DRAFT RESTORATION PLAN

AND

ENVIRONMENTAL ASSESSMENT

FOR THE

OHIO RIVER FISH, MUSSEL, AND SNAIL RESTORATION

Prepared by:

U.S. Department of the Interior
Fish and Wildlife Service

State of West Virginia
Division of Natural Resources
Department of Environmental Protection

State of Ohio
Environmental Protection Agency

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ACRONYMS AND ABBREVIATIONS

CCP	Comprehensive Conservation Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESI	Ecological Specialists, Inc.
FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
m^2	square meter
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NRDAR	Natural Resource Damage Assessment and Restoration
OEPA	Ohio Environmental Protection Agency
ORINWR	Ohio River Islands National Wildlife Refuge
ORVE	Ohio River Valley Ecosystem
ROD	Record of Decision
RM	River Mile
RP	Restoration Plan
RP/EA	Restoration Plan/Environmental Assessment
USACE	U.S. Army Corps of Engineers
USC	United States Code
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources

1.0 INTRODUCTION

This draft Restoration Plan and Environmental Assessment (RP/EA) presents proposed restoration actions to address natural resources allegedly injured (hereinafter referred to as injured natural resources) by the release of hazardous substances from a ferro-alloy manufacturing facility into the Ohio River in 1999. The facility, currently owned and operated by Eramet Marietta, Inc. and previously owned and operated by Elkem Metals Company, L.P., is located on the northern bank of the Ohio River, about four miles southwest of Marietta, Ohio. Releases of hazardous substances in excess of the limitations set forth in the facility's wastewater discharge permit allegedly resulted in a series of fish, mussel, and snail kills within a twenty-mile segment of the river, which forms the boundary between the states of Ohio and West Virginia.

In February 2006, a settlement agreement was reached between the companies, the United States Department of the Interior (DOI), and the States of West Virginia and Ohio. The settlement resolves claims for natural resource damages under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The settlement agreement also resolves civil penalty and injunctive relief claims brought by the United States Environmental Protection Agency (EPA) under Sections 309(b) and (d) of the Clean Water Act (CWA).

1.1 Trustee Responsibilities

Under CERCLA, federal agencies who administer natural resources, all state governors, and federally-recognized Indian tribes are designated as natural resource trustees for those natural resources for which they have statutory authorities and responsibilities. These designated natural resource trustees have the responsibility to restore, rehabilitate, replace, or acquire the equivalent of natural resources injured as a result of a hazardous substance release.

For the purposes of this incident, the Region 3 Regional Director of the U.S. Fish and Wildlife Service (FWS) has been designated as DOI's authorized official, to act as the natural resource trustee on behalf of the DOI Secretary. The governor of the state of West Virginia has designated the West Virginia Division of Natural Resources (WVDNR) and the West Virginia Department of Environmental Protection (WVDEP) to act as the CERCLA trustees on behalf of the state of West Virginia for all cases that affect natural resources for which West Virginia is a trustee. The governor of the state of Ohio has designated the Ohio Environmental Protection Agency (OEPA) to act as the CERCLA trustee on behalf of the state of Ohio for all incidents that affect natural resources for which Ohio is a trustee.

As the CERCLA designated natural resource trustees for natural resources that have been affected by this incident, the DOI and the states of West Virginia and Ohio are responsible for the development of a restoration plan, and for the implementation and oversight of activities aimed at restoring fish, mussel, and snail populations to the stretch of the Ohio River that suffered near total mortality in late 1999 and 2000, following the release of the hazardous substances from the ferro-alloy manufacturing facility. As natural resource trustees, these parties are also responsible for administering the natural

resource injury-related settlement funds, coordinating with responsible parties and other affected agencies, and soliciting public input into the restoration process.

Under the National Environmental Policy Act (NEPA), DOI, as a federal agency, must also assess the potential environmental impacts associated with the proposed restoration actions. Therefore, the requirements of a restoration plan and a NEPA environmental analysis are being combined in this document.

1.2 Summary of the Settlement

Elkem Metals Company, L.P., its two partners (Ferro Invest III, Inc., and Ferro Invest II, LLC), and Eramet Marietta, Inc. have agreed to pay $3.25 million to settle allegations that the companies injured natural resources (under the Natural Resource Damage Assessment [NRDA] provisions of CERCLA) and violated the CWA as a result of wastewater discharges from their ferro-alloy manufacturing facility in Marietta, Ohio. As a result of the settlement, the companies paid a combined total of $2,040,000 towards restoration of injured natural resources in the Ohio River. They also paid a total of $460,000 as reimbursement to DOI and the states of West Virginia and Ohio for past natural resource assessment costs under CERCLA. In addition, Elkem paid a penalty of $245,000 and Eramet paid a penalty of $525,000 to EPA for alleged CWA violations.

A Consent Decree among the parties was entered by the U.S. District Court for the Southern District of Ohio on April 19, 2006. The portion of the Consent Decree dealing with settlement of natural resource damage claims stipulates that such funds shall be used jointly by the natural resource trustees to restore, replace, or acquire the equivalent of the injured natural resources. The settlement enables the natural resource trustees to work together to restore freshwater aquatic life that experienced substantial impact and loss within the affected reach of the Ohio River.

1.3 Summary of Hazardous Substance Release and Injury

Eramet Marietta, Inc. owns and operates a ferro-alloy production facility located on the northern bank of the Ohio River approximately four miles southwest of Marietta, Ohio. The facility is a 1,350-acre site that was originally part of a large Union Carbide Corporation complex that was constructed between the late 1940's and the mid 1950's. In 1981, Elkem Metals Company, L.P. purchased the ferro-alloy division from Union Carbide. In 1988, a coal burning power plant, which was part of the ferro-alloy division, was sold by Elkhem to American Municipal Power-Ohio, Inc. Eramet purchased the remainder of the ferro alloy operations from Elkem on or around June 30, 1999.

The facility discharges wastewater to the Ohio River through Outfall 003, located at River Mile (RM) 176.9. This discharge is permitted through the National Pollutant Discharge Elimination System (NPDES) by the OEPA.

1.3.1 Fish, Mussel and Snail Kills

On June 7, 1999, a major fish kill was reported on the Ohio River between RM 176.5 and 185.0. On June 8, 1999, a fish kill investigation was conducted by the WVDNR between RM 175.0 and 187.0. Eighty stations were sampled along the West Virginia shoreline, including all shorelines associated with islands and open water sections. Dead fish were found at 68 of the 80 stations. Based upon the numbers of dead fish found, it is estimated that approximately 4,000 fish were killed. Ninety-eight percent of the dead fish were

freshwater drum (*Aplodinotus grunniens*). Channel catfish (*Ictalurus punctatus*), hybrid striped bass (*Morone saxatilis x M. schrysops*), bluegill (*Lepomis macrochirus*), walleye (*Sander vitreus vitreus*), sauger (*Sander canadense*), gizzard shad (*Dorosoma cepedianum*) and suckers were also observed. FWS personnel continued to observe dead or distressed fish between RM 176.0 and 181.5 from June 9 through June 18, 1999. These fish are natural resources under the trusteeship of the states, as defined by CERCLA.

On June 8, 1999, FWS divers inspected mussel beds at Muskingum Island (upstream of the Eramet facility), Vienna Island (approximately 600 feet downstream from the Eramet facility), and Site 11 (approximately three miles downstream from the Eramet facility). Native and zebra mussels were alive and siphoning normally at all three sites.

On July 8, 1999, a smaller fish kill was reported between RM 178.0 and 182.0. WVDNR investigated and found one dead channel catfish and six freshwater drum. Witnesses in the area reported that dead and dying fish had been numerous the proceeding two days (July 6 and 7, 1999).

On September 2, 1999, FWS divers, conducting a routine survey, discovered that a major kill of freshwater mussels had occurred at Site 11 (RM 179.0 to180.0). Zebra mussels (*Dreissena polymorpha)*, an invasive mussel which in recent years had been abundant, were absent. Many dead or distressed native mussels were also observed.

Site 11 had been inhabited in recent years by two federally-listed endangered species, the pink mucket pearly mussel (*Lampsilis orbiculata*) and the fanshell (*Cyprogenia stegaria*). Pink mucket pearly mussel juveniles were documented at Site 11 as recently as 1991, and fanshell juveniles were documented at Site 11 as recently as 1994. Thus, although none of these species were found dead, it is reasonable to conclude some were in the area and, therefore, affected by the release. As defined by CERCLA, these two federally-listed endangered mussel species are under the trusteeship of the states and DOI.

