical copies of the document are also available for review by interested members of the public at the address listed above. Trustees have also maintained records documenting the information considered and actions taken during this NRDAR process. These records are available on the Southeast Missouri Lead Mining District NRDAR [website](#). Arrangements must be made in advance to review or obtain copies of records by contacting the U.S. Fish and Wildlife Service representative listed above.

As restoration progresses, the Trustees may amend the RP/EA if significant changes are made to the types, scope, or impact of the projects. In the event of a significant modification to the RP/EA, the Trustees will provide the public with an opportunity to comment on that particular amendment.

1.8. Organization of the Draft RP/EA

The chapters that follow describe the injury to natural resources at and in the vicinity of the Herculaneum Lead Smelter Site (Section 2), proposed restoration alternatives (Section 3); and the affected environment and the probable consequences on the human environment that may result from the implementation of the alternatives (Chapter 4); the potential cumulative impacts from the proposed activities, including past, current, and foreseeable future projects (also Chapter 4); and a general monitoring framework for the Preferred Alternative (Chapter 5).

2. Summary of Injury to Natural Resources

A variety of studies have been conducted at or near the Herculaneum Lead Smelter Site suggestive of injuries to natural resources (Entrix, 2007). Elevated upland and floodplain soil concentrations have been documented in a wide area around Herculaneum. Concentrations of lead and cadmium exceed benchmark toxicity thresholds for mammals and birds, suggesting potential injury to animals that incidentally ingest contaminated soil. Zinc levels in the floodplain near the slag pile exceed concentrations that are considered toxic to plants. Liver samples collected from songbirds exceed thresholds indicative of subclinical and clinical lead poisoning. (Wiebler and Coffey, 1999) Laboratory tests conducted with fathead minnows exposed to water and slag were indicative of acute toxicity (ie. short-term lethality).

3. Proposed Restoration Alternatives

To compensate the public for injuries (*e.g.*, service losses) to natural resources resulting from releases of hazardous substances from the Herculaneum Lead Smelter Site, the Trustees are required to develop alternatives for the “restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the natural resources and the services those resources provide” (42 C.F.R. §11.82 (a)). The Trustees developed the SEMORRP and identified broad categories of restoration types. As described in Alternative D (Preferred Alternative) of the SEMORRP, the Trustees presented a suite of restoration project types that would be considered for implementation, including upland resource restoration and preservation, enhancement, and creation; wetland, floodplain, and riparian corridor restoration or enhancement; surface water quality and aquatic resource improvement; groundwater quality and resource improvement; and public education and enjoyment projects. The Preferred Alternative proposed by the Trustees in Section 3.3 of this Draft RP/EA is consistent with the Preferred Alternative in the SEMORRP and falls into the category of upland resource protection, restoration, or enhancement.

Trustees evaluated the alternatives to determine if they provide sufficient type, quality, and quantity of ecological services to compensate for those lost due to contamination in the context of both site-specific and regulatory evaluation criteria (43 C.F.R. §11.82 (d)). The Trustees also evaluated whether significant effects may be associated with the proposed alternatives to restore the natural resources and services injured or lost due to the releases hazardous substances as required by NEPA (40 C.F.R. §1508.9(b)).

3.1. Restoration Evaluation Criteria

To ensure the appropriateness and acceptability of restoration options addressing ecological losses, the Trustees evaluated each option against restoration evaluation criteria. The criteria were developed through discussions with natural resource managers at each of the Trustee agencies and are consistent with the criteria identified in Sections 6.4 and 6.5 of the SEMORRP, incorporated by reference herein.

Below are the criteria used to evaluate potential restoration projects as part of the Herculaneum

Lead Smelter NRDAR process. The criteria reflect the “factors to consider when selecting the alternative to pursue” (NRDAR factors) as described in 43 C.F.R. § 11.82(d)(1-10).

Relationship to Injured Resources and Services:

The preferred alternative that restores the resources and services injured by the release is preferred to projects that benefit other comparable resources or services. The Trustees considered the types of resources or services injured the location of the resources, and the connection or nexus of project benefits to those injured resources.

Technical Feasibility (43 CFR 11.82(d)(1)):

The preferred restoration alternative must be technically sound. The Trustees considered the level of risk or uncertainty involved in implementing a project. A proven record of accomplishment demonstrating the success of projects utilizing similar or identical restoration techniques can be used to satisfy this evaluation criterion.

Compliance with Laws, Regulations, and Policies (43 CFR 11.82(d)(9-10)):

Development of this draft RP/EA requires consideration of a variety of legal authorities and their potentially applicability to the Preferred Alternative. As part of restoration planning process, the Trustees initiated steps to ensure compliance with applicable laws, regulations, and policies. Implementation of the Preferred Alternative remains subject to complying with all applicable all applicable laws and regulations.

Consistency with the Trustees Restoration Goals:

The preferred alternative should meet the Trustee's intent to directly restore the injured resources or the services those resources provide. Included in this criterion is the potential for success (meeting restoration goals) and the level of expected return of resources and resource services.

Public Health and Safety (43 CFR 11.82(d)(8)):

The preferred alternative should not pose a threat to the health and safety of the public.

Avoidance of Further Injury (43 CFR 11.82(d)(5)):

The preferred alternative should avoid or minimize adverse impacts to the environment and the associated natural resources. The Trustees considered the future short- and long-term injuries, as well as mitigation of past injuries, when evaluating projects.

