FINAL

DAMAGE ASSESSMENT/RESTORATION PLAN
and
ENVIRONMENTAL ASSESSMENT

M/V WESTCHESTER
CRUDE OIL DISCHARGE

LOWER MISSISSIPPI RIVER, LOUISIANA
NOVEMBER 28, 2000

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INTRODUCTION AND SUMMARY CHAPTER 1

This Damage Assessment and Restoration Plan/Environmental Assessment (DARP/EA) has been prepared by state and federal natural resource Trustees (listed in Section 2.2 of this document) to address the restoration of natural resources and resource services injured by the M/V Westchester oil spill of November 28, 2000 (the "incident") on the Mississippi River in Plaquemines Parish, Louisiana. This DARP/EA was developed after a Draft DARP/EA, informing the public of the results of natural resource injury studies/analyses and proposed restoration actions to address those injuries, was released for a 30-day public comment period. The DARP/EA also serves as an Environmental Assessment as defined under the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321, et seq.). The integrated EA addresses the potential impact of proposed restoration actions on the quality of the physical, biological, and cultural environment.

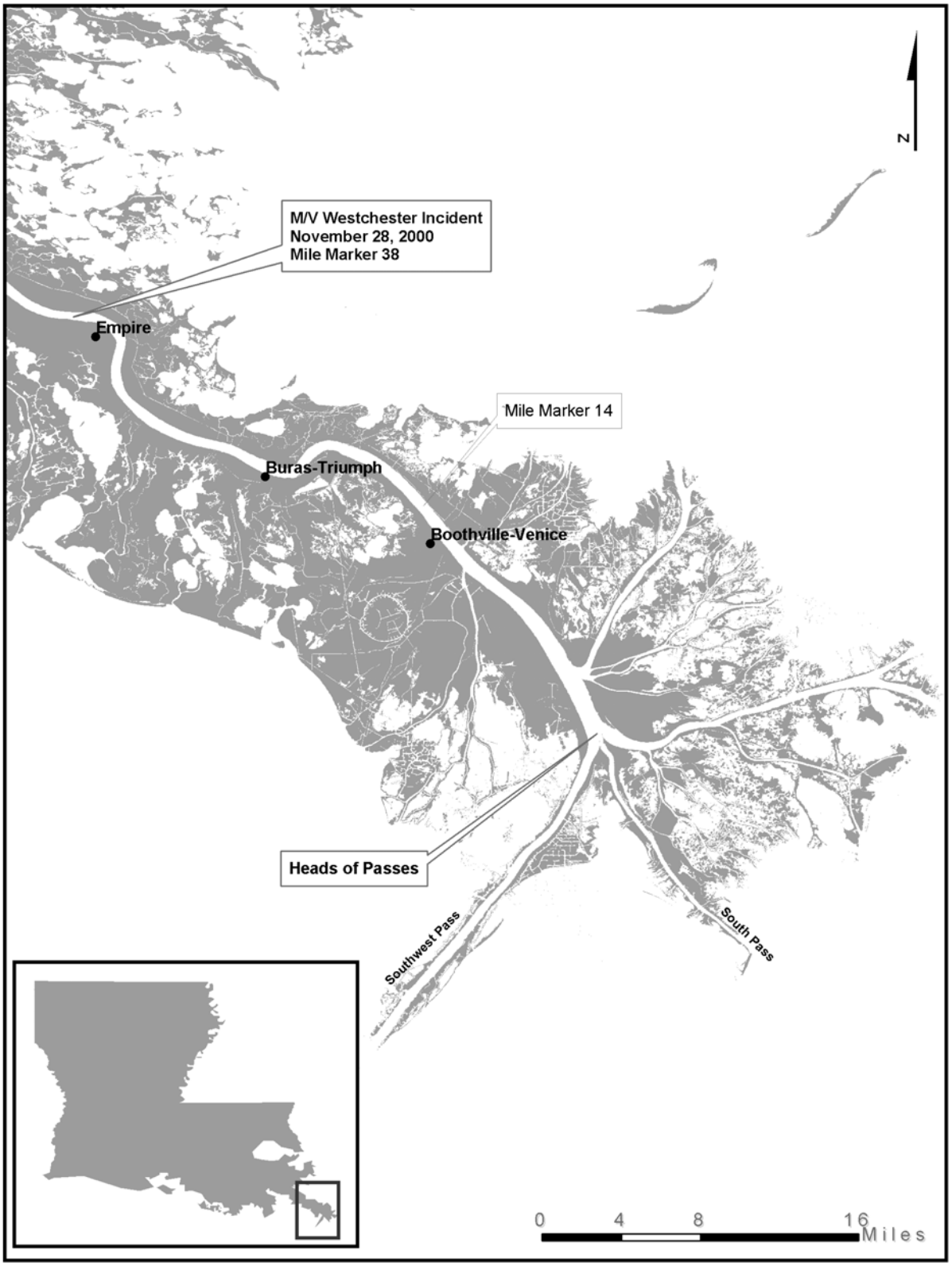
The Trustees and the Responsible Parties (RPs) for the Westchester incident considered the injuries resulting from this incident, evaluated potential restoration alternatives suggested by the public, local scientists, and other interested parties, ranked the alternatives according to established criteria, and identified preferred restoration alternatives to address these injuries. These preferred restoration alternatives were identified in the Draft DARP/EA, released for a 30-day public comment period on September 27, 2001. No comments were received during the public comment period; therefore, the restoration alternatives identified as preferred in the Draft DARP/EA were selected for implementation in this DARP/EA to address these injuries in accordance with the Oil Pollution Act of 1990 (OPA) (33 U.S.C. § 2701, et seq.) and the OPA regulations for natural resource damage assessments (15 C.F.R. Part 990). Furthermore, the Trustees determined that the restoration projects are not likely to have significant adverse impacts on the environment, and the NEPA process will conclude with the issuance of a Finding of No Significant Impact (FONSI).

1.1 OVERVIEW OF THE INCIDENT

At approximately 6:20 PM CST on November 28, 2000, the U.S. Coast Guard (USCG) Marine Safety Office in New Orleans was notified that the M/V Westchester lost steerage because of a crankcase explosion while transiting the Mississippi River at Mile Marker (MM) 38 (measured from the Head of Passes). The vessel grounded, holing the #1 starboard cargo tank, and subsequently leaked approximately 550,000 gallons of Nigerian crude oil into the river. Response efforts were quickly mounted, including placing booms at key bayous and cuts, and deploying skimmers to collect oil from the water surface. Much of the oil became trapped in the rip-rap on the west bank of the river, which facilitated the recovery of oil, resulting in a more efficient recovery than is typical for oil spills. The location of the incident is shown in Figure 1.

State and federal agency personnel along with the RPs responded to the spill, as part of the unified command, and observed potential indications of biological injury and effects on recreational activities due to the incident. As a result of this incident, several thousand acres, including Mississippi River surface waters and shoreline habitats, coastal surface waters, adjacent marsh and other habitats, and the fauna inhabiting these areas, were exposed to crude oil (black oil, emulsified oil, or sheen). Vessel traffic on the Mississippi River between MM 38 and MM 9 was halted on the

FIGURE 1. Site of Westchester Incident (MM 38). Black oil went as far south as MM 14, with sheens going beyond that point and into marshes located south of Venice.



morning of November 29, 2000, affecting both commercial and recreational use of the river itself, and also use of down river recreational sites largely dependent on use of the river for access. The river was opened to in-bound traffic at around 4:00 PM CST on November 30, 2000; the river was opened to both up river and down river traffic on December 1, 2000. Pursuant to Section 1006 of OPA (33 U.S.C. § 2706), designated natural resource Trustees have conducted a damage assessment to evaluate potential injuries to natural resources and services, and to determine the need for and scale of restoration actions required. During the period of active response, representatives of the RPs met with Trustee representatives to establish a cooperative assessment process for the natural resource damage assessment (NRDA) conducted for this incident.

1.2 NATURAL RESOURCE INJURIES

The Trustees reviewed the information gathered as a result of response activities as well as information collected specifically for injury assessment. Based on this work, the Trustees believe that the incident caused injuries to habitats and biota in the Mississippi River and shoreline environments, including a variety of birds.

Using a modeling approach (as described in Section 4.4.1.2), the Trustees estimate that approximately 19,396 kilograms of finfish and shellfish biomass (direct kill and production foregone) were lost as a result of the incident. A modeling approach was also used to estimate direct mortality to birds and wildlife (see Section 4.4.2.2). The model estimates that approximately 582 birds were killed from exposure to oil, and predicts that no mammals, amphibians, or reptiles were killed. These faunal injuries were translated into marsh biomass equivalents, as described in Section 5.4.1.2.3.1.

A number of different habitats were affected as a result of the incident. These habitats (as categorized by the Trustees for the purpose of this assessment) include freshwater river vegetative habitat, delta marsh habitat, rip-rap habitat, and sandflat habitat. The Trustees used experience gained from injury analysis for similar habitats impacted in previous spills and the opinions of local agency personnel to derive estimates for service losses caused by the oiling and the recovery time to baseline[1] service flows. A phased approach was used in this assessment, with the Trustees first applying conservative assumptions[2] to determine upper-end habitat injury estimates in order to inform them about how to prioritize efforts to refine the injury estimates. However, as described in Chapter 5, the Trustees and RPs found an extremely cost-effect restoration alternative to address habitat injuries. Therefore the Trustees did not seek to further refine these injury estimates, nor did the RPs request refinements, because the cost of doing the additional injury work would increase

[1] Baseline is defined as the condition that would have existed, but for the incident.

[2] Here and throughout this document, the term "conservative assumption" indicates that the value of the parameter in question would tend to favor the resource and the public's interests when used in the analysis. The assumed value therefore leads to an upper-end estimate of how much injury occurred or how much restoration is required. Often these assumptions are used in initial analyses to guide Trustees in determining the appropriate level of effort to apply in obtaining more refined estimates. Sometimes, as is the case for most of these kinds of assumptions used in this NRDA, the cost of developing refined estimates for parameters would exceed the potential reduction in the cost of restoration. In these instances, the use of conservative assumptions in the final analysis, rather than developing more precise point estimates, results in an overall cost savings to the RPs while still protecting the public's interest in obtaining sufficient restoration for the injuries.

overall costs compared to simply scaling restoration needs based on the preliminary injury estimates.

Recreational fishing was a human-use activity that was affected during the incident by the closure of the Mississippi River and, after the closure ended, by restrictions on access points for launching boats. Additionally, the spill occurred during the waterfowl hunting season in Louisiana, and access to the Delta National Wildlife Refuge (DWR) and the Pass-a-Loutre State Wildlife Management Area (PAL), two prime hunting sites, was restricted due to the incident. The Trustees contacted federal and state officials with knowledge on recreational use of the Mississippi River, PAL, and DWR, and estimated that 655 angler days and 804 hunter days may have been affected as a result of the incident. The recreational injury analysis is described in Section 4.4.4.2.

1.3 SELECTED RESTORATION ALTERNATIVES

Restoration actions under OPA are termed primary or compensatory. Primary restoration is any action taken to accelerate the return of injured natural resources and services to their baseline condition. Trustees may elect to rely on natural recovery rather than primary restoration actions in situations where feasible or cost-effective primary restoration actions are not available, or the injured resources will recover relatively quickly without human intervention.

Compensatory restoration is any action taken to compensate for interim losses of natural resources and services pending recovery. The scale of the required compensatory restoration will depend both on the magnitude of initial resource injury and how quickly each resource and associated service returns to baseline. Primary restoration actions that speed resource recovery reduce the requirement for compensatory restoration.