On September 8 and 9, 1999, FWS divers collected mussel samples and videotaped the substrate at selected locations between RM 175 and 181. Native and zebra mussels upstream of the facility at Muskingum Island were alive and siphoning normally. However, downstream of the facility, zebra mussels, which had previously been abundant, were absent or dead for more than a four-mile segment of the river below the facility's discharge. Native mussels were also dead or distressed at Vienna Island and Site 11 (Figure 1). As defined by CERCLA, all these mussel species are natural resources under the trusteeship of the states.

A second major fish kill was reported on October 4, 1999. WVDNR found over 5,000 dead fish from RM 176.0 to 187.0. About 96 percent of the fish killed were freshwater drum. Dead sauger and gizzard shad were also observed.

On October 18 and 19, 1999, biologists from the FWS and WVDNR inspected the bottom of the Ohio River between RM 175.3 (upstream of the facility) and RM 179.9 using a drop camera. Native and zebra mussels were alive and siphoning normally from RM 175.3 to 176.9 (upstream of the facility's discharge). No live mussels were observed along the Ohio shoreline between RM 176.9 and 179.9 (downstream from the facility).

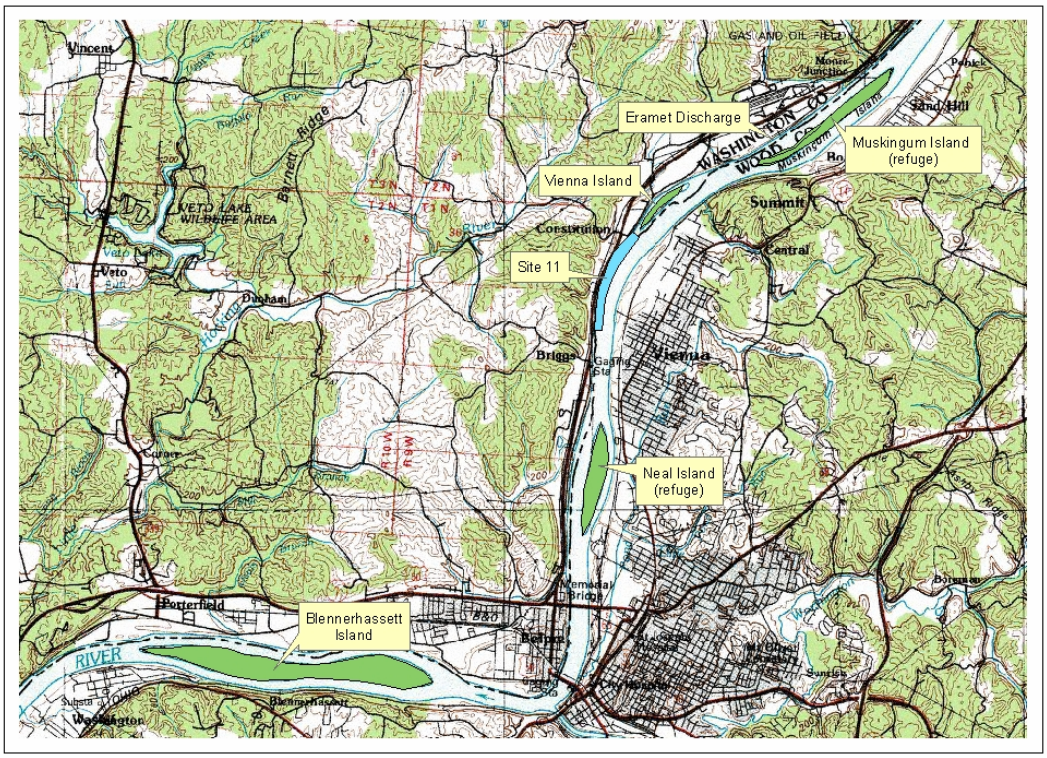


Figure 1. Primary Restoration Area: River Mile 175 to 190

A quantitative survey of Site 11 conducted by Ecological Specialists, Inc. (ESI) in May 2000, found native and zebra mussel mortality to be 100 percent. In addition, ESI reported that gastropod (snail) mortality was 99.8 percent and that there were no living benthic invertebrates within 260 feet of the Ohio shoreline. A second quantitative survey in October 2000, found similar results in the segment of the Ohio River from the facility's discharge to the head of Neal Island, which is part of the Ohio River Islands National Wildlife Refuge (ORINWR). ESI expanded its surveys down to the Belleville Dam (RM 203) and estimated that over 990,000 native mussels, and over 12,000,000 snails were lost from discrete sampling locations over a 20-mile stretch of the Ohio River (ESI 2002). The actual kill was likely much larger.

1.3.2 Exposure Pathways

Unusually low flows were experienced in the Ohio River in 1999, resulting in accumulation and concentration of hazardous substances. The available data suggest that both zebra and native mussels were directly exposed by filtering particulates from contaminated water near the bottom of the Ohio River. Fish species, primarily freshwater drum which are known to feed on mussels, were then exposed by consumption of the contaminated mussels.

1.3.3 Summary of Natural Resource Injury

The CERCLA NRDA regulations (43 Code of Federal Regulations [CFR] 11) state that injury to a surface water resource results from the discharge of a hazardous substance if concentrations and duration of substances sufficient to have caused injury to biological resources when exposed to surface water, suspended sediments, or bed, bank, or shoreline sediments has occurred.

The regulations state that injury to biological resources results from a release of a hazardous substance if concentrations of the substance are sufficient to cause death, deformities, or other abnormalities of organisms.

Documented injuries within a five-mile reach of the Ohio River resulting from the hazardous substances released from the ferro-alloy manufacturing facility are summarized as follows.

- Injury to surface water has occurred as evidenced by sediment concentrations of chromium sufficient to cause injury to biological resources.
- Injury to biological resources has occurred as evidenced by death of:
    - Fish (estimated over 8,600 killed), including freshwater drum, sauger, hybrid striped bass, channel catfish, bluegill, walleye, gizzard shad, and suckers.
    - Freshwater mussels (estimated over 990,000 killed) including, but not limited to, the native *Actinonaias ligamentina, Amblema p. plicata, Elliptio crassidens, Elliptio dilatata, Ellipsaria lineolata, Fusconaia flava, Lampsilis cardium, L. siliquoidea, Lasmigona c. complanata, Leptodea fragilis, Ligumia recta, Megalonaias nervosa, Obliquaria reflexa, Obovaria subrotunda, Plethobasus cyphyus, Pleurobema cordatum, P. sintoxia, Potamilus alatus, P. ohiensis, Pyganodon grandis, Quadrula metanevra, Q. p. pustulosa, Q. quadrula, Truncilla donaciformis, T. truncata, Utterbackia imbecillis,* and non-native zebra mussels.
    - Gastropods (snails--estimated over 12,000,000 killed) including, but not limited to, one species of *Pleurocera,* one species of *Campeloma,* and one species of *Lithasia*.
    - Other benthic invertebrates (100 percent mortality at Site 11 within 80 meters of the Ohio shore; not quantified elsewhere).

The injured natural resources under federal trusteeship include the two federally-listed endangered mussel species (pink mucket pearly mussel and fanshell), mussels and their supporting ecosystems on the ORINWR, and supporting ecosystems for migratory birds. The injured natural resources under the states' trusteeship include surface water, fish, freshwater mussels, gastropods, other benthic invertebrates, and their supporting ecosystems.

1.4 Restoration Goals

The purpose of the proposed restoration actions are to restore, rehabilitate, replace, or acquire the equivalent of mussels, snails, and fish injured or destroyed by the hazardous substance release, pursuant to the requirements of the Consent Decree, and applicable federal and state laws and regulations.

The $2,040,000 recovery for restoration will allow for the development, implementation, and oversight of planned activities that will advance the goal of restoring ecologically viable populations of mussels, snails, and fish within the affected area of the Ohio River.

1.5 Need for Restoration

The proposed restoration actions are needed to facilitate and/or insure the restoration and recovery of natural resources injured by the hazardous substance release.

1.6 Compliance with Other Authorities

The following environmental laws, regulations, and executive orders were considered in the restoration planning process because they may impose limits or standards for restoration completion.