Time to Provide Benefits:

The Trustees considered the time expected for the project to begin providing benefits to the target ecosystem and/or public. A more rapid time to delivery of benefits is favorable.

Duration of Benefits:

The Trustees considered the expected duration of benefits from the restoration alternatives. Projects expected to provide longer-term benefits were regarded more favorably.

Additionally, actions undertaken to restore natural resources are anticipated to have long-term beneficial and sometimes short-term adverse impacts to the physical, biological, socio-economic,

and/or cultural environments. In the analysis below, the Trustees examine the likely beneficial and adverse impacts of three alternatives on the quality of the human environment. The following sections evaluate anticipated environmental consequences of the restoration alternatives. Table 2 provides a comparative analysis of alternatives using restoration evaluation criteria.

3.2 Alternative A: No Action Alternative (Natural Recovery)

As required under CERCLA and NEPA, the Trustees considered a No Action alternative. Under this alternative, the Trustees would rely on natural recovery and would take no direct action to restore injured natural resources or compensate for interim lost natural resource services. This alternative would include the continuance of ongoing monitoring programs by federal and state agencies but would not include additional activities aimed at acquiring valuable urban property and preserving the ecosystem through a permanent conservation easement. Under this alternative, no compensation would be provided for interim losses in resource services.

Under the No Action alternative, the acquisition of property from Doe Run would not occur and therefore no habitats would be preserved beyond what agencies and organizations are already doing in the vicinity of impacted resources. Terrestrial habitats would continue to be degraded at and near the Herculaneum Smelter Site. Injuries to migratory bird individuals and/or populations would continue to occur because of continued contamination and subsequent exposure and toxicological effects, and degradation of resting, foraging, and nesting habitat. Local citizens and visitors recreating in the affected areas would not benefit from improved ecological resources or access to new, alternative areas providing replacement recreation opportunities.

3.3 Alternative B: Joachim Creek Properties Transfer and Protection (Preferred)

This alternative involves the ownership transfer and conservation of the Joachim Creek Properties, approximately 105 acres, consisting of two parcels (Table 1 and Figure 1) made up of upland and bottomland forest (Figure 2) in Jefferson County, Missouri. The primary goal of Alternative B is to preserve and protect the natural resources, including native plants and animals, notably migratory birds. Alternative B will also preserve and protect natural resource services provided by native habitats, including but not limited habitat for migratory birds, and native wildlife. Secondary goals may include future land management that provides, 1) passive use and environmental education at targeted access sites while protecting natural features from overuse and disturbance, and 2) monitoring ecological condition over time and taking action where monitoring reveals existing or potential damage to natural resources.

As described in the Consent Decree, within 365 days after the U.S. District Court approves the Consent Decree, Doe Run will complete the land donation to an entity designated by the Trustees. This entity will manage the properties consistent with this Restoration Plan.

Table 1. Joachim Creek Properties

Property	County	Township	Range	Section	Acres
Northern Parcel (entire)	Jefferson	41N	6E	29	~86
Southernmost Parcel (entire)	Jefferson	41N	6E	30	~16