Based on observations made during the injury assessment studies, the Trustees determined that no active primary restoration actions were required to return injured natural resources and services to baseline, including human use services (see Section 5.3.1). Therefore the natural recovery (no action) alternative was chosen for primary restoration. The Trustees evaluated many compensatory restoration alternatives with the potential to provide additional resources to compensate for the

Table 1-1
SELECTED RESTORATION ALTERNATIVES

Injured Resource/ Service	Primary Restoration	Compensatory Restoration
Water Column Fauna	Natural recovery/No action	Marsh creation
Birds	Natural recovery/No action	Marsh creation
Freshwater Vegetation Habitat Services	Natural recovery/No action	Marsh creation
Rip-rap Habitat Services		
Sandflat Habitat Services		
Delta Marsh Habitat Services		
Recreational Human Use	Natural recovery/No action	Projects to increase recreational access to resources

ecological losses pending environmental recovery. As indicated in Table 1-1, the Trustees selected a compensatory restoration action directed at habitat services, aquatic fauna, and birds. The Trustees also selected a restoration action to compensate for lost public use (i.e., recreational fishing and hunting) resulting from the Westchester incident.

1.4 ORGANIZATION OF THIS DOCUMENT

The remainder of this document presents further information about the natural resource injury studies and selected restoration actions for the Westchester oil spill incident.

Chapter 2 briefly summarizes the incident, the legal authority and regulatory requirements of the Trustees, and the respective roles of the RPs and the public in the damage assessment process.

Chapter 3 provides a brief description of the physical and ecological environments affected by the spill, as required by NEPA (42 U.S.C. § 4321, et seq.), and of the cultural and economic importance of Mississippi River delta natural resources.

Chapter 4 describes and quantifies the injuries caused by the spill, including an overview of Preassessment activities, a description of assessment strategies employed by the Trustees, and a presentation of assessment results.

Chapter 5 provides a discussion of restoration options considered during the Restoration Planning Phase, and determines the appropriate scale of the selected restoration actions, based on the nature and extent of injury presented in Chapter 4.

Appendix A provides a list of the documents submitted to the Administrative Record as of December 20, 2001.

Appendix B presents a list of applicable environmental laws that have been considered by the Trustees in conducting the assessment and planning restoration for this incident.

PURPOSE OF AND NEED FOR RESTORATION CHAPTER 2

This chapter explains the NRDA process and describes the legal authority under which Trustees act on behalf of the public. It explains the requirement for the Trustees to seek involvement of the RPs and the opportunities for public participation in the NRDA process.

2.1 THE WESTCHESTER OIL SPILL: SUMMARY OF INCIDENT

At around 6:20 PM CST on November 28, 2000, the USCG Marine Safety Office in New Orleans was notified that the M/V Westchester lost steerage because of a crankcase explosion while transiting the Mississippi River at MM 38 in Plaquemines Parish, Louisiana. The vessel ran aground and leaked approximately 550,000 gallons or more of sweet Nigerian crude oil into the river from the holed #1 starboard cargo tank. A dive survey identified six fractures over a 40-foot section in the forward section of this tank ranging from 2-6 inches wide and 2-6 feet long. The Mississippi River was closed between MM 38 and MM 9 on November 29, 2000. The river was opened to in-bound traffic on November 30, 2000; it was opened to two-way traffic on December 1, 2000. The locks at Empire and Ostrica were also closed on November 29, 2000, and opened on December 1, 2000. Similarly, booms located at Baptiste Collette Bayou, The Jump, and Cubits Gap were moved on December 1, 2000, to allow sportsmen access (Research Planning, Inc., 2001).

By 9 AM CST on November 30, 2000, heavy black oil had accumulated along the West Bank from MM 29 to MM 16, especially in rip-rap areas and sloughs. Most of the black oil remained trapped along the West Bank, although sheens were observed in marsh tidal creeks and bayous such as Grand Pass. Sheens also passed through cuts in the river levee into open water and marshes below Venice. Response efforts were quickly mounted, including placing booms at key bayous and cuts and deploying skimmers to collect oil from the water surface. Oil was washed off of rip-rap with high pressure flushing, contained with boom, and skimmed. Shoreline cleanup included manual removal of oil from sand and mudflats, low pressure flushing of oil from vegetation, and cutting of oiled vegetation. By February 20, 2001, the last shoreline segment was signed off on as meeting agreed-upon cleanup endpoints. For more information on this incident, see the Preassessment Data Report (Research Planning, Inc., 2001)

2.2 AUTHORITY AND LEGAL REQUIREMENTS

This DARP/EA has been prepared jointly by the Louisiana Oil Spill Coordinator's Office (LOSCO), the Louisiana Department of Wildlife and Fisheries (LDWF), the Louisiana Department of Natural Resources (LDNR), the Louisiana Department of Environmental Quality (LDEQ), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of the Interior (DOI) which is represented by the United States Fish and Wildlife Service (USFWS) (collectively, "the Trustees"). Each of these agencies is a designated natural resource Trustee under Section 1006(b) of OPA, 33 U.S.C. § 2706(b), and the National Contingency Plan, 40 C.F.R. §§ 300.600-300.615, for natural resources injured by the Westchester incident. As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages, and to plan and implement actions to restore natural

resources and resource services injured or lost as the result of incidents involving the discharge, or significant threat of discharge, of oil.

2.2.1 **Overview of OPA Requirements**

NRDA is described under Section 1006(c) of OPA (33 U.S.C. § 2706(c)). Under the OPA NRDA regulations at 15 C.F.R. Part 990, the NRDA process consists of three phases: 1) Preassessment; 2) Restoration Planning; and 3) Restoration Implementation.

During the Preassessment Phase, the Trustees determine whether they have jurisdiction to pursue a NRDA for the incident. In order for the Trustees to proceed with a NRDA, the following conditions must be met under 15 C.F.R. § 990.41:

1. an incident must have occurred as defined at 15 C.F.R. § 990.33;
2. the incident must not be permitted under a permit issued under federal, state, or local law;
3. the incident must not involve a public vessel; and
4. the incident must not be from an onshore facility subject to the Trans-Alaska Pipeline Authority Act (43 U.S.C. § 1651, et seq.).

The Trustees determined that an incident occurred and that all of the above conditions were met for the Westchester oil spill. In addition, based on early available information collected during the Preassessment Phase, Trustees must make a preliminary determination whether natural resources or services have been injured and/or are threatened by ongoing injury. Injury is defined as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service" (15 C.F.R. § 990.33). Through coordination with response agencies (e.g., the USCG), Trustees next determine whether response actions will eliminate injury or the threat of ongoing injury. If injuries are expected to continue, and feasible restoration alternatives exist to address such injuries, Trustees may proceed with the Restoration Planning Phase. Restoration planning also may be necessary if injuries are not expected to continue but are suspected to have resulted in interim losses of natural resources and services from the date of the incident until the date of recovery.

The purpose of the Restoration Planning Phase is to evaluate potential injuries to natural resources and services, and use that information to determine the need for, and scale of, restoration actions. Natural resources are defined as "land, fish, wildlife, biota, air, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any state or local government or Indian tribe" (15 C.F.R. § 990.30). This phase provides the link between injury and restoration and has two basic components: injury assessment and restoration selection.

The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thus providing a factual basis for evaluating the need for, type of, and scale of restoration actions. As the injury assessment is being completed, the Trustees develop a plan for restoring the injured natural resources and services. The Trustees must identify a reasonable range of restoration alternatives, evaluate and select the preferred alternative(s), develop a Draft

Restoration Plan presenting the alternative(s) to the public, solicit public comment on the Plan, and consider these comments when developing a Final Restoration Plan.

Under the regulations, the Final Restoration Plan is presented to the RPs at the start of the Restoration Implementation Phase, to implement or to fund the Trustees' costs of implementing the plan, thus providing the opportunity for settlement of damage claims without litigation. Should the RPs decline to settle a claim, OPA authorizes Trustees to bring a civil action against the RPs for damages, or to seek disbursement from the USCG's Oil Spill Liability Trust Fund equal to the value of the damages. Components of damages include the cost of implementing the selected restoration action or actions, including monitoring and necessary corrective actions, and the cost of the damage assessment itself (33 U.S.C. §§ 2701(5) and 2702(b)). For this incident, however, the Trustees and RPs worked cooperatively throughout the Restoration Planning Phase in identifying potential restoration actions. The RPs agreed to implement the selected restoration actions identified in this Final DARP/EA.

2.2.2 **NEPA Compliance**

Any restoration of natural resources under OPA must comply with NEPA (42 U.S.C. § 4321, et seq.) and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 C.F.R. § 1500, et seq.). In compliance with NEPA and the CEQ regulations, the Draft DARP/EA summarized the environmental setting, described the purpose and need for action, identified alternative actions, assessed their applicability and environmental consequences, and summarized opportunities for public participation in the decision-making process. This information was used in making a threshold determination as to whether preparation of an Environmental Impact Statement (EIS) is required prior to the selection of the final restoration actions (i.e., are any of the proposed actions a major federal action that may significantly affect the quality of the human environment?). Based on the draft EA integrated in the Draft Restoration Plan, it was determined that the proposed restoration actions do not meet the threshold requiring an EIS. The Trustees received no public comments on the Draft DARP/EA affecting this judgment; and therefore, a Finding of No Significant Impact (FONSI) will be issued.

2.3 COORDINATION WITH THE RESPONSIBLE PARTY

The OPA regulations require the Trustees to invite RPs to participate in the damage assessment process. Although the RPs may contribute to the process in many ways, final authority to make determinations regarding injury and restoration rests solely with the Trustees.

Accordingly, the Trustees engaged in several informal discussions with representatives for the RPs concerning a cooperative assessment and more formal discussions during a meeting on November 30, 2000, and also during a joint site visit by Trustees and RP representatives on December 11, 2000. Further coordination continued throughout the restoration planning process, including site visits to investigate potential restoration options in May, June, and October, 2001, with local agency and RP representatives. Coordination between the Trustees and RPs helped reduce duplication of studies, increase the cost-effectiveness of the assessment process, increase sharing of information and experts, and is expected to decrease the likelihood of litigation. Input from the RPs was sought and considered throughout the damage assessment process.

2.4 PUBLIC PARTICIPATION

Public review of the Draft DARP/EA was an integral component of the restoration planning process. Through the public review process, the Trustees sought public comment on the analyses used to define and quantify natural resource injuries and the methods being proposed to restore injured natural resources or replace lost resource services. The Draft DARP/EA provided the public with information about the nature and extent of the natural resource injuries identified and restoration alternatives evaluated.

Following issuance of a public notice, the Draft DARP/EA was made available to the public for a 30-day comment period beginning on September 27, 2001. Public review of the Draft DARP/EA is consistent with all state and federal laws and regulations that apply to the natural resource damage assessment process, including Section 1006 of OPA (33 U.S.C. § 2706), the OPA regulations for NRDAs (15 C.F.R. Part 990), NEPA (42 U.S.C. § 4321, et seq.) and the regulations implementing NEPA (40 C.F.R. §1500, et seq.). No comments were received during the public comment period, which ended on October 27, 2001.

2.4.1 Administrative Record

The Trustees developed records documenting the information considered by the Trustees as they planned and implemented assessment activities and addressed restoration and compensation issues and decisions. These records have been compiled into an administrative record, which is available for public review at the address given below. The administrative record facilitated public participation in the assessment process and will be available for use in future administrative or judicial review of Trustee actions to the extent provided by federal or state law. A list of those documents submitted to the administrative record through December 20, 2001 is attached as Appendix A to this document.