1.6.1 Endangered Species Act

The federal Endangered Species Act, 16 USC 1531, *et seq.*, 50 CFR Parts 17, 222, 224, directs all federal agencies to conserve endangered and threatened species and their habitats and encourages such agencies to utilize their authority to further these purposes. Section 7 of the Act requires that federal agencies consult with the National Marine Fisheries Service and FWS, as appropriate, to minimize the effects of proposed federal actions on listed endangered and threatened species. The Section 7 consultation with FWS is underway. The conclusions of the Section 7 consultation will be presented in the final RP/EA.

1.6.2 Fish and Wildlife Conservation Act

The Fish and Wildlife Conservation Act, 16 USC 2901-2911, authorizes federal financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife**.** The settlement funds will be used to implement restoration of nongame fish and wildlife.

1.6.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA), 42 USC 4321 *et seq*., established a national policy for the protection of the environment. NEPA applies to all federal agency actions that affect the human environment. Federal agencies are obligated to comply with NEPA regulations issued by the Council on Environmental Quality. NEPA requires that for activities not categorically excluded, an analysis be conducted to determine whether proposed actions will have a significant effect on the quality of the human environment. If an impact is considered significant, then an Environmental Impact Statement (EIS) is prepared and a Record of Decision (ROD) is issued. If the impact is considered not significant, then an Environmental Assessment is prepared and a Finding of No Significant Impact (FONSI) is issued.

1.6.4 National Wildlife Refuge System Improvement Act

The FWS's National Wildlife Refuge System is the world's largest collection of lands and waters set aside specifically for the conservation of wildlife and ecosystem protection. Over 530 National Wildlife Refuges covering over 92 million acres are part of the national network today. With over 77 million acres in Alaska and the remaining 15 million acres spread across the other 49 states and several island territories, over 34 million visitors annually hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretive activities on refuges.

In 1997 the National Wildlife Refuge System Improvement Act (Refuge Improvement Act) was passed. This legislation established a unifying mission for the refuge system, a new process for determining compatible public use activities on refuges, and the requirement to prepare Comprehensive Conservation Plans for each refuge. The Refuge Improvement Act states that first and foremost, the refuge system must focus on wildlife conservation. It further states that the national mission, coupled with the purpose(s) for which each refuge was established, will provide the principal management direction for each refuge.

The mission of the National Wildlife Refuge System is: *"...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."* (National Wildlife Refuge System Improvement Act of 1997, Public Law 105-57). The settlement funds will be used to restore ORINWR natural resources injured by the release.

1.7 Coordination and Scoping

Several state and federal agencies are working closely to plan and implement restoration of mussel, snail, and fish communities in the impacted area. These include those agencies with direct CERCLA trustee authority, as well as non-trustee agencies with the specific expertise required for successful restoration. Designated trustee agencies that are actively involved include the WVDNR, the WVDEP, the OEPA, and the DOI. In addition, the Ohio Department of Natural Resources, and the U. S. Geological Survey are contributing substantial support. As restoration activities proceed, facilities and scientists at hatcheries operated by federal, state, and local entities will also be involved.

1.7.1 Trustee Council Organization and Activities

A trustee council has been established pursuant to a Memorandum of Understanding between the chief executive officers, or authorized officials, of the four designated trustee agencies with direct CERCLA trustee authority for the injured resources. These are the WVDNR, the WVDEP, the OEPA, and the DOI. The trustee council consists of representatives of the chief executive officers, or authorized officials, of the above agencies. The trustee council is ultimately responsible for all aspects of the restoration, including all funding decisions. All actions approved by the trustee council are by unanimous consent.

1.7.2 Public Notification

Under the CERCLA NRDA regulations and NEPA, the natural resource trustees must notify the public and any federal, state, and local government agencies that may have an

interest in the activities analyzed in the RP/EA. A notice of the availability of the draft RP/EA will be published in the following local newspapers:

Parkersburg News and Sentinel
519 Juliana Street
Parkersburg, WV 26101
(303) 485-1891

Marietta Times
700 Channel Lane
Marietta, OH 45750
(740) 373-2121

Copies of the draft RP/EA will be made available at the following locations:

Washington County Public Library
615 5th Street
Marietta, OH 45750

Wood County Public Library
3100 Emerson Ave.
Parkersburg, WV 26104

An electronic version of the draft RP/EA will be posted on the ORINWR website (http://www.fws.gov/northeast/ohioriverislands/).

The public comment period will be 30 days. Parties to whom comments may be sent, and the due date for receipt of comments, will be published in the notice of availability of the draft RP/EA.

1.7.3 Public Meetings and Summary of Scoping

A public meeting will be scheduled if sufficient interest exists as determined by the public comment received on this draft RP/EA. If a public meeting is scheduled, notice will be provided in the same newspapers listed above.

1.7.4 Responsible Party Involvement

The settling parties chose not to participate in restoration planning and implementation.

1.7.5 Administrative Record

The administrative record contains the official documents pertaining to the Ohio River Fish, Mussel, and Snail Restoration case settlement, restoration planning, and restoration implementation. The administrative record for this case is housed at the ORINWR, 3982 Waverly Road, Williamstown, WV 26187.

1.7.6 Regional Plans

Natural resource trustees may consider implementing projects defined in existing regional restoration plans or other planning documents when those projects pertain to the injured natural resource or to the geographic area where the injury occurred. Other planning

documents, and the conservation and restoration priorities set forth in those documents, that were considered in the development of this RP/EA are discussed below.

1.7.6.1 Ohio River Valley Ecosystem Team

In the mid- to late-1990s, the FWS began placing more emphasis on understanding how parts of an ecosystem interrelate and affect the long-term conservation of natural resources. Since then, implementing an ecosystem team approach to management has been a top national priority for the FWS. Fifty-two ecosystem teams were formed across the country, typically using large river watersheds to define ecosystems. Individual ecosystem teams are comprised of FWS professionals and their partners, who work together to develop goals and priorities for research and management.

In forming the Ohio River Valley Ecosystem (ORVE) Team, the FWS initiated new partnerships with private landowners, state and federal agencies, corporations, conservation groups, and volunteers. The ORVE includes portions of ten states and straddles three FWS administrative regions (Northeast, Southeast, and Northcentral). The ORVE Team is charged with the development and implementation of a strategic plan for conserving FWS resources within the ORVE.

The following eight priorities have been identified, each encompassing numerous action strategies:

"In cooperation with partners...":

- reverse the decline of native aquatic mollusks within the ORVE with emphasis on endangered, threatened and candidate species and species of concern.
- reverse the decline and achieve stable, viable populations of migratory landbirds and other bird species of concern.
- reverse the decline of native fishes with emphasis on interjurisdictional, listed, and candidate species, and species of concern.
- protect and restore karst/cave habitat supporting listed and candidate species and species of concern.
- protect and restore wetland, riverine, and riparian habitat in the Ohio River watershed for the protection and enhancement of migratory waterbirds and other wetland-dependant species of concern.
- reduce the decline and promote the recovery of rare resources identified as listed or proposed threatened and endangered species, candidate species, and species of concern.
- achieve the necessary level of protection for those high-priority areas within the ORVE that would help meet the goals of the ORVE Team.
- promote and support sustainable fish and wildlife-dependent recreational uses while maintaining long-term ecosystem health.

1.7.6.2 Ohio River Islands National Wildlife Refuge Comprehensive Conservation Plan

The ORINWR completed its Comprehensive Conservation Plan (CCP) in 2001. This document sets the management direction for the refuge over the next 15 years. Pertinent provisions are set forth below:

Mission: The ORINWR will create a linked network of over 12,000 acres of floodplain forests, wetlands, and aquatic habitat stretching over 400 miles from Pittsburgh to Cincinnati. These refuge lands and waters will fulfill the needs of fish, wildlife, and plants that are native to "big river" ecosystems. Through reforestation, exotic species control, and wetland restoration, the refuge will serve as an anchor for biodiversity and a model for habitat restoration throughout the ORVE. It will forge habitat and management links with other units of the National Wildlife Refuge System.

Habitat Goal: Preserve and restore wetland, riverine, and riparian habitat in order to maintain a natural abundance and diversity of native species that are endemic to the Ohio River floodplain (with emphasis on fish and wildlife resources, particularly endangered and threatened species, and other species of concern).