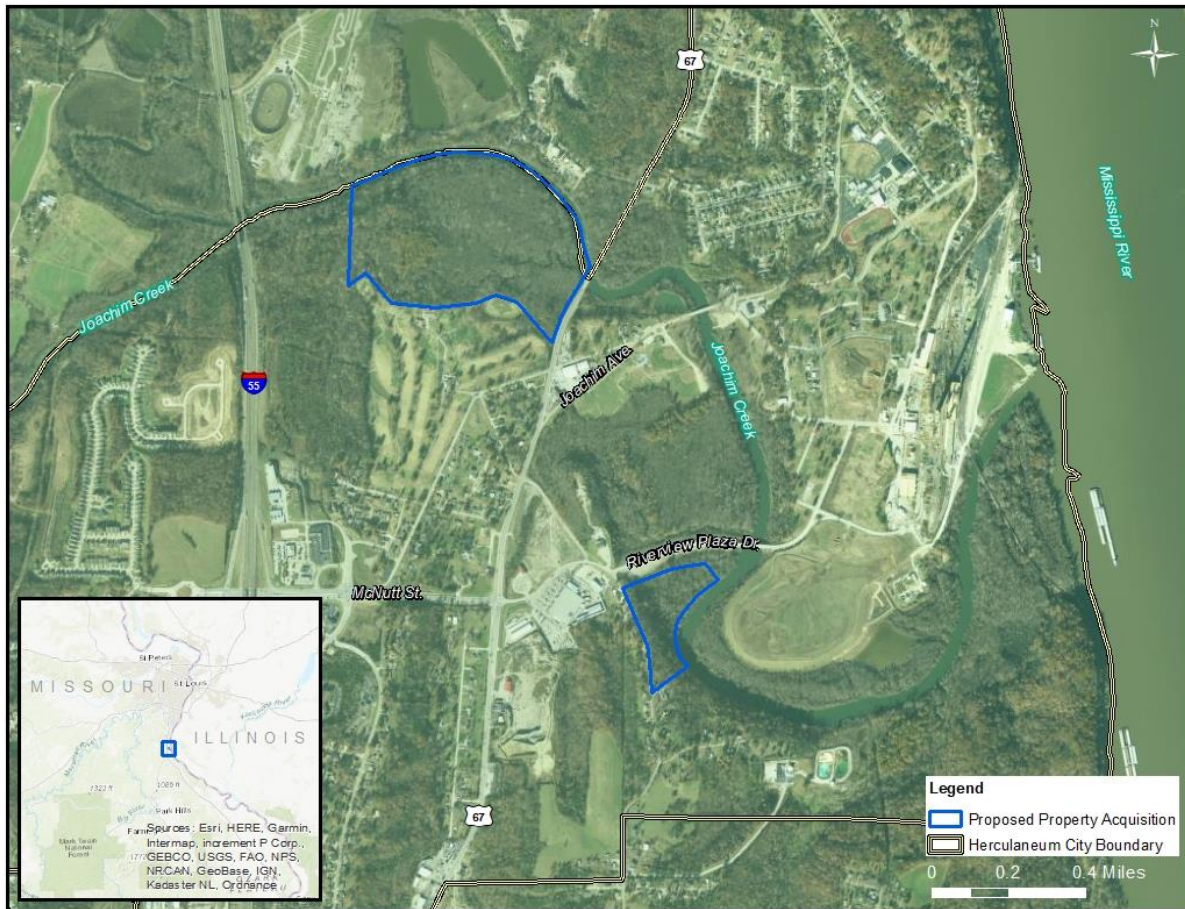


Figure 1. Joachim Creek Properties within the boundaries of the city of Herculaneum.



Figure 2. Photographs of upland forest (top left) and bottomland forest (top right and bottom) on Joachim Creek Properties. (Photo credit: Dave Mosby, FWS)

3.4 Alternative C: Enhancement of Existing Public Lands for Wildlife Habitat

This alternative involves terrestrial habitat restoration projects on existing public lands, utilizing funds recovered in lieu of the land transfer described in Alternative B. Specifically, potential opportunities for habitat restoration exist on land at the following locations: Middle Mississippi Wildlife Refuge near Festus, MO; Valley View Glades Natural Area and Victoria Glades Conservation Area near Hillsboro, MO; Mastodon State Park near Imperial, MO; and/or the Teszars Woods Conservation Area and Strawberry Creek Nature Area near Arnold, MO, as shown in Figure 3. The Trustees will prioritize habitat restoration projects on public lands in Jefferson County, and ideally those in close proximity to the City of Herculaneum.

Restoration techniques include invasive species control, such as burning, herbicide application, and/or mechanical thinning of undesirable species over time. Restoration techniques could also involve planting of native species. These techniques would benefit wildlife and migratory birds by reducing competition of invasive species with native plant species which provide better habitat, including food sources. Conversion of native habitats tends to favor migratory birds and other wildlife most affected by anthropogenic disturbance. The projects would occur over a period of years and adapted to changing conditions of plant communities and wildlife needs. If selected, the Trustees would implement this alternative and would establish cooperative agreements with willing public land managers, as appropriate, in order to outline goals and objectives of proposed restoration activities, including adaptive management.

3.5 Alternative D: Acquisition, Protection, and Enhancement of Wildlife Habitat

This alternative involves the acquisition and protection of approximately 100 to 150 acres of floodplain, riverbank, and/or bottomland forest habitat in Jefferson County. The Trustees have preliminarily identified lands adjacent to the existing Middle Mississippi National Wildlife Refuge (Refuge) for possible purchase and transfer to the Refuge for long-term stewardship and conservation in perpetuity. There are approximately 300 acres adjacent to the Refuge, a portion of which (100-150 acres as stated above) would be considered for acquisition under this alternative. In the event that the Trustees cannot accomplish the acquisition of these specific acres, other properties adjacent to public lands, discussed in Alternative C above, may be considered pending further evaluation as required by CERCLA and NEPA, including the opportunities for public comment as appropriate. The acquisition and conservation of this or similar properties will benefit migratory birds and other species by increasing wildlife habitat. Acquisition and conservation of property, equivalent to that which was injured, would protect a significant riverine wetland and lowland forest assemblage that provides resting, feeding, and nesting habitat for waterfowl and other aquatic dependent birds as well as amphibians and invertebrates. Aquatic species will benefit due to the protection of slack water habitat particularly important for larval stages of many fish and invertebrate species. This potential addition to the Refuge would allow greater access to recreational opportunities for the public. The Refuge generally manages the land for waterfowl and aquatic habitat as established in the Mark Twain Complex National Wildlife Refuge (MTCNWR) Comprehensive Conservation Plan (CCP). The Middle Mississippi NWR is a subsection of the MTCNWR and the CCP establishes specific goals, objectives, and procedures for habitat and fish and wildlife management.