Documents within the administrative record can be viewed at:

Louisiana Oil Spill Coordinator's Office
625 N. Fourth Street, Suite 800
Baton Rouge, LA 70802

Arrangements should be made in advance to review the record, or to obtain copies of documents in the record, by contacting Warren Lorentz at the listed address, by calling him at (225) 219-5810, or by emailing him (wlorentz@losco.state.la.us).

AFFECTED ENVIRONMENT CHAPTER 3

This chapter presents a brief description of the physical and biological environment affected by the Westchester incident, as required by NEPA. The physical environment includes the waters of the Mississippi River and associated shoreline and batture habitats, including sand and mudflats, sloughs and fresh marsh. It also includes delta habitats that were exposed to sheen. The affected environments provide habitat for a wide variety of fish, birds, mammals, and other organisms. Commercial fishing, aquaculture, recreational fishing, hunting, and wildlife viewing in the lower Mississippi River delta contribute to the economy of Plaquemines Parish. The affected environment- cultural, economic, environmental, and recreational- is described in detail in the Draft Heritage Study and Environmental Assessment (National Park Service, 2001) and so will be only briefly discussed below. More information is available at: http://www.cr.nps.gov/delta/home.htm.

3.1 PHYSICAL ENVIRONMENT

The state of Louisiana is located along the north-central coast of the Gulf of Mexico. Over time the Mississippi River has created a number of deltaic lobes, the most recent of which is the area below New Orleans at the present mouth of the river, where the channel forks into many passages. This area is also referred to as the "bird's foot." This lobe was created over the last 5,000 years, but is now being gradually lost due to subsidence and erosion primarily resulting from man-made alterations in the river. There are several types of shoreline habitats along the river itself, including mud and sandflats, rip-rap, fringe vegetation along the river and vegetated edges of sloughs.

3.2 BIOLOGICAL ENVIRONMENT

The lower Mississippi River and delta area ecosystem supports an incredible variety of species. Bird species found in the area include: snowy egrets, double-crested cormorants, various species of gulls, brown and white pelicans, ospreys and various hawks, kingfishers, great blue herons, and many more. It serves as an extremely important wintering area for waterfowl, with the DWR alone supporting up to 200,000 ducks and 50,000 geese. Other wildlife in the area includes alligators, muskrats, and river otters. This area supports both fresh and marine aquatic species. Fish such as redfish, flounder, trout, catfish, buffalo, and gar, among many other species, are found in the waters of the Mississippi River and deltaic marshes. In the outer portions of the delta, shellfish such as crabs and shrimp can be abundant.

3.3 ENDANGERED AND THREATENED SPECIES

The Endangered Species Act of 1973 (16 U.S.C. § 1531, et seq.) instructs federal agencies to carry out programs for the conservation of endangered and threatened species and to conserve the ecosystems upon which these species depend. LDWF's Natural Heritage Program also lists species that are of special concern to the state. Table 3.1 provides a list of federal and state recognized endangered or threatened species reported to reside in or migrate through south coastal Louisiana ecosystems.

Table 3.1 FEDERAL AND STATE ENDANGERED OR THREATENED SPECIES IN PLAQUEMINES PARISH, LOUISIANA		
Common Name	**Scientific Name**	**Status**
MAMMALS		
Florida Panther*	*Felis Concolor coryi*	Endangered
Louisiana Black Bear	*Ursus americanus luteolus*	Threatened
West Indian Manatee	*Trichechus manatus*	Endangered
REPTILES		
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened
Green Sea Turtle	*Chelonia mydas*	Threatened
BIRDS		
Brown Pelican	*Pelecanus occidentalis*	Endangered
Piping Plover	*Charadrius melodus*	Threatened
Eskimo Curlew*	*Numenius borealis*	Endangered
Bachman's Warbler*	*Vermivora bachmanii*	Endangered
Ivory-Billed Woodpecker*	*Campephilus principalis*	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
FISH		
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered

* These species may no longer be present in Louisiana, but remain officially listed.

3.4 CULTURAL ENVIRONMENT AND HUMAN USE

Ever since the early 1600s when the explorer Robert Cavelier, Sieur de La Salle, successfully reached the mouth of the Mississippi River claiming the region for France, the delta has become widely known as an area with an abundance of fish and wildlife resources. A variety of cultures have existed in this region, including Native American, Spanish, French, British, Acadian (Cajun), Creole, and African. This area is directly used for commercial and recreational crabbing, trapping, hunting, and fishing, and is also used for wildlife viewing. Ecotourism (primarily bird and wildlife viewing and hunting and fishing) is increasingly important to the area. Oil and gas exploration and production also occur in this area.

Two National Historical Monuments are located in the area affected by the incident. Fort Jackson is located on the right descending bank near MM 20 and Fort St. Philip is located slightly downriver on the left descending bank. They served as the Confederate Army's primary defensive positions protecting New Orleans during the Civil War. The Union Navy managed to move upriver of these fortifications in April 1862, leading to the surrender of New Orleans. Access to Fort St. Philip is limited, and it is in a lesser state of preservation than Fort Jackson, which is a well-maintained and popular point of interest for tourists. Fort Jackson also serves as the location of Plaquemines Parish's annual Parish Fair and Orange Festival each December.

INJURY DETERMINATION AND QUANTIFICATION CHAPTER 4

This chapter describes and quantifies the injuries caused by the Westchester incident. The chapter begins with an overview of data collected during the Preassessment Phase of the NRDA process. The following section describes the Trustees' assessment strategy, including the approaches used to identify, determine, and quantify potential injuries. The remainder of the chapter presents the results of Trustee injury assessments for the specific resources affected by the Westchester incident. Chapter 5 addresses the identification, selection, and scaling of restoration options to restore injured resources and services.

4.1 OVERVIEW OF THE PREASSESSMENT PHASE

The following three requirements identified in the OPA regulations, at 15 C.F.R. § 990.42, must be met before Restoration Planning can proceed:

- injuries have resulted, or are likely to result, from the incident;
- response actions have not adequately addressed, or are not expected to address, the injuries resulting from the incident; and
- feasible primary and/or compensatory restoration actions exist to address the potential injuries.

Information collected during the Preassessment Phase of the incident is contained in the Preassessment Data Report (Research Planning, Inc., 2001). This information meets the first two criteria listed above. A number of potential restoration actions exist that can provide the same or equivalent services and resources to those affected by the incident, thereby meeting the third criterion. Because these three criteria are met, the Trustees determined that there was a need for restoration planning to address impacts resulting from the incident and proceeded to the Restoration Planning Phase.

4.1.1 Aquatic Faunal Impacts

The release resulted in concentrations of polycyclic aromatic hydrocarbons (PAHs) that were detected in some locations at concentrations known to be toxic to aquatic organisms in laboratory tests. Although there were no reports of large numbers of fish or shellfish mortalities observed as a result of the incident (dead fish that were observed during the cleanup operations are believed to be shrimp boat by-catch and not spill-related), the Trustees' modeling effort suggests that some mortality did occur. The model estimates that approximately 19,400 kg of aquatic fauna were lost either from direct mortality or from future growth foregone (French-McCay and Galagan, 2001).

4.1.2 Bird Impacts

The Trustees conducted field surveys during the response phase of the spill. On November 30, 2000, a total of 1,680 birds were observed between MM 12 and MM 25. Of these, nine birds had visible oil on their plumage. Tri-State Bird Rescue personnel observed 117 oiled birds that they

could not capture. Fourteen oiled birds were brought into the rehabilitation center, of which ten died. Another five dead oiled birds were collected, for a total of 15 known bird deaths believed to have been spill-related. This is likely only a fraction of the total birds killed; the Trustees' model run predicts that approximately 582 birds may have been killed as a result of this incident (French-McCay and Galagan, 2001).

4.1.3 Habitat Impacts

A number of different shoreline habitats were affected by oil released during the incident (see descriptions in Research Planning, Inc., 2001). Oiled habitats include approximately eleven acres of rip-rap, less than one acre each of fresh marsh and freshwater edge of slough, slightly more than seven acres of sandflats, and just over 15 acres of mudflats. Although the areal extent was not precisely quantified, the Trustees observed that marshes west of the river below Venice, Louisiana, were exposed to sheen. Based on observations made during the response, the Trustees believe that the acreage of delta marsh vegetation affected was 100 acres or less (not inclusive of the open water areas between portions of marsh).

4.1.4 Human Recreational Use Impacts

The incident affected human use services in the Mississippi River delta. Under OPA, the Trustees are responsible for evaluating and obtaining compensation for public (but not private) lost human use of natural resources (33 U.S.C. § 2706(d)(1)). The closure of the river to vessel traffic affected recreational activities that depend on river access, including hunting and fishing in PAL and DWR. The Trustees contacted federal and state officials with knowledge on recreational use of the Mississippi River, PAL, and DWR, and estimated that 655 angler days and 804 hunter days may have been affected as a result of the incident (Galvin, 2001a).

4.1.5 Other Potential Impacts

Assessment of some resources that had the potential to be injured was not carried forward into the Restoration Planning Phase following the Preassessment Phase because the evidence of injury was not sufficient to justify further evaluation. An example of such a resource is mammals. Although two dead nutria were found, possibly spill-related, the Trustees recognized that nutria are an introduced species that is considered a nuisance, and are not seeking compensation for this loss. The model used to quantify bird and aquatic faunal injury also evaluated potential injury to mammals, and did not predict any mortalities to mammalian species. The Trustees examined evidence of injury to mammals and other resources, and have determined that none of those potential injuries merited further assessment efforts. The Trustees are reassured by the fact that the selected ecological restoration project (see Section 5.4.1.2) will benefit a number of resources, thereby helping to ensure that the public and environment are made whole in the event that some injury was missed in the assessment.

4.2 ASSESSMENT STRATEGY

The goal of injury assessment under OPA is to determine the nature and extent of injuries to natural resources and services, thus providing a technical basis for evaluating the need for, type of, and

scale of restoration actions. The assessment process occurs in two stages: injury determination and injury quantification.

Injury determination begins with the identification and selection of potential injuries to investigate. The OPA regulations allow the Trustees to consider several factors when making this determination, including, but not limited to:

- the natural resources and services of concern;
- the evidence indicating exposure, pathway and injury;
- the mechanism by which injury occurred;
- the type, degree, spatial and temporal extent of injury;
- the adverse change or impairment that constitutes injury;
- available assessment procedures and their time and cost requirements;
- the potential natural recovery period; and
- the kinds of restoration actions that are feasible.

The Trustees considered all of the above-listed factors when making injury determinations for this incident. A list of the injury categories carried forward into the Restoration Planning Phase for the Westchester incident is provided in the first column of Table 4-1. As indicated in the table, the Trustees assessed possible injuries to four categories of ecological resources and recreational fishing and hunting losses. These categories were selected based on input from preassessment activities; local, state and federal government officials; the RPs; and others knowledgeable about the affected environment.

For each potential injury, the Trustees determine whether an injury has occurred, identify the nature of the injury and identify a pathway linking the injury to the incident. Injury is defined by the OPA regulations as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service" (15 C.F.R. § 990.30). The assessment methods used for the incident are described in the second column of Table 4-1. Where feasible, the Trustees use simplified, cost-effective procedures and methods to document resource injuries.