Objectives:

1. Restore an average of 50 acres annually of floodplain forest through plantings of native bottomland hardwoods.
2. Control or eradicate an average of 30 acres of invasive plant species annually through mechanical, chemical, and biological techniques and evaluate their effectiveness.
3. Between 2001 and 2010, acquire or protect (through fee title purchase, donation, or easement) 2,537 acres of remaining islands - Fish Creek, Eightmile, Mustapha, Gallipolis, Brush Creek, Neal, Newberry, Halfway, Lower Sister, Manchester Island in-holdings, Blennerhassett, and possibly portions of Eureka and Brown.
4. Continue mussel quarantine and support the captive rearing program.
5. In coordination with state resource agencies, re-introduce fish and mussel species which have been extirpated from the refuge.
6. Install, monitor, and maintain 80 prothonotary warbler nest boxes, 60 wood duck nest boxes, and ten butterfly and bat boxes, and evaluate their effectiveness.
7. Install an average of one linear mile annually of longitudinal dikes or vegetative waddles for shoreline stabilization and revegetation.
8. Revegetate/restore an average of two acres per year of wetland habitat (riverine aquatic bed, riverine emergent, or palustrine emergent).
9. Where feasible, manage water levels on refuge wetlands to mimic natural fluctuations, and promote aquatic and wetland vegetation.
10. Using a watershed approach, restore the habitat of selected areas with willing partners, including applicable state, local, and federal agencies.
11. Work with the USACE to provide erosion protection and rehabilitation of islands.

1.7.6.3 State Wildlife Action Plans

State Wildlife Action Plans were developed by the states of West Virginia and Ohio. These plans assess the condition of each states' wildlife and associated habitats, and identify actions needed to insure long-term conservation of these wildlife resources.

1.7.6.4 Ohio River Ecosystem Program

A regional restoration effort for the Ohio River, led by the USACE, the FWS, and state natural resource agencies, is currently in the early planning stages. During the course of the Ohio River Mainstem Study, a study that evaluated long-term strategies for major navigation improvements along the entire river, the USACE and its partners identified the need for an Ohio River Ecosystem Restoration Program. An interagency, multi-disciplinary team was established to develop ecosystem restoration objectives and study alternatives for an environmental program for the river. The team prepared a study report that recommended authorization of a cost shared ecosystem restoration program for the Ohio River. Subsequently, the Ohio River Ecosystem Restoration Program was authorized in the Water Resources Development Act of 2000. However, the program is not currently funded.

In response to authorization of the Ohio River Ecosystem Restoration Program, the Ohio River Foundation, a non-profit organization dedicated to protecting and restoring water quality and ecology of the river, developed a draft document entitled *A Framework for Ecosystem Restoration of the Ohio River and its Watershed* (2004). This document discusses issues related to ecosystem restoration of the Ohio River, and expands the framework developed by the USACE. Restoration of native mussels is identified as a key priority in this document.

2.0 PROPOSED RESTORATION ACTION/PREFERRED ALTERNATIVE

2.1 Criteria for Identifying and Selecting the Proposed Restoration Action/Preferred Alternative and Alternatives

The primary restoration goal is to restore the fish, mussel, and snail assemblage to an ecologically viable level within the affected reach of the Ohio River. To meet this goal, trustees:

1. Defined a targeted viable and ecologically sustainable fish, mussel, and snail community.
2. Selected appropriate fish, mussel, and snail species for restoration.
3. Identified potential restoration alternatives.
4. Developed a biologically-sound restoration plan.
5. Developed a monitoring process to assess the continuing health of the restored fish, mussel, and snail populations.

The preferred restoration alternative (Section 2.2.2) is a set of actions that achieves the goal of restoration in a coordinated and cost-effective manner. These actions reflect a combination of restoration and rehabilitation activities through resource replacement.

Drawing upon the factors within the DOI NRDA regulations and DOI policy for selecting a restoration alternative, the trustees selected a preferred restoration alternative based on relevant considerations, including general consideration of the following factors:

- Nexus between the restoration activities and the documented injuries.
- Degree to which the restoration activities will directly benefit the injured resources.
- Technical feasibility.
- Relationship of the expected costs of the proposed actions to the expected benefits from the restoration action, including the amount of desirable functions restored and the ecological benefit to the surrounding watershed.
- Cost-effectiveness.
- Potential for additional injury resulting from the proposed actions, including long-term and indirect impacts to the injured resources or other resources.
- Ability of the resources to recover with or without the alternative actions.
- Potential effects of the action on human health and safety.
- Consistency with relevant federal and state policies.
- Compliance with applicable federal and state laws.

The preferred restoration alternative described herein is based on conceptual plans for which some costs have been estimated. The size and design of the recommended restoration actions may change based on additional public input or additional scientific findings. If, during implementation, the trustees determine that significant changes to the selected restoration alternative are needed, additional public review and comment will be sought, as appropriate. No restoration activities will be conducted by trustees that would incur ongoing expenses in excess of those than can be funded by settlement monies.

2.2 Description of the Alternatives

2.2.1 No Action Alternative

A no action alternative is addressed to fulfill requirements under NEPA, and is consistent with the damage assessment process under the CERCLA NRDA regulations. Under this alternative, no action would be taken to restore fish, mussels, or snails injured from hazardous substance releases to the Ohio River, or to replace or acquire the equivalent of the ecological resources lost. The underlying assumption of this alternative is that adequate numbers and diversity of native aquatic species are present within the geographic area, and given adequate time and a stable habitat, these species will recolonize the impacted zone. Recovery of the resource and resource function would be completely dependent upon natural processes. This alternative has no cost.

2.2.2 Proposed Action/Preferred Alternative

The preferred restoration alternative described in this section is designed to restore mussels, snails, and fish populations to the geographic area in which the natural resource injury occurred. This will include restoring mussels and snails to the mussel beds at Site 11 and Neal Island (Figure 1) between RM 176.9 and 181. Neal Island is within the ORINWR. These two mussel beds experienced greater than 99 percent mortality as a result of the release of hazardous substances from the Eramet facility. If additional money becomes available through matching grants or other means, additional historic mussel bed locations between RM 176.9 and the Belleville Dam may be actively restored or augmented.

Injuries to fishery resources were localized within a relatively small area. Although significant numbers of fish were killed, the trustees believe the injured fish species (primarily freshwater drum) have already recolonized the impacted area to pre-release conditions. Therefore, the trustees propose to restore historic native Ohio River fish species that have not fully recovered from past ecosystem problems, such as shovelnose sturgeon (*Scaphirhynchus platorynchus*), lake sturgeon (*Acipenser fulvescens*), blue catfish (*Ictalurus furcatus*), blue sucker (*Cycleptus elongates*), speckled chub (*Macrhybobsis aestivalis*), and big river perch species including channel darter (*Percina copelandi*), river darter, (*Percina shumardi*), crystal darter (*Ammocrypta asprella*), walleye (*Stizostedion vitreum*), and longhead darter (*Percina macrocephala*).

2.2.2.1 Defining Targeted Viable Aquatic Community Density

Mussel community density at the mussel beds at Site 11 and Neal Island exceeded five mussels per square meter ($5/m^2$) prior to the spring of 1999. The proposed action will not fully restore the two mussel beds to pre-release densities, but will in the short-term aid in re-creating a minimally viable and ecologically sustainable mussel community. Long-term restoration to pre-spring 1999 densities will rely on natural recolonization from other Ohio River and tributary mussel resources, successful reproduction by restored species, and most importantly continued improvements to the physical and chemical habitat at these two mussel beds as mussels become reestablished. The presence of mussels helps stabilize the substrate and increase the likelihood of colonization by other invertebrates including other mussels. By anchoring into the substrate, mussels help promote aeration of the substrate. As filter feeders, they convert planktonic food to a form available to other benthic invertebrates and fish. Mussels also filter large quantities of suspended materials (silt, sediment, etc.) from the water column and help purify the water. Their shells are colonized by other macroinvertebrates and snails that provide food for fish. Over time, as the physical, chemical, and biological habitat of the mussel beds improves, natural recolonization by mussels and other aquatic species is more likely to occur.