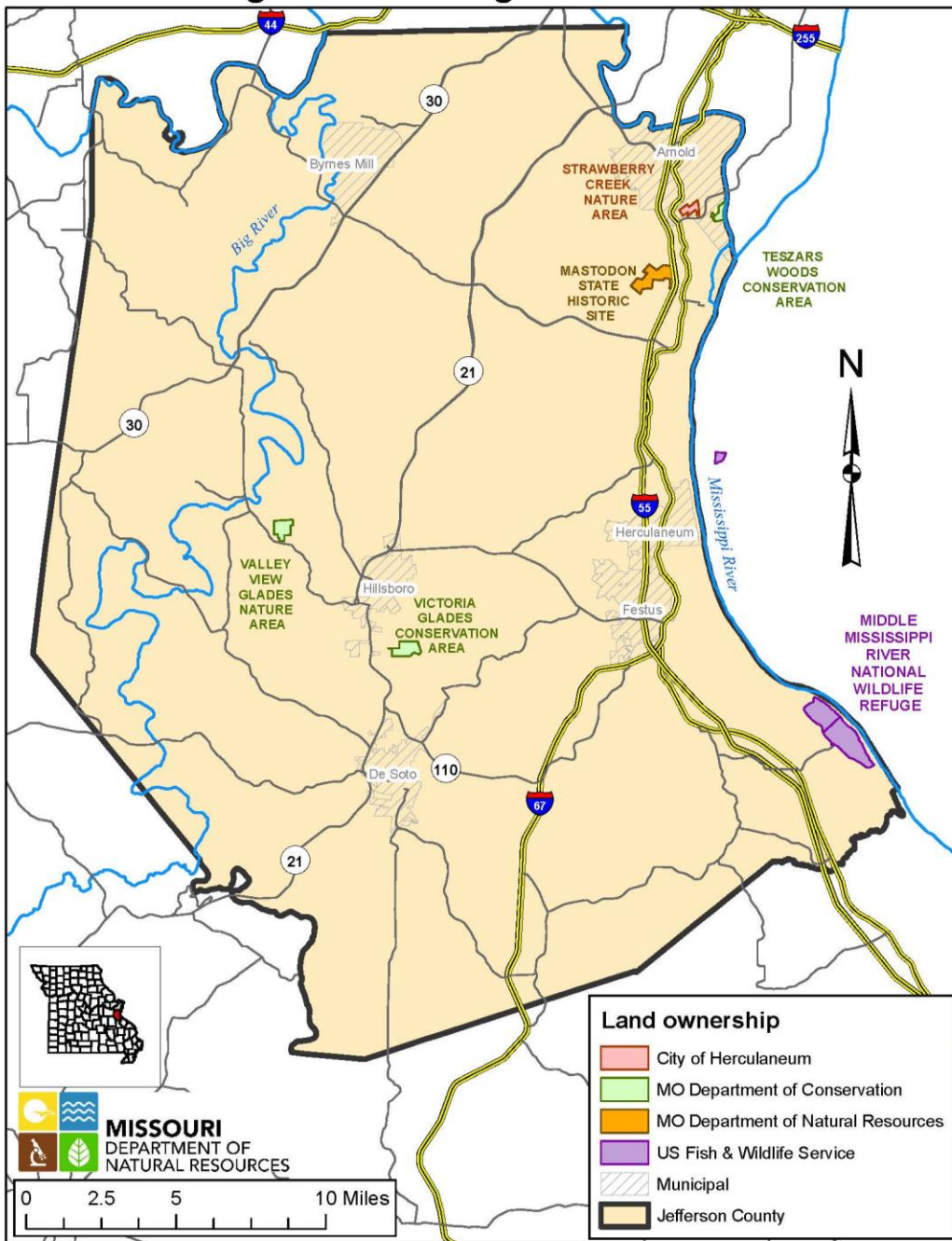


Figure 3. Existing public lands considered for wildlife habitat enhancement under Alternative C.

Table 2. Evaluation of alternatives using restoration criteria.

Restoration Criteria	Alternative A: No Action	Alternative B: Joachim Creek Properties Transfer and Preservation (Preferred)	Alternative C: Enhancement of Existing Public Lands for Wildlife Habitat	Alternative D: Acquisition, Protection, and Enhancement of Wildlife Habitat
Technical Feasibility	The No Action alternative is technically feasible.	Activities included in this alternative are technically feasible and likely to result in conservation of similar resources injured.	Activities included in this alternative are technically feasible and likely to result in conservation of similar resources injured.	Activities included in this alternative are technically feasible and likely to result in conservation of similar resources injured.
Relationship to Injured Resources and Services	The No Action alternative would not provide for restoration, replacement, enhancement or acquisition of resources that were injured from releases of hazardous substances.	This alternative would involve protecting terrestrial habitat in the vicinity of areas affected by releases of hazardous substances. This alternative is likely to meet the restoration criterion and support and protect wildlife and plant species injured.	This alternative would involve enhancing equivalent terrestrial habitat within 15 miles of areas injured by releases of hazardous substances. This alternative is likely to meet the restoration criterion and enhance wildlife habitat similar to those injured.	This alternative would involve protecting equivalent terrestrial habitat within 10 miles of areas injured by releases of hazardous substances. This alternative is likely to meet the restoration criterion and support and protect wildlife and plant species injured.
Compliance with Laws and Policies	The No Action alternative does not meet the requirements and goals of CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances.	This alternative meets the requirements and goals of the CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances. The Trustees will comply with applicable such requirements.	This alternative meets the requirements and goals of the CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances. The Trustees will comply with such requirements.	This alternative meets the requirements and goals of the CERCLA NRDAR process to provide for restoration that compensates the public for the injury and loss of the natural resources and services caused by releases of hazardous substances. The Trustees will comply with such requirements.