Table 4-1
ASSESSMENT METHODS FOR POTENTIAL RESOURCE AND SERVICE INJURIES

Aquatic Fauna	Injury estimate developed by Trustees using a site-specific modeling approach.
Birds	Injury estimate developed by Trustees using a site-specific modeling approach.
Habitat Services	Injury estimates developed by Trustees using information gathered during the response and Trustee site visits, together with Trustees' experience from previous spills and knowledge of local agency experts and other experts.
Recreational Human Use	Recreational loss estimate developed using a benefits transfer approach with consumer surplus estimates from literature and normal recreational use estimates from local agency experts.

The Trustees considered the following factors in selecting appropriate assessment procedures:

- the range of procedures available under the OPA regulations at 15 C.F.R. § 990.27(b);
- the time and cost necessary to implement the procedures;
- the potential nature, degree, and spatial and temporal extent of the injury;
- the potential restoration actions for the injury; and
- the relevance and adequacy of information generated by the procedures to meet information requirements of restoration planning.

Accordingly, depending on the injury category, the Trustees rely on information and methodologies from relevant scientific literature, literature-based calculations, and models and/or focused injury determination and quantification studies in assessing injury. Best professional judgement of local experts, Trustees familiar with effects of oil in similar environments, and others is also utilized, when appropriate.

If the Trustees determine that a resource has been injured, the injury may be quantified as the next step in the assessment. The injury quantification process determines the degree and spatial and temporal extent of injury relative to baseline, and therefore forms the basis for scaling restoration actions. Baseline refers to the condition that the resource would have maintained but for the effects of the incident.

4.3 SUMMARY OF ASSESSMENT METHODS

Injury quantification for aquatic fauna and bird resources begins with developing an estimate of the number of animals killed. Possible sublethal injuries to populations also are considered, if the Trustees have evidence that such effects might be important. Quantification of injury to habitats begins with an estimate of the amount of acreage affected, and the amount of habitat service flow reduction.

Once the magnitude of injury is established, Trustees estimate the recovery time required for the resource to return to baseline condition. The actual biological processes that determine recovery from an oil spill are complex. Both the magnitude of injury and recovery time must be considered when scaling compensatory restoration actions. For resources such as fish, under the specific circumstances of this incident, it is helpful for scaling purposes to express the injury in terms of biomass lost. To include recovery time as part of the lost biomass estimate the Trustees calculate the growth foregone for animals killed by the incident during the recovery period. Growth foregone in each year after the incident is discounted at three percent per year, summed, and added to the injury in the year of the incident to generate an estimate of total injury. The discounting calculation accounts for differences in timing between the initial kill and later years when growth is foregone. After discounting, the total injury is expressed in present terms as of the date of the initial kill[3]. The discount rate of three percent approximates society's rate of time preference. Discounting reflects the greater value that people assign to goods and services now, compared to in

[3] The year 2000 was used as the "present year" for the purpose of discounting.

the future. For additional discussion concerning discounting, please refer to the NOAA technical document on discounting (NOAA, 1999) which is available at the following website:

http://www.darp.noaa.gov/darporg/publicat.htm.

For habitat injury, the injury is quantified as acre-years of lost habitat services, and is discounted in a similar fashion as faunal injuries. An acre-year of habitat services is the flow of benefits that one acre of habitat provides to the entire ecosystem over the time period of one year. For example, an acre-year of marsh services is the totality of services provided by one acre of marsh over the period of one year.

Diminution in recreational use of natural resources constitutes an injury as defined by the OPA regulations, in that use by the public constitutes a service provided by natural resources (15 C.F.R. § 990.30). Recreational injury analysis starts with estimating the number of affected user-trips for each activity. Affected trips can be trips that are totally forgone, trips to alternate, less-preferred sites, or trips to the affected area where the value of the trip is diminished because of the injuries and response activities. Economists often use the average consumer surplus as the measure of the net economic value for a recreation trip. Consumer surplus is the measure of an individual's value of a good, in this case recreational hunting and fishing, above and beyond any payments that are necessary to obtain that good.

For incidents such as the Westchester oil spill, in which the number of affected trips was relatively small, use of literature values to estimate the reduction in benefits, rather than site-specific studies, is a reasonable approach. This method of estimating the value (consumer surplus) of an affected hunting or fishing trip by the public is known as benefits transfer. Benefits transfer utilizes value estimates previously generated for other similar activities through extensive survey-based analyses to estimate a value for the specific activities in question. This method applies the per day consumer surplus estimates as reported in the existing literature for fishing and hunting in Louisiana (when available) and in comparable areas of the United States to the estimated number of hunters and anglers impacted by the Westchester spill. All literature estimates must be adjusted for inflation, based on the Consumer Price Index. Once the loss (reduction in value) associated with each affected trip is then estimated, the loss per trip estimate is multiplied by the estimate of the number of affected trips in order to determine the total loss.

4.4 INJURIES TO SPECIFIC RESOURCES AND SERVICES

The following sections of this chapter describe the results of the Trustees' injury determination and quantification efforts for the incident that were conducted subsequent to the Preassessment Phase. For some of the injuries, preliminary scoping injury analyses, using conservative assumptions that would tend to produce an upper-end injury estimate, indicated that the amount of potential injury was relatively low. For those injuries, the Trustees chose not to further refine the injury estimates. Although additional analysis would likely reduce the estimated injury for some affected resources and services, such work and expense was judged to be unnecessary given the kinds of cost-effective restoration alternatives available to redress those injuries. The cost of refining the injury estimates would be greater than the potential reduction in the cost of implementing restoration with scaling

based upon the preliminary estimates. The Trustees provided the RPs with documents that formed the basis for the injury estimates, and discussed the assessment strategy used with them. However, as discussed in the following chapter, the RPs recognized that there were very cost-effective restoration alternatives available and agreed with the Trustees that further work to refine the injury estimates would not be reasonable given the availability of these alternatives. Thus, the agreement to move forward to find and scale appropriate restoration alternatives without further refining the injury estimates does not necessarily indicate that the RPs agree with all of the approaches used by the Trustees or the results obtained. Potential injuries that were assessed in the Restoration Planning Phase are organized into four categories: aquatic fauna, birds, habitats, and human use (recreation).

4.4.1 **Aquatic Fauna**

The lower Mississippi River and delta area is heavily used by aquatic fauna, including blue crabs, shrimp, and other invertebrates, and numerous species of fish.

4.4.1.1 Determination of Injury

Water samples collected by the Trustees on December 1-2, 2000, indicate that polycyclic aromatic hydrocarbons (PAHs) were present in the water column at levels which likely resulted in some mortality to aquatic organisms, especially in the early portion of the incident (see appendix F in French and Galagan, 2001). Although some dead fish were observed along the shoreline, the fish species observed tended to be offshore species and were probably shrimp fishery by-catch, rather than spill-related mortality.

4.4.1.2 Injury Quantification Strategy

The Trustees determined that the cost of conducting a large field study to investigate aquatic faunal injuries was not warranted, given the specific circumstances of this incident. A field effort designed to quantify injuries to fish, shellfish, and other aquatic organisms would be very expensive, and the natural variability that exists in the aquatic fauna in this region would have made it difficult to detect the magnitude of injuries that the Trustees believed were present. Although some aquatic mortalities were observed, as noted above, there were not any dramatic fish kills or strandings of large numbers of organisms as sometimes occur following releases of petroleum products (e.g., North Cape oil spill, and others). Given the visual evidence suggesting that the magnitude of injury to aquatic organisms was relatively small, the Trustees decided to use a modeling approach to quantify injury to aquatic fauna.

The Trustees decided to develop a site-specific modeling approach, using some algorithms from the Natural Resource Damage Assessment Model for Coastal and Marine Habitats (Version 2.4, April 1996), modified to account for the specific circumstances of the incident. The resultant injury estimate includes the direct predicted mortality as well as an estimate of the lost somatic growth that would have been expected had these organisms not been killed. The model estimates that approximately 19,400 kg of aquatic fauna was lost as a result of this incident.

This injury category, as evaluated by the model approach utilized by the Trustees, estimates the aquatic injury that resulted from death due to exposure to predicted concentrations of low molecular weight PAHs in the water column in the early days following the incident. The model also estimates the resulting loss in growth of the aquatic fauna predicted to have died from exposure to PAHs[4]. It does not account for a reduction in aquatic faunal production that resulted from reductions in habitat service flows supporting aquatic fauna. Losses due to a reduction in habitat services supporting aquatic organisms are accounted for in the assessment of injury to these habitats.

The Trustees and the Westchester RPs agreed to move forward with identifying an appropriate restoration alternative to compensate for these losses. The selected restoration option and the scaling approach are discussed in Chapter 5.

4.4.2 **Birds**

The lower Mississippi River and delta area is used by a variety of bird species, including mottled ducks, snowy egrets, great egrets, Louisiana herons, sandpipers, rails, gulls, and terns. Individuals of several species of birds, including white and brown pelicans, great blue herons, and double-crested cormorants were reported as oiled.

4.4.2.1 Determination of Injury

Although only fifteen dead birds were documented, the Trustees believe that additional birds were killed as a result of direct exposure to the oil in the first few days following the incident. Oil from the release was documented to cover hundreds of acres of surface waters and shoreline habitats where numerous birds were seen.

4.4.2.2 Injury Quantification Strategy

The large size of the affected area and the complexity of the extensive marsh and shoreline vegetation and batture habitats in which dead birds would be difficult to find, were practical obstacles in determining bird injury. Additionally, many birds may have been carried down river away from the incident site or drawn underwater by river currents during the first evening and not observed. Rather than try to conduct an extensive field survey whose results (and restoration needs based on those results) would likely not be proportionate to the amount of time and expense required for such a survey, the Trustees decided to use a site-specific modeling approach. This approach used many algorithms from the Natural Resource Damage Assessment Model for Coastal and Marine Habitats (Version 2.4, April 1996), along with new algorithms to account for the specific circumstances of the incident, and updated habitat data. Bird species composition and abundance data used in the model were taken from the survey conducted by Trustee representatives on November 30, 2000. The Trustees' model estimates that approximately 582 birds were lost as a result of the incident from impacts due to oil released from the vessel (French-McCay and Galagan,

[4] The model also includes the effects of the direct kill of lower trophic levels (e.g., plankton, forage fish not individually tabulated as injured, and others) on higher trophic levels (such as fish and birds), as a component in the injury estimate for higher trophic level organisms. The estimated injury associated with food web losses is a very small component of the total aquatic fauna or bird injuries (French and Galagan, 2001).

2001). Of this total, approximately 75 percent of the estimated avian mortalities are cormorants, 19 percent are gulls, and five percent are terns.

In this model, all birds that are "oiled" by contact with the slick are assumed to have been killed. This is a conservative assumption in that it is possible that some of the oiled birds did not die. The Trustees believe, however, that a significant proportion of the birds that were exposed to oil likely died. It is not unexpected that only a small proportion of expected bird mortalities were found, because dead birds can be subject to predation, sinking, or could have been hidden in the thick marsh vegetation. This approach does not address possible sub-lethal impacts on birds, including potential reduction in growth or reproduction (but see footnote 4).

This injury category, as evaluated by the Trustees' modeling approach, estimates the bird injury that resulted from death due to exposure to surface slicks that were present in the early days following the incident. It does not estimate the potential reduction in bird production that resulted from reductions in habitat service flows supporting birds. Losses due to a reduction in habitat services supporting birds are accounted for in the assessment of injury to the affected habitats

The Trustees and the Westchester RPs agreed to move forward with identifying an appropriate restoration alternative to compensate for these losses. The selected restoration alternative and the scaling approach are discussed in Chapter 5.