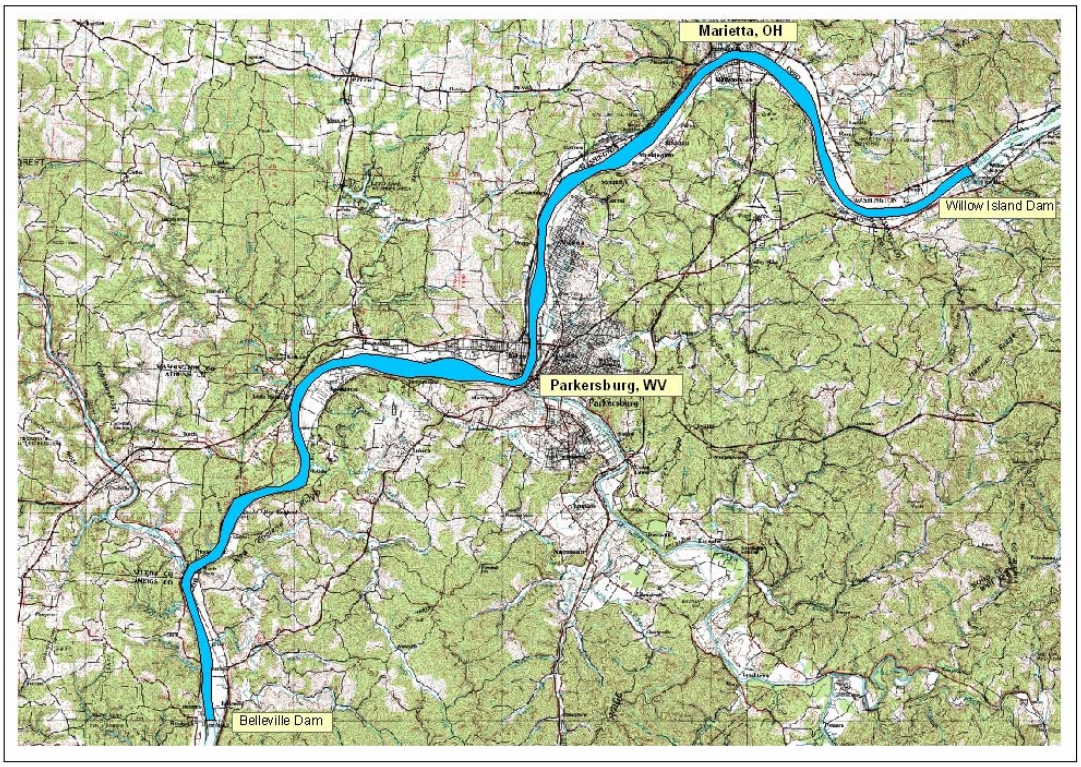
The targeted restored density for this alternative is a minimum of one adult mussel per square meter ($1/m^2$) or 20 percent of the pre-spring 1999 density. This targeted density is based on the current consensus of malacologists of a minimum ecologically significant mussel community in the mid-Ohio River. If additional money becomes available through matching grants or other funds, then the target restoration density will be

increased through additional stocking and relocation to approach the pre-kill density of five mussles per m^2.

The targeted restoration density for aquatic snails is 80 per m^2, which is the mean number of live snails collected in quantitative surveys upstream of the Eramet facility, at Muskingum Island, since 2002.

2.2.2.2 Selecting Appropriate Mussel Species

Individuals of 27 species of native mussels were found dead in 2000 at sampling sites within the Belleville Pool below RM 176.9 (Figure 2), and 35 species have been collected in the past 15 years within this reach (Table 1). This proposed alternative will actively restore a subset of species known to occur within the Belleville Pool, based on the following criteria: the rarity of the species in the Ohio River (as evidenced by state listings); the importance of individual populations within the Ohio River; habitat preference as big river fauna; the species zoogeography and overall abundance; the species abundance and distribution elsewhere in the mid-Ohio River basin; availability of and ease of working with brood stock mussels; scientific knowledge of fish hosts; ease or difficulty of holding fish hosts in captivity; and distance to the next known population source.



Figue 2. The Belleville Pool of the Ohio River

Belleville Pool

0 1.25 2.5 5 7.5 10 Miles

N W E S

Table 1. Species of Native Mussels Occurring in the Belleville Pool of the Ohio River

Scientific Name	**Common Name**
*Amblema plicata**	three-ridge*
*Elliptio crassidens**	elephantear*
*Elliptio dilatata**	spike*
*Fusconaia flava**	Wabash pigtoe*
*Megalonaias nervosa**	washboard*
*Pleurobema sintoxia**	round pigtoe*
*Pleurobema cordatum**	Ohio pigtoe*
*Quadrula metanevr*a*	monkeyface*
*Quadrula p. pustulosa**	pimpleback*
*Quadrula quadrula**	mapleleaf*
*Lasmigona c. complanata**	white heelsplitter*
*Pyganodon grandis**	giant floater*
*Utterbackia imbecillis**	paper pond shell*
*Actinonaias ligamentina**	mucket*
*Ellipsaria lineolata**	butterfly*
*Lampsilis cardium**	plain pocketbook*
*Lampsilis siliquiodea**	fatmucket*
*Leptodea fragilis**	fragile papershell*
*Ligumia recta**	black sandshell*
*Obliquaria reflexa**	three-horn warty-back*
*Obovaria subrotunda**	round hickorynut*
*Plethobasus cyphyus** ***FC***	sheepnose*
*Potamilus ohiensis**	Ohio heelsplitter*
*Potamilus alatus**	pink heelsplitter*
*Truncilla donaciformis**	fawnfoot*
*Truncilla truncate**	deertoe*
Cyprogenia stegaria ***FE***	fanshell
Epioblasma triquetra ***SR***	snuffbox

Lampsilis abrupta ***FE***	pink mucket
Anodonta suborbiculata	flat floater
Lasmigona compressa	creek heelsplitter
Lasmigona costata	fluted shell
Strophitis undulatus	creeper
Lampsilis teres	yellow sandshell
Toxolasma parvus	lilliput

* Found freshly dead between River Mile 179.5 and 195 during qualitative or quantitative surveys in 2000
FE federally endangered
FC federal candidate for listing
SR status review underway to consider listing

2.2.2.3 Mussel Restoration Strategies

Active restoration of mussels will involve implementation of three different strategies: (1) adult mussel translocation; (2) infestation of host fishes with glochidea (mussel larvae) and subsequent release of the fish directly to the River, or placement of the fish in gages in the River; and (3) propagation and release of juvenile mussels. All animal transfers and releases will follow "Aquatic Nuisance Species and Disease Control Procedures" established by the WVDNR. The goal of active restoration is to recreate a viable and ecologically stable mussel community. Follow-up surveys at Neal Island and Site 11 in 2002 and 2006 showed that native mussels are recolonizing these two sites. Although only a few young individuals of three species were collected, this indicates the habitat is suitable for mussel recolonization.

Translocation of Adult Mussels

Translocation involves moving adult mussels from other locations directly to the restoration areas. Translocation is proposed for species that are common and abundant in the Belleville Pool, the Ohio River mainstem, and immediate tributaries to the Ohio River. The objective of adult translocations is to stabilize the substrate in the affected areas and make the habitat more suitable for other invertebrates and mussels to co-habit. The trustees may take advantage of opportunities to translocate mussels from other construction areas to the affected areas of the Belleville Pool (e.g., mussels are often translocated from bridge crossings and industrial facilities). Species likely to be available in large numbers are three-ridge, mapleleaf, washboard, mucket, and spike. Biologists will use the appropriate scientific collection and importation permits as needed to collect and transport individuals. Depending on the source site, individual mussels will be quarantined at the ORINWR facility for an appropriate time period prior to their release to restoration areas.

Infest and Release Host Fishes

Most native freshwater mussels require a fish host in order to complete their reproductive cycle. The female mussel siphons sperm out of the water column to fertilize her eggs. The fertilized eggs or larval mussels, called glochidea, develop into juvenile mussels only after spending some period of time attached as parasites to a fish host. The female mussel expels the glochidea onto a fish, where they attach to the skin, fins, or gills. Some species of mussels require only one species of fish, whereas other mussel species use a variety of fish species as hosts. Many species of mussels have adapted techniques to attract fish in order to maximize the likelihood of successful attachment of glochidea to the fish. Once the glochidea are attached, they become encysted and ride around on the fish for a number of weeks or months, getting nourishment from the fish tissue and growing in size. The host fish do not suffer any ill effects from this process. Over time, the glochidea grow into juvenile mussels and drop off the fish. If the habitat is suitable, the juvenile mussels burrow in and grow into adults.