Consistency with the Trustees Restoration Goals and Objectives	The No Action alternative would not provide for restoration, replacement, enhancement or acquisition of injured natural resources, making this alternative inconsistent with Trustee restoration goals.	This alternative is consistent with preferred project types described in the SEMORRP and the goal of preserving, restoring, or enhancing natural resources.	This alternative is consistent with preferred project types described in the SEMORRP and the goal of restoring, or enhancing natural resources.	This alternative is consistent with preferred project types described in the SEMORRP and the goal of restoring, or enhancing natural resources.
Avoidance of Further Injury	The No Action alternative would not cause further injury, but will also provide no benefit to offset interim losses.	This alternative will not cause further long-term injury although short-term, minor, adverse impacts could occur on the properties or during natural resource management actions.	This alternative will not cause further long-term injury although short-term, minor, adverse impacts could occur on the properties or during natural resource management actions.	This alternative will not cause further long-term injury although short-term, minor, adverse impacts could occur on the properties or during natural resource management actions.
Public Health and Safety	Any potential public health and safety issues or concerns that exist under current and future natural resource management activities would likely remain the same.	This alternative would not pose elevated public health and safety issues.	This alternative would not pose elevated public health and safety issues.	This alternative would not pose elevated public health and safety issues.
Time to Provide Benefits	The time to provide natural resource benefits under the No Action alternative is greater than if the Trustees were to pursue restoration under the Preferred Alternatives. Under the No Action alternative, natural recovery would be relied upon to improve ecological services.	The time to provide natural resource benefits under this alternative is less than the No Action alternative because preservation of natural resources would occur upon acquisition and habitat benefit could occur over-time. The No Action alternative allows for continued degradation of	The time to provide natural resource benefits under this alternative is less than the No Action alternative because habitat would be enhanced in the relatively short term. This alternative could achieve natural resource benefits sooner than the Land Donation and Transfer Alternatives.	The time to provide natural resource benefits under this alternative is less than the No Action alternative because preservation of natural resources would occur upon acquisition and habitat benefit could occur over-time. The No Action alternative allows for continued degradation of resources with no

	resources with no environmental offset.				environmental offset.
Duration of Benefits	The duration of benefits under the No Action alternative is unknown. Perpetual conservation easements and other mechanisms to conserve habitat would not occur under this alternative.	The duration of benefits from this alternative will be long-term due to the terms and conditions of the perpetual conservation easement.	The duration of benefits from this alternative would depend on the specifics of the restoration project.	The duration of benefits from this alternative will be long-term due to the ownership and management objectives of the National Wildlife Refuge System.	

4. Environmental Assessment

In accordance with CERCLA NRDAR regulations (43 C.F.R. § 11.93), the Trustees' primary goal in this section is to evaluate restoration alternatives that compensate the public for natural resource injuries and associated losses resulting from release of hazardous substances from the Herculaneum Lead Smelter Site. In this section, the Trustees also assess the environmental consequences of the No Action, Alternative B (Preferred Alternative), Alternative C and Alternative D to determine whether implementation of any of these alternatives may significantly affect the quality of the human environment, particularly with respect to physical, biological, socio-economic, or cultural environments. Lastly, the Trustees make a conclusion at the end of the evaluation for each alternative identifying whether it is a preferred alternative and whether it should be implemented in the event a Finding of No Significant Impact is reached following the public comment period and publication of the Final RP/EA.

The following definitions will be used to characterize the nature of the various environmental consequences evaluated in this Draft RP/EA:

- *Short-term or long-term impacts.* In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.
- *Direct or indirect impacts.* A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action.
- *Negligible, minor, moderate, or major impacts.* These relative terms are used to characterize the magnitude of an impact. Negligible impacts are generally not quantifiable and do not have perceptible impacts on the human environment. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively inconsequential effect. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth under NEPA (40 C.F.R. § 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.
- *Adverse or beneficial impacts.* An adverse impact is one having unfavorable or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.
- *Cumulative impacts.* Cumulative impacts are defined as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

4.1 Affected Environment

4.1.1 Physical and Biological Setting

The affected natural environment in eastern Jefferson County near Herculaneum includes upland forest and bottomland deciduous forest near the Mississippi River floodplain and creek bottoms. Agriculture generally dominates the floodplains with mixed row crops and hay fields. Jefferson County is increasingly suburban from Festus north toward St. Louis County, including Herculaneum. Southern and southwestern Jefferson County is more rural and is typical of Ozark landscapes, of low hills dissected by stream valleys. The potential locations for Alternative C fall within eastern Jefferson County. Alternative D is located southeast of Festus, approximately 7 miles from Herculaneum.

The proposed project area for the Preferred Alternative (Alternative B) is west and adjacent to the city of Herculaneum, situated along Joachim Creek. Residential and commercial developments are in the nearby vicinity but not directly adjacent to the properties. The Mississippi River is approximately one mile downstream of the southern parcel along Joachim Creek. Interstate 55 runs north-south approximately 500 feet to the west of the northern approximately 90 acre parcel. The southern edge of the northern parcel is adjacent to a golf course, with the northern edge of the parcel bordered by Joachim Creek. Commercial Boulevard runs along the eastern edge of the parcel. The southern parcel is approximately 15 acres and situated to the south of Wood Street. Joachim Creek runs along the eastern edge of the southern parcel. An additional wooded tract and baseball fields are adjacent to the northern edge.