4.4.3 **Habitats**

A number of different types of habitats are present in the area affected by oil from this incident. Both vegetated (freshwater river shoreline vegetation and delta marsh) and unvegetated (rip-rap and sandflat) habitats provide ecological services to the Mississippi River delta ecosystem that were impacted due to this release.

4.4.3.1 Determination of Injury

The trajectory of the oil and the extent of oiling were documented frequently during the initial response using overflights, on-water surveys, and Shoreline Cleanup Assessment Teams. Trustees participated in many of these activities throughout the early portion of the response, and additionally made a joint site visit with RP representatives on December 11, 2000. A number of habitats were exposed to oil. These habitats include rip-rap, fresh marsh and freshwater edge of slough, sandflats, mudflats, and delta marshes.

4.4.3.2 Injury Quantification Strategy

Based on observations made by Trustees and response personnel, the Trustees developed conservative assumptions to use in a preliminary Habitat Equivalency Analysis (HEA)[5]. This HEA

[5] HEA is an approach that has been used successfully for scaling restoration actions at a number of locations in Louisiana, and around the country. In brief, HEA is a technique that balances “debits” (habitat or other injuries) that have occurred as a result of an incident against compensatory “credits” (resources and services provided by habitat restoration projects). It uses a discount factor to account for the difference in time between when the injuries were

was intended to give the maximum likely amount of injury (ecological service loss) that could have occurred as a result of this incident in order to guide in the development of an injury assessment approach. However, even with the conservative assumptions employed in this preliminary effort, the HEA results suggest that the level of injury to the affected habitats was relatively small. Given this result, and the fact that very cost-effective restoration alternatives exist to compensate for these injuries (discussed in Chapter 5), the Trustees did not seek to refine the injury estimate further at this point. The Trustees, without disagreement from the RPs, decided to use the preliminary results when exploring the type and scale of an ecological restoration project. This was judged a more cost-effective approach than generating additional assessment costs to refine the injury estimate. This judgment was ultimately borne out. Although further refinement would likely reduce the estimate of injury, it would not lower the cost of the implementing the selected restoration project, for reasons described in Section 5.4.1.2.3.2. For more information on HEA, see the technical document (NOAA, 2000) on this scaling approach also available at the web site cited above.

This injury quantification approach attempts to take into account reductions in the entire flow of habitat services. It is intended to account for a reduction in bird production that resulted from reductions in habitat service flows supporting birds. Likewise, it is intended to account for a reduction in aquatic faunal production from reductions in habitat service flows supporting fish, shrimp, crabs, and other aquatic fauna. It is also intended to capture the loss of other habitat services.

4.4.3.2.1 Freshwater Vegetated Habitats

There are a number of different vegetated habitats along the river above the head of passes that have been lumped together in this analysis. The first of these is the partially vegetated mudflats that are primarily located in batture areas. The vegetation ranges from herbaceous grasses to small trees, which are located along the edges of the flats. A total of 15.4 acres of mudflat was moderately oiled. Although some of the mudflat is not vegetated, for the purpose of this analysis it is being treated as if entirely vegetated[6]. The second type is the vegetated banks of sloughs, of which approximately 0.5 acres were heavily oiled. The last type of vegetated habitat located along the river is fresh marsh. A total of approximately 0.9 acres of fresh marsh was oiled, with the vast majority being heavily oiled. In the preliminary analysis, the Trustees assumed that the entire 16.8 acres of these different vegetated habitats had an initial service loss of 50 percent, with full recovery of service flows occurring 12 months following the incident. This assumption of initial service loss is higher than that which would normally be expected from the nature of the oiling of these habitats, based upon the Trustees' experience from past spills. The recovery period is likely to shorter than that assumed, due to the dynamic nature of the Mississippi River with substantial water

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suffered and when the restoration services are delivered. The final output of the HEA for this incident is a quantitative calculation of the number of acres of habitat to be created to fully compensate the public for the injuries resulting from the spill.

[6] The mapping of habitats was not of sufficient resolution to distinguish the vegetated from the non-vegetated portions of mudflats or, as described later, sandflats. To account for this, the Trustees treated the mudflats as being entirely vegetated and the sandflats as being entirely unvegetated. For the purpose of this preliminary analysis, such an approach is conservative, because there was likely to be less vegetated acreage than was assumed in the analysis. However, as discussed in Section 5.4.1.2.3.2, the amount of restoration required to compensate for all habitat injuries is very small compared to that required for faunal injuries; therefore, the assumption that all oiled mudflat is vegetated has little effect on the results.

level fluctuations and scouring/shoaling. This conservative analysis indicates that up to approximately 3.7 discounted service acre-years (DSAYs) of freshwater vegetated habitat services were lost.

4.4.3.2.2 Rip-rap Habitat

This habitat is composed of cobble to boulder-sized pieces of rock that have been placed along the river edge for shoreline protection, but rip-rap also provides a substrate for the attachment of algae and refugia for some fish and invertebrates species (Curry, 2000) as well as other ecological services. A total of 11.14 acres of rip-rap were oiled as a result of this incident. Of this total, approximately 7.1 acres were heavily oiled, 2.5 acres were moderately oiled, and 1.6 acres were lightly oiled. In the preliminary analysis, the Trustees assumed that the entire 11.14 acres of rip-rap initially suffered a complete service loss, with a six-month recovery period to baseline service levels. The six-month recovery period is judged to be conservative because the approaching high-flow period would have removed residual oil, and recovery of habitat like rip-rap in the Mississippi River from disturbance is very rapid (Carl Way, Barry Vittor and Associates, pers. comm.). Using these conservative assumptions, the injury to rip-rap habitat is estimated at 2.3 DSAYs of rip-rap habitat services.

4.4.3.2.2 Sandflat Habitat

This habitat type consisted of flats made up of fine-grained sand, exposed during low water. Although there is some vegetation along the edges of some of these flats, for the purposes of this analysis, sandflat habitat is treated as being entirely unvegetated. Treating this habitat as being totally unvegetated will serve to offset the unvegetated areas of mudflats that were treated as if they were entirely vegetated. A total of 7.23 acres of sandflat habitat was heavily oiled. In the preliminary analysis, the Trustees assumed an initial 100 percent loss of service due to the heavy coating of oil, recovering to a 25 percent loss of service after one month, with full recovery to baseline service flows assumed to occur one year following the incident. The Trustees believe that the effective removal of oil from the flats during the response, and the effects of the following high-flow period, resulted in a quicker recovery than was assumed in the preliminary analysis. The HEA analysis, using these conservative assumptions, indicates that 0.8 DSAYs of unvegetated sandflat services were lost.

4.4.3.2.3 Delta Marsh Habitat

The marsh located west of the river below Venice, Louisiana, was exposed to only sheen, not black oil. No quantitative estimate of the acreage of this marsh that was exposed to sheen was made during the response, primarily because no cleanup activities took place in these areas due to the limited exposure. The Trustees have estimated that 100 acres or less of this marsh (vegetated area only, not including surface waters) were exposed to sheen and suffered an initial ten percent loss of service recovering to full service flows six months following the incident. The service flow reduction used in this analysis was similar to, but greater than, that used in the Lake Barre NRDA for similarly oiled marsh (Trustees, 1999). This conservative analysis suggests that 2.0 DSAYs of delta marsh services may have been lost.

4.4.4 **Human Recreational Use**

Recreational hunters and anglers often visit the lower Mississippi River and delta area, and their use of the area was affected by the closure of the river to navigation. Restrictions on boat launching sites due to use by response personnel, the closure of locks at Empire and Ostrica, and placement of booms at Baptiste Collette Bayou, The Jump, and Cubit's Gap also potentially affected recreational use of the Mississippi River delta.

4.4.4.1 Determination of Injury

The official closure of the river to navigation began on November 29, 2000. The river was opened to upriver traffic late in the afternoon on November 30, 2000, and to down river traffic on December 1, 2000. The incident occurred during the waterfowl-hunting season in Louisiana, and access to the DWR and the PAL, two prime hunting and fishing sites, was restricted due to the incident. Access to private hunting camps was also affected by this incident.

4.4.4.2 Injury Quantification Strategy

The Trustees considered two major types of recreational injuries from this incident: losses of hunting and fishing access. Other recreational human uses may also have been affected, such as bird and wildlife viewing, but such uses were judged by the Trustees to be relatively minor uses during this time of year. Although the actual navigation closure on the river was partially lifted on November 30, 2000, and completely lifted on December 1, 2000, the Trustees assumed that full use of the area resumed on December 4, 2000. This assumption ignores any restrictions on use of access points to the river that may have existed due to on-going cleanup activities that continued into February 2001. The number of anglers expected on weekends and weekdays was estimated based on the Louisiana Marine Recreational Fishing Statistics Survey. An estimate of typical weekday and weekend hunting pressure for the DWR and PAL and private hunting camps was derived through interviews with DWR and PAL resource managers. Overall, it is estimated that 655 angler and 804 hunter trips were affected (Galvin, 2001a).

The Trustees conducted a literature review to derive consumer surplus estimates. The values found in the review for recreational hunting range from $38.41 to $62.30 per trip. The values obtained for recreational angling range from $40.17 to $109.88 per trip. For recreational lost use, using the estimated number of affected trips and the range in consumer surplus for both hunting and fishing activities, the total combined estimated loss ranges from $57,193 to $122,060. The Louisiana-specific studies in the literature for hunting and fishing consumer surplus were on the high-end of the spectrum, so the Trustees feel most comfortable with the high end of the estimated range of loss. However, given the relatively low value of even the upper-end of this range, the Trustees decided to forgo further refinement of the injury estimate. The cost of doing additional research to get a better estimate would be prohibitively costly given the small potential value of the loss. For more details on the assessment of the recreational injury, see Galvin (2001a).

4.5 **INJURY SUMMARY**

After evaluating the potential natural resources and services (including human recreational use) that

could have been affected by the Westchester incident, the Trustees selected aquatic fauna, birds, habitats (freshwater vegetated habitat, rip-rap habitat, sandflat habitat, and delta marsh habitat), and recreational hunting and fishing as requiring assessment. The assessment results for these injury categories are presented in Table 4-2. The Trustees judged that the evidence for injury to other resources and services did not merit further assessment, and no restoration actions are required for them.

Table 4-2
TRUSTEES' ESTIMATES OF RESOURCE AND SERVICE INJURIES

Injury Category	**Injury Estimate**
Aquatic Fauna	19,396 kilograms of finfish and shellfish biomass (direct kill and production foregone) were lost as a result of the incident
Birds	Approximately 582 birds were killed from exposure to oil
Habitat Services	3.7 DSAYs of freshwater vegetated habitat services
	2.3 DSAYs of rip-rap habitat services
	0.8 DSAYs of sandflat habitat services
	2.0 DSAYs of delta marsh services
Recreational Human Use	The combined recreational hunting and fishing loss estimate ranges from $57,193 to $122,060

RESTORATION ALTERNATIVES CHAPTER 5

The overall objective of the restoration planning process is to identify restoration alternatives that are appropriate to restore, rehabilitate, replace or acquire natural resources and their services equivalent to those injured or lost as a result of incidents involving the discharge or the significant threat of a discharge of oil. This chapter lays out the restoration screening and selection process undertaken by the Trustees to address restoration requirements for injuries resulting from the Westchester incident.

5.1 RESTORATION STRATEGY

The goal of restoration under OPA is to make the environment and public whole for injuries to natural resources and services resulting from incidents involving the discharge or threat of a discharge of oil. Restoration actions under OPA are termed primary or compensatory.