Host fish may be collected in the wild or taken from a hatchery. Host fish may either be infested with glochidea at a hatchery or close to the intended release site (shore side or on a boat). Once the fish have been infested, they will be released directly to the river with the expectation that the glochidea will ride around on the fish host and drop off in suitable habitat within the Belleville Pool. It is difficult to measure the success of this technique in terms of actual juveniles produced and settling on the river bottom, but estimates can be made based on parallel cage propogation.

Cage propogation involves placing glochidea-infested host fish in cages in the river. The glochidea metamorphose into juveniles on the fish, and the juvenile mussels drop off and land in the bottom of the cage. The fish are subsequently released to the river and the mussels are kept in the cages long enough to grow into a size suitable for direct stocking to the river. This method allows measurement of the actual number of juveniles produced and stocked. The preferred alternative will likely include a combination of the infest and release techniques discussed above.

Propagation of Mussels

Under this strategy, mussel brood stocks (i.e., gravid females) are brought into captivity in a laboratory or hatchery setting. Glochidea are removed from the female and fish are infested. Fish are then held in tanks in the laboratory until the juvenile mussels drop off. The juveniles can then be stocked directly to the river, or held in captivity until they grow to sufficient size to mark and then stock. It is thereby possible to measure the actual number of juveniles produced and stocked.

For the affected area represented by Site 11 and Neal Island alone, the combined mussel bed surface area is 195,000 m^2; restoration of one mussel per square meter would require a long-term survival of 195,000 mature (age 5) mussels restored via adult translocation and propagation of juveniles at a hatchery. Although survival of mussel juveniles varies by species, some general estimates can be used to help establish the number of juvenile mussels that need to be reared in order to generate the needed number of adults. For example, if the cumulative mussel survival rate is only 1 percent from transformed juvenile to age 5 adult, then hatchery facilities must raise 19.5 million juveniles; with a 2 percent survival, the number would be 9.75 million. This illustrates why different

strategies will be used for different species of mussel, and why the restoration project overall will take at least ten years. State facilities will likely gear up to hold or rear fish host species in captivity and increase mussel propagation capacity.

Biological Parameters

The proposed action is designed to: (1) establish a mussel community density considered viable and ecologically stable; (2) actively restore selected species deemed most ecologically appropriate; and (3) use a combination of strategies that will provide the most likelihood for successful restoration. Biological parameters used to develop this mussel restoration program and proposed action are presented in Table 2. These parameters were derived from peer-reviewed literature and from consultation with experts in the field of malacology.

The number of age day 0 juvenile mussels was determined by using survival to cohort analysis based on age day 0 to 30 cohorts, age day 30 to 365 cohorts, and age year 1 to 5 cohorts. Survival rates were derived from peer-reviewed literature or consensus of mussel experts. Fish host and transformation rates were ascertained from peer-reviewed literature or consensus of mussel experts. The number of fish required was determined through simple calculations. The duration of propagation was based on age structure analysis if available (one half the number of cohorts lost) or a default of 5 years.

Table 2. Biological Parameters Used to Develop a Biologically Sound Mussel Restoration Program

Density of a Viable and Ecologically Stable Mussel Community	$1/m^2$
Age of Mature Mussel	5 years
Number of Juvenile Mussels per Fish • Bluegill and logperch • Channel catfish, flathead catfish, largemouth bass, sauger, and white crappie	 250 500
Mussel Survival Rates • Day 1-30 Low Survival Brooders • Day 1-30 High Survival Brooders • Day 30-365 • Year 1 through Year 5 • Translocated Adult	 10% 25% 15% 90%/year 95%
Survival of Fish Held for Hosts	80%
Number of Years for Propagation • Scientifically Preferred Age Based • Default	 ½ of oldest individual 5 (minimum)

2.2.2.4 Snail Restoration Strategies

Follow up surveys of Site 11 in 2002 and 2006 showed that snails had not begun to recolonize the area. Active restoration of snail populations at Site 11, Neal Island, and possibly other locations within the Belleville Pool will involve: (1) direct translocation; (2) captive propagation; and (3) egg traps.

Translocation

Similar to mussel translocation, this technique involves moving snails from locations in the main stem or tributaries of the Ohio River where they are plentiful to the restoration areas.

Propagation

Captive propagation involves rearing snails in captivity and releasing young snails to the river. Adult brood stock will be collected from the main stem or tributaries of the Ohio River, and transferred to a laboratory or hatchery setting. The snails will reproduce in captivity and the young snails will be released to restoration areas. The techniques used for raising snails are less challenging than those for mussels, but will still require

substantial effort over a long time period to achieve pre-kill densities of 80 animals per square meter. At least three species were injured by the discharges: *Pleurocera canaliculata*, *Campeloma decisum*, and *Lithasia verrusoca*. Researchers at Ohio State University Mussel Research Facility have been experimenting with raising snails, and have had good success raising them in aquaria. Since their reproduction in the river is less complicated than that of native mussels, there should also be substantial on-site recruitment of stocked snails.

Egg Traps

This new technique will be evaluated in 2007. Hard substrate (e.g., clay tiles, Plexiglas, PVC pipe) will be placed on the river bed for snails to lay their eggs upon. After two to three weeks, the traps will be pulled and checked for the presence of snail eggs. Once colonized by eggs, the traps will be moved directly to the restoration sites where the eggs will hopefully hatch and young snails will recolonize the sites.

2.2.2.5 Fish Restoration Strategies

The trustees will not actively restore the common native fish species that were identified during the post-kill fish surveys because natural recolonization by these species is already occurring within the affected reaches of the river. Instead, fish recovery efforts will focus on: (1) propagation and release of a suite of big river fish species that historically inhabited the Ohio River; and (2) release of host fish species used for mussel restoration.

Big river fish species that may be restored include the shovelnose sturgeon, lake sturgeon, blue catfish, blue sucker, speckled chub, channel darter, river darter, crystal darter, and longhead darter. The shovelnose sturgeon was selected, for example, because this species historically inhabited the entire reach of the Ohio River within West Virginia. Over the last 100 years, populations have declined in all historically inhabited water bodies due to degraded water quality and habitat, as well as commercial over-exploitation. This resulted in the extirpation of this species from West Virginia by the mid 1900s. With improved habitat conditions and closure of commercial and recreational fishing for this species, interest has been expressed in restoring shovelnose sturgeon, as well as other historic big river species in the Ohio River.

Candidate host fish species for mussel restoration include: hybrid striped bass (*Morone chrysops x saxatilis*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), blue catfish (*Ictalurus furcatus*), sauger (*Stizostedion canadense*), walleye (*Stizostedion vitreum*), white crappie (*Pomoxis annularis*), and logperch (*Percina caprodes*). Fish species used as hosts for mussel restoration will be raised in hatchery settings and used in mussel propagation either through captive propagation, infest and release, or caged propagation, as described in Section 2.2.2.3.

Shovelnose sturgeon and several species of host fish for mussels will be reared at existing state and federal facilities. To meet this new demand, some renovations to existing state and federal facilities may be required. To create a viable shovelnose sturgeon population, the trustees believe 1,000 to 5,000 fingerling shovelnose sturgeon must be stocked into the Belleville Pool each year, for ten years. At least two species of mussel host fish will be produced annually at state and federal facilities.

2.3 Summary of Restoration Actions by Alternative

Table 3. Summary of Restoration Actions by Alternative

Action	No Action	Proposed Action
Restore, rehabilitate, replace and/or acquire the equivalent of natural resources injured from the release of hazardous substances into the environment and the services those resources provide.	No	Mussels, through: • Translocating adults • Infesting and releasing host fish • Propagation and stocking Snails, through: • Translocation • Propagation and stocking • Egg traps Fish, through: • Propagation and stocking

2.4 Other Alternatives Considered

The trustees considered restoring all species and all numbers of fish, mussels, and snails that were killed. This alternative was deemed infeasible because the amount of the funds available is insufficient, and because the existing rearing facilities lack the capacity that would be required.

3.0 AFFECTED ENVIRONMENT

The logical management unit for this restoration effort is the Belleville Pool of the Ohio River, a 42-mile reach which extends from RM 161.8 to RM 203.9 bordering Pleasants and Wood counties, WV and Washington, Athens, and Meigs counties, Ohio (Figure 2). The area directly affected by the discharges is RM 176.9 to RM 203.9, with decreasing mortality as one moves further away from the discharge point. However, other reaches of the Belleville Pool are indirectly affected by the resource losses, as there are fewer

mussels, snails, and fish to support the larger ecosystem services and functions. The Belleville Pool, a large river warm water ecosystem, is impounded for navigation by the Belleville Dam. Water averages 24 feet (7.3 meters) deep and 1,327 feet (404.5 meters) wide with an average bottom slope of 0.5 feet per mile. Water temperatures in the mainstem typically range from 32 to 85 degrees Fahrenheit, with occasional icing over. The usual low flow period is August through October.