Approximately 60-70% of the forested property is subject to periodic flooding from Joachim Creek or the Mississippi River. The majority of the habitat contained within all parcels is mature and successional upland and floodplain forest containing linear habitat segments along Joachim Creek represented by native trees and herbaceous species common to the region. Representative tree species include various oak species (*Quercus* spp.), such as northern red oak and white oak, hickory species (*Carya* spp.) and understory consisting of dogwood (*Cornus* spp.), red bud (*Cercis canadensis*) and Eastern hop hornbeam (*Ostrya virginiana*).

The physical and biological setting of Alternative D has similar habitat as the Preferred Alternative. However, it is located adjacent to the Mississippi River approximately 6 miles downstream and has a higher percentage of floodplain forest, riparian wetland, and also includes Mississippi River aquatic habitats.

Federally sensitive species occurring on the properties include the gray bat (*Myotis grisescens*; endangered), Indiana bat (*Myotis sodalis*; endangered), and northern long-eared bat (*Myotis septentrionalis*; threatened). There are no critical habitats for these species on the properties. Birds of Conservation Concern potentially occurring on the properties include bald eagle (*Haliaeetus leucocephalus*), eastern whip-poor-will (*Antrostomus vociferous*), prothonotary warbler (*Protonotaria citrea*), red-headed woodpecker (*Melanerpes erythrocephalus*), and wood thrush (*Hylocichla mustelina*).

4.1.2 Demographics and Economy

A summary of demographic data is provided in Table 3. The City of Herculaneum experienced tremendous growth (~32%) between the years of 2000 and 2015. Route 61/67 travels through the city, as well as Interstate 55, both serving as major corridors of transportation and commerce. According to the city’s website (www.cityofherculaneum.org/), the city is aggressively pursuing infrastructure improvements in order to enhance economic development. The nearby industrial sector along the Mississippi supports the local economy and new opportunities may be in the city’s future in the form of a new port.

Table 3. Project area demographics by county and city.

Demographic Category	Herculaneum City	Jefferson County
Population (2017 estimate)	3,987	31,234
Percent Minority	4.6%	5%
Low Income Population**	31%	27%
% persons below poverty level (estimate)	9.0	12.8%
Households	475	87,709
Population per square mile	516	349

* Statistics generated using 2010 U.S. Census Bureau data and EPA’s Environmental Justice Screening and Mapping Tool (Version 2018) <https://ejscreen.epa.gov/mapper/>

** State average is 35%

4.1.3 Environmental Justice

Executive Order 12898 (Feb 11, 1994) requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. In a memorandum to heads of departments and agencies that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum states that “each federal agency shall analyze the environmental effects, including human health, economic and social effects, of federal actions, including effects on minority communities and low-income communities, when such analysis is required by [NEPA]” and emphasizes the importance of NEPA’s public participation process in particular, directing that “each federal agency shall provide opportunities for community input in the NEPA process.” The Council on Environmental Quality (CEQ) has oversight of the federal government’s compliance with Executive Order 12898 and NEPA.

For the purpose of evaluating environmental justice issues associated with implementation of the Preferred Alternative, demographic data were obtained from the U.S. Census Bureau and the State of Missouri. In this analysis, a county or city is considered to have a minority population if its non-white population is greater than 50 percent or is meaningfully larger than the general (statewide) non-white population. Low-income areas are defined as a county or city in which the percentage of the population below poverty status exceeds 50 percent, or is meaningfully greater than the general population (average statewide poverty level).

To make a finding that disproportionately high and adverse effects would likely fall on minority or low-income populations, three conditions must be met simultaneously:

- There must be a minority or low-income population in the impact zone.
- A high and adverse impact must exist.
- The impact must be disproportionately high and adverse on the minority or low-income population

Based on the census data for Jefferson County and the city of Herculaneum, the condition of being classified as having a minority population in the project area is not met since the minority population comprises only approximately 5% for both the county and the city. The project area is not considered low-income because the low-income population is less than the state average and less than 50%. In addition, poverty levels are less than the statewide average (estimate of 14%) at both the city and county level.

4.1.4 Recreation

Recreational resources near the properties under consideration include golf, other sports recreation (baseball fields nearby), and recreation along the creek, such as boating, canoeing and kayaking.

4.1.5 Cultural and Historic Resources

Prior to the implementation of the proposed project, potential impacts to historic and archaeological resources will be reviewed. Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of Preferred Alternative on historic properties. Historic properties must also be given consideration under NEPA. The National Register of Historic Places is a federally-maintained list of districts, sites, buildings, structures, objects, and landscapes significant in American history, prehistory, architecture, archaeology, engineering, and culture. Archaeological sites are places where past peoples left physical evidence of their occupation. Sites may include ruins and foundations of historic-era buildings and structures. Native American cultural resources may include human skeletal remains, funerary items, sacred items, and objects of cultural patrimony. Historic properties can also include traditional cultural properties. Currently, there are no known cultural or historic resources within the boundaries of the proposed sites to be transferred. The Trustees will consult with the Missouri State Historic Preservation Office to complete Section 106 review and compliance prior to accepting the parcels and taking on-the-ground management actions.