Primary restoration is any action taken to accelerate the return of injured natural resources and services to their baseline condition. Natural recovery, in which no human intervention is taken to directly restore the injured natural resources and/or services to baseline conditions (following all response actions) is always considered as a primary restoration alternative (and is equivalent to the NEPA No Action alternative). Natural recovery is the appropriate restoration alternative in situations where feasible or cost-effective primary restoration actions are not available, or where the injured resources will recover relatively quickly without human intervention. Active primary restoration actions (as opposed to natural recovery) are appropriate in situations where injured resources will not recover, or will recover slowly, without taking steps to bring about or speed recovery, and where feasible and cost-effective methods exist to assist recovery to baseline.

Compensatory restoration is any action taken to compensate for interim losses of natural resources and/or services pending recovery to baseline. The no compensatory restoration action alternative (NEPA's No Action alternative) is appropriate for a resource or service which was not injured or, if injured, for which appropriate restoration actions meeting the OPA criteria (see Section 5.3) are not possible. The scale of the required compensatory restoration is dependent on both the initial size of the injury and how quickly each resource and/or service returns to baseline. Primary restoration actions that speed recovery will reduce the requirement for compensatory restoration.

To plan restoration for injuries resulting from the Westchester incident, the Trustees first considered possible primary restoration actions for each injury and determined whether primary restoration can and should be implemented. The Trustees then considered the type and scale of compensatory restoration that can best compensate for lost resources and/or services during the recovery period.

Restoration alternatives must be scaled to ensure that their size appropriately reflects the magnitude of injuries resulting from the incident. Where feasible and otherwise appropriate, the Trustees employ a resource-to-resource scaling methodology. Under this approach, the Trustees determine the scale of restoration actions that will provide natural resources and/or services of the same type

and quality and of comparable value to those lost. Here, equivalency is obtained between the resources and/or services lost and those to be provided through restoration.

If a reasonable range of alternatives providing natural resources and/or services of the same type and quality and comparable value to those lost cannot be identified, other compensatory restoration actions may be considered. These other compensatory restoration actions must, in the judgment of the Trustees, provide services of comparable type and quality as those lost. When restoration provides resources or services not of comparable value as those injured, the Trustees must determine the appropriate trade-off between the injured resources and those provided by restoration.

The scaling calculations set forth in this chapter are based on straightforward methods combined with available data and the best professional judgment of the Trustees. More precise scaling calculations often are not possible due to one or more of the following factors: incomplete knowledge of the relevant physical and biological processes; uncertainties about important project-specific scaling parameters; or the high cost of obtaining additional site-specific data, relative to the likely gains associated with collecting this information. Where data are unavailable or prohibitively costly to collect, there is uncertainty in the true value for required inputs to the scaling calculations. In these instances, the Trustees used conservative assumptions that will ensure that the amount of restoration is sufficient to make the public and environment whole. More complex scaling calculations would be difficult and expensive to undertake and would not significantly improve the accuracy of the scaling results in this case. Moreover, the cost required to refine the scaling would be unjustified, given the availability of extremely cost-effective restoration alternatives. Specific scaling assumptions and calculations are described later in this chapter. The Trustees assume that restoration alternatives will be implemented in the year 2002. In the event that actual implementation occurs after this date, the Trustees will appropriately revise the scaling calculations.

The Trustees shared the scaling methods and results with the RPs as part of the cooperative NRDA process. However, both the RPs and Trustees agreed that, given the outcome of the search for appropriate and cost-effective restoration alternatives, as well as the outcome of the Trustees' scaling performed for the selected restoration alternatives, further refinement of the scaling analyses was not warranted. The acceptance of the outcome of the scaling by the RPs does not necessarily indicate agreement with all of the methods or assumptions used by the Trustees.

5.2 GENERAL RESTORATION ALTERNATIVES

In accordance with the OPA regulations, the Trustees, working cooperatively with the RPs, developed a reasonable range of restoration alternatives and chose preferred alternatives for each injury category which were presented for public comment in the Draft DARP/EA. For this incident, this was a two-step process. The Trustees first identified and evaluated general alternatives capable of serving as primary or compensatory restoration for the injured natural resources and/or services (the later evaluation of specific restoration alternatives is described beginning in Section 5.4). As part of the effort to develop general restoration alternatives, the Trustees and RPs sought input from a variety of local government officials and state and federal agency representatives knowledgeable about the Mississippi River delta ecosystem. These efforts

were important in identifying projects that have the potential to be feasible, have strong net environmental benefits, be acceptable to the local public, and meet restoration requirements to compensate for injuries resulting from the incident. The results of the restoration alternative identification and evaluation process are summarized in Table 5-1, located in Section 5.5.

The OPA regulations require the Trustees to preferentially seek to restore injured natural resources in-kind (e.g., create new marsh to compensate for lost marsh function) and in the geographical vicinity affected, while working to maximize ecosystem benefit, benefit to human uses of the environment (such as fisheries), and cost-effectiveness of restoration as a whole. However in-kind restoration is not always possible and, in those instances restoration of alternative resources that provide similar ecological benefits may be appropriate. Finally, increased benefits and improved cost-effectiveness may often be obtained by addressing several injured resources and/or services or classes of injury with a single restoration project. The logic for selecting alternatives that provide a different resource or service as compensation is described in detail in Section 5.3.

5.3 EVALUATION OF GENERAL RESTORATION ALTERNATIVES

Once a reasonable range of restoration alternatives is developed, the OPA regulations (15 C.F.R. § 990.54) require the Trustees to identify preferred restoration alternatives based on certain criteria. The following criteria, presented in the order given in the regulations, were used:

- the cost to carry out the alternative;
- the extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses;
- the likelihood of success of each alternative;
- the extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury as a result of implementing the alternative;
- the extent to which each alternative benefits more than one natural resource and/or service; and
- the effect of each alternative on public health and safety.

The OPA regulations give the Trustees discretion to consider how to prioritize the criteria, and allow additional criteria to be used. The key criterion for the Trustees for the Westchester NRDA is the second in the list, because this criterion most clearly indicates whether the goal of making the public whole from losses resulting from the incident is met.

Based on a thorough evaluation of a number of factors, including the criteria listed above, the Trustees chose general preferred (now selected) restoration alternatives for primary and compensatory restoration of injured natural resources and/or services (highlighted in Table 5-1). Information relevant to the Trustees' selection of restoration alternatives is provided throughout the remainder of this chapter. In compliance with OPA and NEPA, the selection of restoration alternatives was finalized following public review and comment on the Draft DARP/EA.

5.3.1 <u>Primary Restoration</u>

Based on observations made in the impacted area and on experience gained from recovery of

similar habitats from previous oil spill incidents, the Trustees determined that all affected habitats would recover to baseline condition within a reasonably short period of time. The dynamic nature of the Mississippi River was also a factor in this determination. All of the injured habitats are expected to recover to baseline conditions within one year of the incident. Therefore, the Natural Recovery (No Action) option was selected as the primary restoration alternative for injured habitats. In addition, based on the magnitude of the estimated injury and site conditions, the Trustees determined that no additional actions were necessary to aid in the recovery of aquatic fauna or birds. Therefore, the natural recovery (no action) option was selected as the primary restoration alternative for these resources. Additionally, human recreational use of the river and areas accessible via the river is believed to have returned to baseline conditions shortly after the reopening of the river to vessel traffic, eliminating the need to consider implementing any active primary restoration for this injury.

After determining the appropriate primary restoration alternative for each injury (in this case, natural recovery for all injuries), the Trustees can proceed to determine the type and size of compensatory restoration actions to make the environment and public whole for interim losses to injured resources and/or services (i.e., affected habitats, birds, aquatic fauna, and human use). The evaluation of compensatory restoration alternatives is addressed below.

5.3.2 **Compensatory Restoration**

Consideration of general compensatory restoration alternatives for the different injuries is described below.

5.3.2.1 Habitats

Because interim losses of habitat services occurred during the period of recovery and technically feasible alternatives exist to compensate for these losses, the Trustees determined that compensatory restoration is required for injury to habitats, and the no compensation (no action) alternative was rejected. As discussed in Section 5.2, the preference under the OPA regulations is for in-kind restoration where possible and otherwise consistent with restoration selection criteria. Therefore in-kind restoration was first evaluated for each habitat type before considering other potential types of restoration. If in-kind restoration was not technically feasible, consistent with policies and regulations, cost-effective, or otherwise not appropriate, then other types of restoration that would provide similar services, were considered.

5.3.2.1.1 Freshwater Vegetated and Delta Marsh Habitats

The ecological services provided by the impacted vegetated habitats along the river and out in the delta are similar in many respects, and were therefore treated as a single habitat category to simplify the Trustees' evaluation process. Marsh creation, a common restoration type for shoreline vegetation injuries, was considered as an in-kind restoration type for the injuries to freshwater vegetated and delta marsh habitats.

Marsh creation is an alternative that is consistent with the criteria used by the Trustees to evaluate restoration alternatives. Created marsh will provide an outflow of organic material that will

generally benefit the lower Mississippi River and delta ecosystem by providing a source of organic carbon (energy supply supporting deltaic aquatic and coastal foodwebs). Created marsh will provide services benefiting a wide range of resources, including benthic invertebrate species that inhabit marshes and the bird and fish species that feed on them. By providing critical nursery habitat for shrimp, fish, and other aquatic species, and nesting and foraging habitat for birds and other wildlife, created marsh will benefit recreational uses of the area by supporting increased populations of these species. Marshes located in the Mississippi River delta provide critical over-wintering habitat for a large number of waterfowl. Therefore, this alternative would have clear overall benefits to the environment. Marsh would also benefit anglers by providing additional shoreline for enhanced fishing opportunities. Marsh creation projects typically have a high likelihood of success and tend to be very cost-effective to implement. Marsh creation is also consistent with state and federal government policies. Because in-kind restoration is feasible, cost-effective, and otherwise consistent with policies, marsh creation was chosen as the most appropriate restoration alternative for this injury.

Acquisition or preservation of existing marsh is another potential in-kind restoration alternative. This option is feasible and can, under certain circumstances, be highly beneficial. Acquisition and protection of existing marshes would have little negative impact compared to either creation or enhancement of marsh. No increase in service flows would occur through acquisition or protection alone. However, if a particular marsh site had unique qualities, its location was especially valuable, and its destruction was imminent, benefits derived by exercising this option might increase substantially. Therefore, unless a particular marsh site has these three characteristics, marsh acquisition would not be the preferred general alternative. The Trustees were not aware of any marsh with the required three characteristics in the vicinity of this incident to justify acquisition or preservation of existing marsh as the preferred general alternative.

Some out-of-kind restoration alternatives could also provide some of the vegetated habitat services lost. Oyster reef creation could provide habitat services, increase secondary production services, and other services that would serve as compensation for those lost in vegetated habitat. Because the injury to vegetated habitats is relatively small, use of an out-of-kind restoration alternative might be reasonable provided that that alternative was selected to compensate for other injuries. As discussed below, this is not the case for other ecological injuries for the Westchester incident. Therefore out-of-kind restoration alternatives are not appropriate to compensate for injury to freshwater riverine vegetated and delta marsh habitats.