There are seven islands in the Belleville Pool, three of which are a part of the ORINWR (Buckley Island, Muskingum Island, and Neal Island). The islands provide habitat diversity in the form of extensive shallow water features (less than 15 feet or 4.6 meters). River substrates are primarily mixtures of sand, gravel, and cobble, with occasional boulders, woody debris, submerged and emergent aquatic beds, and nearshore clay and silty sand benches. Major tributaries include the Little Muskingum, Muskingum, Duck, Little Kanawha, Little Hocking, Hocking, and Lee creeks.

Over 100 species of fish are known to inhabit the West Virginia portion of the Ohio River, and many if not all of these species likely occur in the Belleville Pool as well. Over the past 20 years, 35 species of native mussels and the zebra mussel have been collected either alive or freshly dead in the Belleville Pool.

The floodplain through this reach of the Ohio River includes urbanized areas such as the cities of Marietta, Williamstown, Belpre, and Parkersburg; agricultural areas and rural settlements; industrial facilities such as Eramet, Chevron, Marietta Industrial Enterprises, DeGussa, DuPont, GE Plastics, Huntsman Chemical, Kraton Chemical; and some tracts of wetlands and undeveloped bottomland hardwood forests.

Federally-listed species in this reach include the bald eagle (*Haliaeetus leucocephalus*; migration and wintering; one nest attempt failed in 2001); Indiana bat (*Myotis soldalis*; summer); pink mucket pearly mussel (resident); and fanshell mussel (resident). Current candidate species include the sheepnose mussel (resident).

The aquatic resources in the Belleville Pool experienced another recent insult. During a winter flood event in January 2005, a towboat pushing barges upstream out of Belleville Locks lost control, and the barges broke away and wedged into the gates of the dam. As the water levels fell, the gates could not be closed to hold the normal pool. The pool dropped for a period of almost 30 days, and as the pool dropped, aquatic habitat was exposed to drying and freezing conditions. By the time the gates were cleared and could be closed, the river had dropped 18 feet in the lower reaches of the pool, and had started to expose mussel beds at the upper reach near Buckley Island (RM 169). Thousands of mussels, snails, and other invertebrates died, as well as some fish in the tributaries. The states of West Virginia and Ohio recently reached a settlement agreement with the responsible party. Funds from this settlement may be available for partnering opportunities to restore aquatic resources that were impacted.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

4.1 Evaluation of the Alternatives

4.1.1 Evaluation of the No Action Alternative

The No Action Alternative relies on natural recovery to restore the native mussel, snail, and fish communities. This alternative would not restore mussel and snail communities to densities and species composition consistent with the pre-injury condition because mussels and snails were virtually eliminated from affected portions of the river.

Many of the mussel species in the affected reach do not occur in large numbers in other parts of the Belleville Pool or tributaries. Given the fragility of the mussels' reproductive process, some species would not be able to return because the distance to the nearest seed source is likely to be too great. Furthermore, the navigation dams in the upper and middle Ohio River impede the dispersal of mussels to and from other pools because they impede migrating fish that would carry the mussel larvae. Therefore, natural recovery, even after many years, would not result in repopulation of all the mussel species that were lost.

With respect to snails, they generally colonize new areas by "walking" in an upstream direction (counteracting the prevailing downstream flow effects in rivers). Thus, any natural recolonization would come from the closest location downstream that has a robust population of all three species injured, and would occur at the proverbial "snail's pace." In the interim, the river would be deprived of the ecosystem functions (e.g., nutrient cycling, food source for other organisms) fulfilled by these important animals.

Although many of the common fish species killed have repopulated the affected reach of the river, historic native fish species that are important to the ecological community are not present in the tributaries. Thus, there is no natural supply of these historic native fish available in the area.

4.1.2 Evaluation of the Proposed Action/Preferred Alternative

4.1.2.1 Translocation of Adult Mussels

This low-risk strategy of directly translocating adult mussels into impacted reaches will be employed only in limited instances. Unfortunately because of environmental insults over the last two centuries, most mussel species are not found in adequate numbers within their endemic range to provide transplant candidates. Additionally, the translocation of any species represents no net gain to a given water system, but merely re-allocates an already depleted resource. However, in those areas where large scale relocations are already taking place to avoid impacts to mussels (e.g., bridge crossings), there may be opportunities to acquire animals for translocation that must be moved anyway. Thus, this action would have a positive impact to the receiving river reach and for the relocated mussels**.** Translocation would have no negative effect on the river or other species in the river. It would provide a positive impact by providing the mussels in a river reach currently without the benefits mussels provide (e.g., water filtering, food base, etc.).

4.1.2.2 Infest and Release Host Fish

Under this strategy, fish are either collected in the wild or taken from a hatchery and infested with glochidea close to the release site (shore side or on a boat). Once the fish have been infested, they are released directly to the river with the expectation that the glochidea will ride around on the fish host and drop off in suitable habitat within the Belleville Pool. It is difficult to measure the success of this technique in terms of numbers of juveniles produced and settled on the river bottom, but estimates can be made based on parallel cage studies. Cage studies involve placing host fish in cages in the river. Host fish are maintained in the cages until juvenile mussels drop off. Host fish are then released. This technique allows measurement of the number of juvenile mussels that are released within the cages.

If the appropriate fish hosts are identified and infested with mussel larvae in a controlled environment prior to release at the impacted areas, it is a reasonable assumption that the released mussel juveniles will aid in the restoration of the mussel community. Impacts to the river and its inhabitants from stocking mussels reared on host fish will be positive regardless of where the mussels settle or are stocked. Minimal disturbance to the river bottom is expected in areas where cages are used.

4.1.2.3 Propagation of Mussels

Technology and knowledge to successfully propagate mussels in a controlled environment has been developed over the last ten years. Consequently, the availability of hatchery-reared mussels that can be released directly into a degraded reach has aided mussel community restoration. Risk of this strategy is moderate, and will decrease over time as knowledge of the biological requirements of fish hosts and various life stages of mussels in both controlled and wild environments continues to increase. Impacts to the river reach and current inhabitants from propagation and release of mussels will be positive.

4.1.2.4 Translocation of Snails

For the same reasons as those described above for mussels (Section 4.1.2.1), translocation of snails is a low-risk strategy that will be employed in limited instances. Translocation of snails will have a positive impact to the receiving river reach**,** its inhabitants**,** and for the relocated snails, with minimal disturbance to the river bottom.

4.1.2.5 Propagation of Snails

Propagation of snails involves collecting adult brood stock from the river and transferring them to a laboratory or hatchery. Snails will be reared in captivity then released to the river. Release of young snails will have a positive impact on the river and its inhabitants. Minimal disturbance to the river bottom is expected during the collection of adult brood stock and release of young snails.

4.1.2.6 Egg Traps

Use of egg traps for snail restoration is a new technique that may be employed as part of the proposed action. This technique involves placing hard removable material (e.g., clay tiles, Plexiglas, etc.) on the river bottom in areas already inhabited by snails. Once the

egg traps are colonized by snail eggs, the traps can be relocated to restoration sites where the eggs will hatch. Impacts to the river and its inhabitants from recolonization of snails will be positive. Minimal disturbance to the river bottom is expected from placement and removal of egg traps.

4.1.2.7 Propagation of Fish

Fish recovery efforts will focus on propagation and release of a suite of big river fish species that historically inhabited the Ohio River; and the release of native host fish species used for mussel restoration. Impacts to the river from fish recovery efforts will be positive.

4.1.2.8 Aquatic Nuisance Species and Disease Control Procedures

The introduction of aquatic nuisance species, fish-related diseases, and non-endemic genotypes of native aquatic species is a concern. Therefore all animals brought into West Virginia must follow release or transfer procedures established by the WVDNR

4.2 Summary of Impacts by Alternative

Table 4. Summary of Environmental Consequences By Alternative

Injured Resource	No Action	Proposed Action
Mussels	The no action alternative relies on natural recovery over time which would result in failure to restore the native mussel communities to densities and species composition consistent with the pre-injury condition.	The proposed action/preferred alternative is designed to actively restore the mussel communities to a minimally viable and ecologically stable condition by translocation of adults, infesting and releasing fish hosts, and propagation of mussels. Over the long term this alternative relies on natural recolonization of mussels from other locations in the Ohio River and its tributaries, and successful reproduction by restored species to fully restore the mussel communities to the pre-injury condition. Impacts to the river from this alternative will be positive. No negative impacts are anticipated.