4.2 Components Not Affected or Not Analyzed in this Document

The following components have been identified as not being present, affected, or analyzed. These components are not brought forward for additional analysis in this Draft RP/EA:

- Social/Economic/Environmental Justice – No social or economic impacts are expected from the proposed restoration project because low-income populations will not be adversely affected due to the intended beneficial environmental outcomes of the Preferred Alternative and use of some of the areas for recreation.
- Cultural and Historic Resource Concerns – The Trustees will consult with the Missouri State Historic Preservation Office prior to implementing any restoration activities.
- Health and Safety – The Trustees do not foresee any health and safety issues with land management activities implemented to preserve or enhance ecological resources. However, at a minimum, a Phase I environmental site assessment will be completed to ensure there are no existing contamination or other health and safety issues on the Joachim Creek Properties.
- Air and Climate – There are no anticipated impacts to air and climate associated with the Preferred Alternative. Carbon sequestration, by way of preserving trees and preventing land conversion, is a minor benefit to the local area. Trees and other vegetation have also been shown to reduce local temperatures, have other microclimate effects, and remove some air pollutants.

4.3 Evaluation of Alternative A: No Action/Natural Recovery Alternative

The No Action/Natural Recovery Alternative is described on page 16 of the SEMORRP and compared to other SEMORRP alternatives pages 25 and 26 of that plan. Environmental consequences of the No Action alternative are described on pages 35 and 36 of the SEMORRP. This information in the SEMORRP is incorporated by reference herein.

4.3.1 Conclusion on Alternative A

The Trustees found that the No Action Alternative would not meet the purpose and need for restoration under either this Draft RP/EA or the responsibilities of the Trustees under CERCLA, including as defined by NRDAR procedures under CERCLA and guided by the Restoration Evaluation Criteria. Therefore, the No Action Alternative is not a preferred restoration alternative when evaluated against the NRDAR evaluation criteria.

4.4 Evaluation of Alternative B: Joachim Creek Properties Transfer and Protection (Preferred)

Environmental consequences associated with implementation of the Preferred Alternative have been evaluated at a programmatic level at Section 5 of the SEMORRP. This information in the SEMORRP is incorporated by reference herein. This section that follows tiers from and expands

upon the SEMORRP analysis to a project-specific level.

4.4.1 Environmental Impacts of Alternative B

Overall, the long-term beneficial impacts are anticipated to outweigh any short- or long-term adverse impacts described below. This alternative may result in new or improved access to forested upland areas within one or both parcels. Donated land will be managed to ensure long-term protection of wildlife habitat, particularly those beneficial to migratory birds. Depending on the plans for management by a new property owner, new or improved access to resource-based recreational activities, such walking or hiking through forested areas, or access Joachim Creek could occur through building a new trail or creek walkway, respectively. Currently, however, it's unclear what actions could be taken on the parcels outside of management activities needed to reduce invasive species; remove dead, diseased, or dying trees, if warranted; and address other situations where threats could reduce ecological value of the properties. In addition to management actions, such as those mentioned above, the property owner will be able to implement monitoring and long-term stewardship activities meant to ensure existing natural resource services and aesthetic values are conserved into the future. Land transfer and subsequent recreational use on protected properties is anticipated to result in long-term, beneficial impacts to recreation. A Conservation Easement on the property will prohibit the use or any activity on the Joachim Creek Properties that would impinge upon or interfere with preservation of the parcels habitat located on the property. in their present conditions include, but are not limited to, creation of roads; placement of fill material; storage or disposal of trash, debris, or abandoned equipment; placement of billboards or signs; and actions or uses detrimental or adverse to water conservation and purity, and fish, wildlife, or habitat preservation.

4.4.2 Conclusion on Alternative B

The Trustees found this alternative to meet all of the Restoration Evaluation Criteria (see Table 2), including alignment of the proposed project and the Trustees' restoration goals identified in the SEMORRP. The Preferred Alternative also meets the purpose and need statements in Section 1.2. The Trustees anticipate this alternative to have primarily beneficial direct and indirect long-term impacts in the form of natural resource preservation and improved land management activities enhancing wildlife populations and recreation opportunities. For these reasons, Alternative B is the Preferred Alternative.

4.5 Evaluation of Alternative C: Enhancement of Existing Public Land for Wildlife Habitat

Environmental consequences associated with enhancement or restoration of wildlife habitat have been evaluated at a programmatic level in Section 5 of the SEMORRP. This information in the SEMORRP is incorporated by reference herein. This section that follows tiers from and expands upon the SEMORRP analysis to a project-specific level.

4.5.1 Environment Impacts of Alternative C

Overall, the beneficial impacts are anticipated to outweigh any short- or long-term adverse impacts described below. Burning, thinning, or pesticide use to effect habitat structure and control invasive species may have short-term negative consequences for some species. However, the long term benefits to migratory birds and species that depend on habitats that have a high percentage of native plant species would far outweigh the short-term impacts. The Trustees would insure that the implementing entity would follow best management practices when implementing habitat management. This would insure proper use of pesticides and burning or forest thinning would meet health and safety guidelines and habitat enhancement recommendations approved by the Trustees.