5.3.2.1.2 Rip-Rap Habitat

Loss of rip-rap habitat services could be compensated by the placement of additional rock material to create new rip-rap structure. This restoration alternative would most closely replace lost services, has a very high likelihood of success, and would be relatively cost-effective. However, rip-rap habitat is not as productive as other potential habitats, such as marsh or oyster reef, which would provide more benefits to other natural resources than would rip-rap. Oyster reef restoration in this area is problematic, as discussed below in evaluation of injury to aquatic fauna, so marsh creation is a more feasible type of restoration for rip-rap injury resulting from this incident. Additionally, because marsh creation was selected as the preferred restoration approach for other habitat types, it is relatively cost-effective to create additional marsh as compensation for this injury. Created marsh

habitat will provide many of the same services as rip-rap habitat, including erosion protection, refugia for organisms, and as a site for primary and secondary production. Marsh creation is therefore chosen as the preferred (now selected) compensatory restoration alternative for rip-rap injury.

5.3.2.1.3 Sandflat Habitat

Similarly to the analysis of rip-rap habitat injury, in-kind restoration for sandflat injury is possible, but this injury is more appropriately compensated for by creation of marsh under the circumstances of this case. Created marsh will provide some of the same services as sandflats including habitat for benthic infauna and a site for primary and secondary production. Marsh will also provide many additional services, benefiting a wide-range of resources, above and beyond that provided by sandflat habitat. Additionally, because marsh creation was selected as the preferred restoration approach for other habitat types, it is relatively cost-effective to create additional marsh as compensation for this injury. Marsh creation is therefore selected as the compensatory restoration alternative for sandflat habitat injury.

5.3.2.2 Aquatic Fauna

The Trustees determined that technically feasible and cost-effective alternatives exist to compensate for interim losses to aquatic fauna. Thus, the Trustees determined that compensation was necessary for this injury, rejecting the no compensation (no action) alternative. The Trustees considered three types of restoration actions to compensate for injuries to aquatic fauna. The first of these was in-kind restoration (stocking). Because a variety of aquatic species would be expected to be killed as a result of a large oil spill on the lower Mississippi River (including both marine and freshwater species), targeted restocking of a particular species would not be appropriate to restore all of the affected species. Restocking several species would increase the cost of this type of alternative, compared to other alternatives. Furthermore, the carrying capacity for some species may be limited by habitat; and, therefore, simply placing additional animals in the area does not necessarily result in increased populations. Trustees have often used some form of habitat restoration to support increased populations of many aquatic species as a cost-effective method for addressing injury to a large number of different species simultaneously. If there had been a large injury to a particular species or a limited number of species, then stocking of the affected species would be more appropriate as a restoration alternative than it is for this incident.

Oyster reef creation can be an appropriate type of restoration for aquatic injuries under many circumstances. Oyster reef would support many marine and estuarine organisms, including many species of fish, provide an area for increased secondary productivity, while providing additional benefits such as a site for recreational fishing. Oyster reefs cannot be created in freshwater areas. Therefore, for an incident that affected many freshwater species, oyster reef creation is not as appropriate as it would be for an incident occurring in estuarine or marine waters. Furthermore, oyster reef restoration would not be expected to be successful within the general vicinity of the incident, due to the general low salinity regime in the vicinity of the incident and also the limited availability of waterbottoms suitable for oysters with appropriate salinity conditions that are not already leased. For these reasons creation of an oyster reef was not considered further as a restoration alternative for this injury.

Marshes are widely recognized as providing a suite of critical services for aquatic life. Marshes serve as spawning and nursery areas for many species of juvenile fish and shellfish, export detritus to surrounding waters, and can increase water quality by filtering sediments and other pollutants from the water column. In addition, marsh habitat provides many collateral benefits such as habitat for birds and mammals. As already discussed, marsh creation will benefit recreational use of the area by increasing production of important recreational species and their prey items. Marsh creation can be successfully and cost-effectively implemented. The rapid loss of coastal marshes in Louisiana due to subsidence and erosion is a serious threat to the ecology and economy of Louisiana. Efforts to offset the amount of marsh loss due to natural and man-caused processes, through marsh creation projects, are widely supported throughout the state. In addition, marsh creation is consistent with state and federal policies concerning wetlands and essential fish habitat.

5.3.2.3 Birds

The Trustees feel that technically feasible and cost-effective alternatives exist to compensate for interim losses to birds. Thus, the Trustees determined that the no compensation (no action) alternative was not appropriate compensatory restoration for this injury and considered three other alternatives for compensatory restoration: in-kind restoration through actions to directly increase bird populations, oyster reef creation, and marsh creation.

On two previous incidents occurring in inshore waters of the eastern half of Louisiana, the Trustees considered several actions that would directly compensate for bird losses by creating, enhancing, or protecting bird nesting sites: fenced enclosures to reduce predation on eggs and young, shelters to reduce predation on chicks, and wooden rafts and platforms to provide additional nesting sites. The goal of these actions would be to increase the number of fledgling birds. In some cases, these types of actions have been successful in increasing survivorship and augmenting avian populations. However, in the studies considered by the Trustees in evaluating this restoration alternative, success was greatest when the actions were taken in response to known problems that were limiting the reproduction of a specific, targeted species. The Trustees carefully considered and discussed these options with state and federal bird experts, including managers of nearby LDWF and USFWS wildlife refuges, when considering this option for the two previous incidents. The Trustees were discouraged from implementing these types of projects for those incidents, and circumstances of the Westchester incident were sufficiently similar to also reject this type of bird restoration alternative for this spill.

Another option considered was implementing habitat modifications to benefit birds. Among the type of action considered was to build up supratidal land with dredged material and to plant trees on this land. This type of restoration action would benefit neotropical migratory bird species by providing them with convenient resting locations. Another potential habitat modification considered was to remove exotic plant species and to plant native plants in their place. Although these types of actions would be very beneficial ecologically, the Trustees recognized that the bird species that would benefit from this alternative would primarily be different bird species than were affected by this incident. Bird species that were injured by the incident would benefit little from the implementation of this alternative. This factor was sufficient to end consideration of this form of restoration as a compensatory restoration alternative for this incident, given better alternatives.

The Trustees also considered creation of an oyster reef as a restoration alternative to benefit birds. A created oyster reef would serve as a substrate for increased secondary productivity, would support fish, and therefore could provide feeding areas for some bird species. If constructed appropriately, it could provide an important resting area for birds during low tides. As discussed in Section 5.3.2.2, oyster reef creation would also have some very positive benefits to fish, other organisms, and recreational fishing. Although technically feasible, creation of an oyster reef in the Mississippi River delta area is not practical because there are few available waterbottoms with appropriate salinity and bottom strata characteristics not currently leased for oyster production. Therefore, this alternative was not deemed viable for compensation for bird injuries.

The Trustees decided that the preferred (now selected) compensatory restoration action for bird injury is marsh creation within the Mississippi River delta. As discussed in Section 5.3.2.1.1, marshes provide many services including nesting, cover, and foraging habitat for a variety of bird species, including many of those species found to be injured. In addition, marshes export detritus to the surrounding aquatic environment, which serves as a food source for bird prey organisms. Given the importance of marsh as habitat for birds, and because of the many other collateral benefits marsh provides, the Trustees determined that creation of marsh was the most beneficial compensatory restoration alternative for bird injuries resulting from the Westchester incident. This selection is also a very cost-effective alternative given that marsh creation was chosen as the preferred (now selected) restoration alternative for other ecological injuries caused by this incident.

5.3.2.4 Scaling Marsh Creation Requirements for Habitat, Aquatic Fauna, and Bird Injuries

The size of marsh restoration was determined using Habitat Equivalency Analysis (HEA), a resource-to-resource scaling approach that is used to determine compensation for lost services based on the quantification of incident-related natural resource injuries. HEA considers several project-specific factors in scaling restoration, including elapsed time from onset of injury to restoration implementation, relative productivity of restored habitats (that is, the proportional equivalence of ecological services provided by the compensatory restoration project compared to the baseline condition of the relevant injury categories), the time required for created habitats to reach full-function (i.e., maturity), and project lifespan. Therefore, identification of a preferred (now chosen) restoration project, with its own unique characteristics, was necessary before HEA could be applied. Section 5.4.1.2 discusses selection of the marsh creation alternative and provides a detailed description of project scaling using HEA.

5.3.2.5 Human Recreational Use

Human recreational use was primarily affected by the restrictions on use of the Mississippi River, either directly as a result of the closure of the river to navigation or indirectly through inability to access the river due to closure of locks, use of launch sites by response personnel, and other factors. The Trustees therefore treated actions that would serve to increase access to the natural resources of the Mississippi River delta as in-kind restoration. Numerous alternatives exist that would act to increase access for hunting and fishing and that are feasible, cost-effective, and otherwise consistent with the restoration selection criteria. Therefore, the Trustees chose increasing access to natural resources in the Mississippi River delta as the general restoration alternative to compensate

for lost human use due to this incident. The evaluation of specific restoration project alternatives to increase access is discussed beginning in Section 5.4.2.

5.4 EVALUATION OF SPECIFIC RESTORATION ALTERNATIVES

Once a general restoration type has been chosen to address a specific injury or injuries, the Trustees must evaluate among possible project alternatives to identify the project or projects of that restoration type that best meets the restoration selection criteria. The evaluation process for identifying a marsh creation project and a recreational access enhancement project is described in the following sections.

5.4.1 Evaluation of Marsh Creation Alternatives

The Trustees chose marsh creation as the compensatory restoration project for all ecological resource injuries. Because marsh restoration is a broad category that could include many types of actions and sites, the Trustees completed the second step of the evaluation process: the development of a range of project-specific marsh restoration alternatives and selection of a preferred alternative from that list submitted for public review and comment. The selection process for these marsh restoration alternatives is described in greater detail below.

First, the Trustees compiled an initial comprehensive list of possible marsh creation project alternatives from local agency experts, Plaquemines Parish officials, and from representatives of the RP. The Trustees then conducted an evaluation of the suggested projects using the OPA restoration selection criteria, discussed above, to identify the most appropriate project as the preferred restoration alternative to compensate for habitat, bird, and aquatic fauna injuries. The Trustees also sought input from Plaquemines Parish representatives on their views of the various projects in a meeting where some of the more attractive marsh creation restoration projects were discussed. Section 5.4.1 describes the selection process. Sections 5.4.2 through 5.4.4 provide detailed information for the selected restoration alternative and the three other, non-selected alternatives.

5.4.1.1 Preliminary List of Marsh Restoration Alternatives

The Trustees and the RP actively solicited restoration ideas and input from appropriate staff within Plaquemines Parish, state and federal agencies and from other interested parties. The suggestions received fell into four categories of marsh creation methods. These methods are:

1. cut a crevasse through a river pass bank to allow a splay marsh to form;
2. reconfigure a U.S. Army Corps of Engineers (COE) spoil disposal area to create marsh by cutting channels to create flow and either allow natural colonization or plant marsh vegetation;
3. dredge material and deposit it as ‘islands’ at appropriate elevations and allow natural colonization of marsh; and
4. create berms for COE to later fill with maintenance dredging material that would otherwise be uncontained, and plant with marsh vegetation when sufficiently de-watered.

These marsh creation alternatives were evaluated using the same OPA restoration selection criteria as were used to evaluate among the broader types of general restoration alternatives as discussed in Section 5.3.

5.4.1.2 Selected Alternative: Cut a Crevasse to Form a Splay Marsh

A crevasse will be cut through a bank to allow sediment-rich water to flow out into shallow water where the sediment settles, allowing vegetation to colonize and form a splay marsh.