Snails	The no action alternative relies on natural recovery over time which will likely result in failure to restore the full complement of snail communities to densities and species composition consistent with the pre-injury condition.	The proposed action/preferred alternative is designed to actively restore the snail communities to a minimally viable and ecologically stable condition by propagation and stocking of reared snails. Over the long term this alternative relies on natural recolonization of snails from other locations in the Ohio River and its tributaries, and successful reproduction by restored species to fully restore the snail communities to the pre-injury condition. Impacts to the river from this alternative will be positive. No negative impacts are anticipated.
Fish	The no action alternative relies on natural recovery over time. No fish species would be actively restored. Natural recolonization by common native fish species that were identified during the post-kill surveys is already occurring.	This alternative would begin to restore (through propagation and stocking) historic fish species such as shovelnose and lake sturgeon, big river percids including darters, blue catfish, and blue sucker to the Belleville Pool. This alternative would also involve the release of fish species that serve as hosts for mussel restoration. Impacts to the river from this alternative will be positive. No negative impacts are anticipated.

4.3 Cumulative Impacts

As evidenced by the recent pool loss in 2005, the aquatic resources of the Belleville Pool are subject to stochastic events on both a localized (e.g., spill) and large scale (e.g., pool

loss). The long-term stability of the aquatic community is dependent upon there being sufficient numbers of diverse populations spread out along the entire reach to serve as anchors for biodiversity and recruitment. The large scale loss of individuals due to the toxic discharges in 1999 has made the resources of the pool more vulnerable to possible future impacts.

Native mussels and snails have experienced increased mortality from the invasion of the zebra mussel. Zebra mussels entered the lower Ohio River in 1991, and were first detected in the Belleville Pool in 1994. Their numbers remained relatively low (5 to 225 per m^2) until late 1998 and 1999 when densities reached 5,700 and then 10,500 per m^2, respectively, at the refuge monitoring station next to Muskingum Island (RM 175.6). Zebra mussels then "crashed" almost river wide during late summer of 2000, and have not regained a foothold since.

Native mussel and snail mortality has correlated directly with zebra mussel density and biomass, but is delayed by one to two years. Normal background mortality in a mussel community is less than 10 percent; annual monitoring by the refuge showed fresh dead mussels ranged from 2 to 7 percent prior to 2000. In 1999, it was still 2 percent (although the zebra mussels had exploded that year), but in 2000 the mortality of native mussels jumped to 17 percent and then 27 percent in 2001. Snails were not monitored using the same methods until 2002, so there is no comparison of background and maximum mortality of snails due to the presence of zebra mussels. However, the monitoring since 2002 has shown snail mortality ranging from 4 to 16 percent.

Other potential impacts to the habitat of the Belleville Pool include dredging and spoil disposal; construction of river-based loading and unloading facilities; and accidental spills. At the present time, there are no permitted commercial sand and gravel dredging operations in the pool; maintenance dredging is restricted to the lock approaches, and disposal areas are regulated and sited away from known mussel concentrations. The proposed construction of facilities in and along the river is regulated by Section 10 of the Rivers and Harbors Act, and Section 404 and 401 of the CWA. Resource agencies coordinate closely to avoid impacts to mussel beds and seek mitigation for any unavoidable impacts.

The proposed restoration of mussels, snails, and fish will help restore aquatic habitat pool wide, and thus help offset recent historic losses from zebra mussels and pool loss. The restoration of mussels, snails, and fish will not result in a cumulative negative impact to the river ecosystem.

5.0 MONITORING PROGRAM AND PERFORMANCE CRITERIA

The goal of the monitoring program is to ascertain the status of the fish, mussel, and snail communities at the restored beds over a ten-year period. The final monitoring efforts under this restoration program will take place no sooner than five years after the last stocking event. The monitoring program for mussels will follow standard quantitative

and qualitative mussel sampling protocols developed by consensus of active Ohio River malacologists. A maximum of five days per year of active surveys are proposed.

6.0 BUDGET SUMMARY AND TIMETABLE

The settlement with defendants provided $2,040,000 for restoration of the injured natural resources. These funds are held in an interest-bearing account in the U. S. Department of the Interior's Natural Resource Damage Assessment and Restoration (NRDAR) Fund, and are available to the trustee agencies only for planning and implementation of actions necessary to restore, replace, or acquire the equivalent of the injured natural resources. The trustee agencies may only access these funds through formal resolutions of the trustee council, consisting of representatives of the chief executive officers, or authorized officials of the WVDNR, the WVDEP, the OEPA, and the DOI.

Because of limited capacity to procure, and propagate sufficient numbers and species of mussels, snails, and fish, it is anticipated that restoration will require a minimum of ten years to complete. As restoration progresses, the natural resource trustees will withdraw only those funds needed for the activities planned for that year and will make every effort to both maintain the majority of the funds in interest-bearing accounts, and to partner existing funds with other federal, state, and private funding sources.

7.0 LIST OF PREPARERS

This RP/EA was prepared by representatives of the natural resource trustee agencies, listed below, in consultation with experts in the field of malacology (see Section 6.0). Report preparation assistance and review were provided by individuals from the DOI NRDAR Program Restoration Support Unit, also listed below.

Dave DeVault, Fish and Wildlife Biologist
U.S. Fish and Wildlife Service

Patricia Morrison, Refuge Biologist
U.S. Fish and Wildlife Service
Ohio River Islands National Wildlife Refuge

Scott Morrison, District Fisheries Biologist
West Virginia Division of Natural Resources

Janet Clayton, Wildlife Diversity Biologist
West Virginia Division of Natural Resources

John Navarro, Fisheries Biologist
Ohio Division of Wildlife

Barbara Schmalz, Field Liaison
NRDAR Restoration Support Unit

Susan Kennedy, Ecologist
NRDAR Restoration Support Unit

8.0 LIST OF AGENCIES, ORGANIZATIONS, AND PARTIES CONSULTED FOR INFORMATION

Dr. Richard Neves, Malacologist
Virginia Polytechnic University

Dr. G. Thomas Watters, Malacologist
Ohio State University Museum of Biological Diversity

Dr. Paul Johnson, Malacologist
Alabama Aquatic Biodiversity Center
(and formerly with Southeast Aquatic Research Institute)

9.0 PUBLIC COMMENTS AND TRUSTEE RESPONSES

In accordance with NEPA, this RP/EA has been prepared to analyze the impacts of the alternatives considered, select a preferred alternative, and determine whether the preferred restoration alternative is expected to have a significant effect on the quality of the human environment. If a significant effect is expected, an environmental impact statement (EIS) must be prepared. If no significant effects are expected from the proposed restoration alternative, the NEPA process concludes with the environmental assessment and issuance of a finding of no significant impact (FONSI).

In analyzing the potential significance of a proposed project, federal agencies must consider: (1) the nature of the impacts and whether they are beneficial or detrimental; (2) impacts on public health and safety; (3) unique characteristics of the geographic area of the project; (4) whether the project is likely to generate controversy; (5) whether the project involves uncertain impacts or unknown risks; (6) the type of precedent created by implementing the project; (7) cumulative impacts of the proposed action with known other future actions; (8) impacts on nationally significant cultural, scientific, or historic resources; (9) impacts on threatened or endangered species or their habitats; and (10) potential violations of federal, state, or local environmental protection laws.

The trustees welcome input from the public in evaluating the likely success of the Proposed Action in making the environment and the public whole for losses suffered from the hazardous substance releases. Information currently available suggests that the proposed restoration projects will not have a significant effect on the quality of the human environment. If no new substantive information is received during the public

comment period that would change the evaluation of the restoration alternatives and the selection of the preferred alternative, then the NEPA process will likely conclude with a FONSI.

The final RP/EA will be available for public review and comment for 30 days from the date of publication of the notice of availability.

9.1 Public Comments

Comments that are received during the 30-day public comment period for this draft document will be presented in this section of the final RP/EA.

9.2 Trustee Responses to Public Comments

Trustee responses to the public comments will be presented in this section of the final RP/EA.

10.0 LITERATURE CITED

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