Regarding herbicide usage to control invasive species, such actions could cause direct, short-term, moderate, adverse impacts to soils, water, air, biological resources, and land use and recreation. These impacts would result from the potential for lethal effects on soil biota and the short-term loss of shading and habitat for prey species provided by the invasive plant. The potential impacts to birds, aquatic organisms, and terrestrial organisms will be mitigated by the use of the least toxic herbicides, surfactants, and spray pattern indicators available, but sub-lethal impacts are possible. Potential impacts to non-target plant species are reduced when proper application methods are prescribed, but rainfall and wind may cause herbicides to leach into the surrounding soil or be transported to non-invasive plants, causing unintentional damage. Best management practices, including use of a certified applicator, using herbicides approved for application within wetlands, and placement of straw wattles to trap sediment, would be employed when herbicides are used. A project area may be treated several times per year, often for multiple years, to control regrowth of the invasive plant. Where feasible, the area will be regularly monitored for regrowth of the target or new invasive species. Generally, use of herbicides in project areas would be conducted according to established protocols for the locality, as determined by a licensed herbicide applicator. Such protocols would include information and guidelines for appropriate chemical to be used, timing, amounts, application methods, and safety procedures relevant to the herbicide application.

4.5.2 Conclusion on Alternative C

The Trustees found this alternative to meet all of the Restoration Evaluation Criteria (see Table 2), including alignment of the proposed project and the Trustees' restoration goals identified in the SEMORRP. This alternative also meets the purpose and need statements in Section 1.2. The Trustees anticipate this alternative to have primarily beneficial direct and indirect long-term impacts in the form of natural resource preservation and improved land management activities enhancing wildlife populations.

4.6 Evaluation of Alternative D: Acquisition, Protection and Enhancement of Wildlife Habitat

Environmental consequences associated with implementation of the Alternative D have been evaluated at a programmatic level at Section 5 of the SEMORRP. This information in the SEMORRP is incorporated by reference herein. This section that follows tiers from and expands upon the SEMORRP analysis to a project-specific level.

4.6.1 Environmental Impacts of Alternative D

Overall, the long-term beneficial impacts are anticipated to outweigh any short- or long-term adverse impacts described below. The environmental impacts for Alternative D would be virtually the same as Alternative B. Property adjacent to the Refuge with existing wildlife habitat would be transferred to Refuge which would ensure the long-term protection and maintenance as habitat. Access to the Refuge is currently available through one of the parcels via an existing easement. If the Refuge owned the area in fee title, little net difference from existing management would occur. Visitor numbers would also unlikely change due to acquisition of an additional 100-150 acre parcel.

4.6.2 Conclusion on Alternative D

The Trustees found this alternative to meet all of the Restoration Evaluation Criteria (see Table 2), including alignment of the proposed project and the Trustees' restoration goals identified in the SEMORRP. Alternative D also meets the purpose and need statements in Section 1.2. The Trustees anticipate this alternative to have primarily beneficial direct and indirect long-term impacts in the form of natural resource preservation and improved land management activities enhancing wildlife populations and recreation opportunities.

Alternative D could be implemented in the event Alternative B (transfer of Joachim Creek Properties) is not feasible and does not move forward due to the lack of a willing entity to receive the Joachim Creek Properties.

4.7 Cumulative Impacts

Cumulative impacts associated with the Preferred Alternative of the SEMORRP can be found in Section 5.5.1 of that restoration plan. This information in the SEMORRP is incorporated by reference herein. The section that follows tiers from and expands upon the SEMORRP analysis to a project-specific level.

Cumulatively, the Preferred Alternative proposed in this plan is anticipated to have a cumulative impact that is long-term and beneficial. Terrestrial habitat and natural resource services provided, such as reducing soil runoff and pollutant contributions to Joachim Creek, will be protected through a perpetual conservation easement and long-term management. Such acquired habitats serve as buffers from upstream human impacts. Also, creation of public natural areas has been shown to improve human physical and psychological health, strengthen communities, and make cities and neighborhoods more attractive places to live and work.

The Preferred Alternative is not expected to result in significant cumulative impacts on the human environment since it alone, or in combination with other current and future activities in the vicinity, would not change the larger current hydrological patterns of discharge in Joachim Creek and would cause only a negligible to minor change in recreation, economic activity, and land-use in the project area. Future growth of the city of Herculaneum and surrounding areas has

the potential to bring both positive and negative changes to Joachim Creek. For example, stream restoration or water quality improvement activities would be beneficial to Joachim Creek or its tributaries. Conversely, increased residential, commercial, and industrial development may result in increased runoff and associated surface pollutants transported into Joachim Creek or its tributaries.

Regulatory activities expected in the future that could contribute to cumulative effects of the proposed restoration include decommissioning and closure of the smelter facility. The facility is being redeveloped as a port for loading barges on the Mississippi River. Other potential impacts could be in the form of ex-urban sprawl due to Herculaneum's proximity to greater St. Louis Metropolitan Area. Under foreseeable residential and commercial growth planned for the City of Herculaneum and nearby areas, preservation of natural open space could have increasingly beneficial effects.

5. Agencies, Organizations, and Parties Consulted for Information

Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176
Jefferson City, MO 65102

USFWS
Columbia Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, MO 65203

Jefferson County Parks and Recreation
725 Maple Street
Hillsboro, MO 63050

Doe Run Company
1801 Park 270 Drive, Suite 300
St. Louis, MO 63146

6. Literature Cited

Entrix, Inc. 2007. Draft Characterization Area Investigation Report, Prepared for the Doe Run Company

Wiebler B. and Coffey M. 1999. Preliminary Ecological Risk Assessment for Fish and Wildlife Habitats around the Doe Run Company Lead Smelter, Herculaneum, Missouri. U.S. Fish and Wildlife Service, Region 3 Contaminants Program, Rock Island, Illinois, Draft Report, February 11, 1999.