5.4.1.2.1 Project Description

A crevasse will be cut in the bank along South Pass, in the PAL, to allow suspended sediment to flow out into a shallow receiving basin. As the sediment enters this area, water velocity will decrease, causing much of the suspended sediment to settle. Eventually as the sediment builds up forming mudflats, vegetation, such as *Sagittaria*, will begin to colonize the area, thereby increasing the rate of settling. *Sagittaria* is highly prized as a food item for some waterfowl species. Eventually other plant species will colonize the area as the elevation of the deposited material increases. The process will continue as long as the crevasse is open, with the advancing edge of the splay made up of plants such as *Sagittaria*, and the older sections composed of marsh vegetation such as *Scirpus*. Approximately 20 acres or more of marsh should form, with the potential for as much as 100 acres. Over time, the crevasse will begin to fill in, and the formed marsh will begin to subside. Existing crevasses in similar sites have lasted approximately 20 years (to date), and the created marsh is not anticipated to be fully lost for another 50 years or more (James Harris, USFWS pers. comm.).

A number of other locations for a crevasse were examined, but the South Pass site has several factors in its favor. South Pass is a primary channel off the Mississippi River, and crevasses that are created off of primary channels are likely to be more successful at splay formation than crevasses created at secondary or tertiary distributary channels. Additionally, there are no existing pipelines that would have to be moved to create this crevasse, unlike some other locations evaluated, which will keep costs much lower than if a pipeline had to be moved. Furthermore, a splay marsh located in PAL, a state wildlife management area, will be accessible to the general public, whereas a splay marsh created at many of the other potential sites might have less public access. Thus, the South Pass site should provide a good location for both recreational hunting and fishing.

5.4.1.2.2 Restoration Objectives

The primary goal of this restoration project is to provide vegetative habitat sufficient to compensate for lost habitat services and for bird and aquatic faunal injuries. The determination of how much created marsh is required to achieve this goal is described in the following section.

5.4.1.2.3 Restoration Scaling Approach

The scaling approach used to determine the extent of resource restoration required as compensation for natural resource injuries is based on Habitat Equivalency Analysis (HEA). HEA begins with the injury assessment and an identification of the habitat-specific resource services that were lost

due to the incident. A "debit" is specified for the lost services for each type of resource habitat. The debit equals the loss in service-acre-years from the injury to the habitat, as a result of the incident, in present-value terms. For each debit, the scale of a compensatory restoration project is determined by calculating the credit, per acre, that the restoration project will generate over its lifespan. This credit is the present value of the ecological services provided by the project. Then, the size of the compensating project is calculated so as to equate the total credit to the debit. Both the debit and per-acre credit are measured by service-acre-years, as discussed in Section 4.3.1.

This scaling procedure is summarized by the following equation:

Debit = (Credit per acre from restoration project) X (Acres of restoration project)

The first component is the debit for the injured resource services. The second component is the credit per acre from implementing the restoration project. The credit is based on a set of input parameters to the HEA model. Given the debit, and the credit per acre for restoration, it is a simple task to solve the equation for the acres of the restoration project needed to equal the debit.

5.4.1.2.3.1 *HEA Debit Model*

The debit is composed of two parts. The first part corresponds to the reduction in the full set of marsh services from oiled habitats, including faunal support services. This part of the debit corresponds to the habitat injuries described in Chapter 4. Because the selected type of restoration for all habitat injuries is marsh, all of the habitat injuries were converted into DSAYs of marsh. The Trustees treated services from delta marsh and freshwater river vegetation as equivalent to services provided by splay marsh. However rip-rap and sandflat habitats are less productive than marsh; therefore, the DSAYs associated with these habitats, translated in marsh DSAYs, is less than shown in Table 4-2. Given the low level of injury to these habitats, the Trustees did not conduct studies to assist in converting rip-rap or unvegetated sandflat DSAYs into marsh DSAYs. The debit in sandflat DSAYs is 0.8, and was translated to marsh services (0.16 DSAYs) by assuming that marsh provides approximately five times the service flows of unvegetated sediments. This assumption was adopted from the trade-off assumption developed for another NRDA in a Gulf of Mexico estuary (Kern, 1999). The debit in rip-rap DSAYs is 2.3, and was translated to marsh services (0.23 DSAYs) by assuming that marsh provides approximately ten times the service flows of rip-rap. The Trustees believe that this assumption concerning the trade-off between marsh and rip-rap habitats is very conservative, based on discussions with experts on Mississippi River ecology (e.g., Carl Way, Barry Vittor and Associates, 2000). The estimated level of rip-rap injury was deemed too low to justify the expense of refining the trade-off estimate to lower the DSAYs of marsh injury (translated from rip-rap injury). The total injury for habitats, translated into marsh, is 6.08 DSAYs.

The second part of the debit corresponds to the direct aquatic faunal and bird injuries described in Chapter 4, translated into marsh services, required to restore direct faunal losses. Indirect injuries to fauna due to reductions in habitat services that support fauna are included in the habitat debit. The process of translating biomass of lost aquatic fauna and birds into marsh biomass is described in Galvin (2001b). The total injury for aquatic fauna and birds, translated into marsh biomass production (considering the efficiency of energy transfer through different trophic levels), is 9,697,950 kg. Using the assumptions provided in Moore and Kern (2001), the faunal loss is

equivalent to 239.6 DSAYs, considering primary production from the marsh as the only service considered (Galvin, 2001b).

5.4.1.2.3.2 *HEA Credit Model*

Similarly to the process of calculating the HEA debit, the HEA credit has two components, that for habitats and that for fauna.

To quantify the benefits per acre from the marsh creation project in terms of marsh services (habitat service losses) and primary production (faunal losses) and ultimately to determine the scale of restoration, a number of parameters were defined. The parameters include when the restoration project begins (assumed to be 2002), the rate of splay growth and the provision of services over time, the lifespan of the marsh, and the relative productivity of the created resources and services compared to the injured resources and services. The description of the assumptions used for the splay marsh is provided in Moore and Kern (2001). Opinions of experts and published studies were used in developing these conservative assumptions. Basically, it was assumed that the created splay would grow at a constant rate for a period of 15 years, and then would begin to decline at a constant rate over the next 25 years. The service flows of this marsh at maturity (after four years) is assumed to be equivalent to the service flows from the freshwater vegetation and delta marsh habitats.

After developing the assumptions for the characteristics required to calculate the amount of credit gained per acre of created marsh, the restoration needs for injured habitats and for faunal losses were calculated separately. The results of this scaling exercise is that 0.04 acres of growth per year of vegetated splay marsh is required to compensate for habitat injuries; another 1.53 acres of growth per year is required to compensate for the faunal injuries. Therefore, the growth of approximately 1.57 acres per year of splay marsh is required to compensate for all of the ecological injuries considered in this assessment. Details of the entire HEA calculations and results are located in the administrative record (Galvin, 2001c).

For the faunal restoration component, it should be recognized that primary production is the only service the created marsh will provide that counts toward compensating for the faunal injury. Other ecological services provided by this portion of marsh are not considered in the scaling calculations. For this incident, trying to distinguish the 'excess' services provided by the marsh acreage that goes toward compensating for the faunal injury, and reducing the acreage requirement to adjust for that excess, would be difficult and time-consuming. Given that a marsh splay project's size cannot be strictly controlled, and instead marsh forms as long as the crevasse remains open, there would be no cost-savings in construction costs if this calculation (or, for that matter, any refinement of the injury estimates, themselves) was conducted. This is because there would be no change in the project design. This represents an additional level of conservatism in the Trustees' overall restoration planning process.

5.4.1.2.4 Probability of Success

Crevasse projects in the Mississippi delta area have been successfully implemented and studied for a number of years (for example, see Boyer et al., 1997). This potential project site was identified by

experts in splay marsh creation as a good location for creating a splay marsh. The probability of success for this project is therefore very high.

5.4.1.2.5 Performance Criteria and Monitoring

Post-implementation monitoring is an essential component of any restoration project and will be performed for this project. The monitoring program for this restoration effort is designed to objectively determine whether the project goals and objectives have been achieved. Information gathered during monitoring will help the Trustees assess the performance, viability, and stability of the restoration project. Monitoring will allow the Trustees and RPs to determine whether corrective actions are required to meet the restoration project's goals and objectives. Project performance will be assessed by comparing quantitative monitoring results to pre-determined performance criteria developed by the Trustees that define the minimum physical or structural conditions of the project that are important in determining if the restoration is successful.

5.4.1.2.5.1 *Monitoring Schedule*

Monitoring will be conducted annually for three years for the crevasse project to provide an assessment of project progress and allow for implementation of corrective actions early in the project, if warranted. Baseline acreage will be determined prior to construction of the crevasse, and monitoring events will occur once per year for the next three years. Additional monitoring will not be required if the project meets the required performance criteria

5.4.1.2.5.2 *Performance Criteria*

The crevasse project's success will be determined by comparing quantitative monitoring results to pre-determined performance standards. Performance standards are criteria developed by the Trustees that define the minimum physical or structural conditions of the restoration project deemed to represent acceptable growth and development. If the performance criteria are satisfied at the 3-year monitoring event, then the Trustees are confident, based on previous experience, that the project will be successful and no further monitoring will be required. The specific performance criteria are that there be at least 4.7 acres of vegetated splay marsh, that the crevasse remain open, and that plant species characteristic of splay marshes are present at the end of three years. An aerial photograph taken prior to the cutting of the crevasse will be used to determine the baseline for measurement of future growth of the splay. Aerial photographs will be taken each year for three years to gauge the progress of the splay development.

5.4.1.2.6 Corrective Actions

Should one or more of the performance criteria not be met, corrective action will be considered to remedy the situation. Corrective action options to be considered include: waiting for an additional period of time to see if the project begins to match predicted trends in growth, re-opening the crevasse, opening a new crevasse, or other actions agreed upon that would correct the deficiency and ensure growth at the required rates.

5.4.1.2.7 Environmental and Socioeconomic Impacts

Creating a splay marsh is not expected to have any significant adverse environmental or economic impacts. As discussed below, there will be some impact to a small area of habitat directly affected by cutting the crevasse, but the environmental benefits of this project will far outweigh this impact, as proven by the performance of other crevasse projects in this area. The impacted area will gradually recover, and the opening will eventually silt in and become vegetated. Created marsh will gradually disappear once the crevasse does silt in. The environmental benefits associated with the created marsh will far exceed the miniscule and temporary adverse affects from implementation of this project.

5.4.1.2.8 Evaluation

Marsh creation by cutting crevasses is a well-proven technology that has been successfully used at a large number of sites in the Mississippi River delta area. It was previously used as the restoration alternative for ecological injuries on the 1995 Dixon Bay oil spill (Trustees, 1995). Marsh formed as a result of this method of creation is very productive, and is used by a variety of fauna, including wintering waterfowl. A splay marsh has a high probability of growing beyond the required acreage, thus providing additional benefits beyond those strictly required to compensate for the injuries from the spill. Splay marshes can be very inexpensive to construct, especially if considered on a per-acre basis, provided that there are no obstacles to cutting the crevasse such as pipelines. There would be some impact to a small amount of existing habitat when cutting the crevasse, but the anticipated gain in habitat would far outweigh this small impact (as proven by similar projects conducted in the past). This type of project will not impact public health or safety. The great benefits obtained, the high likelihood of success, and the low cost make this marsh creation method the best overall fit to the restoration selection criteria.

5.4.1.3 Non-Selected Alternative: Reconfigure Spoil Disposal Area

There are a number of spoil disposal areas that were intended to result in marsh formation, although some of them have formed marsh. This alternative would create marsh on one of the non-successful disposal areas.

5.4.1.3.1 Project Description

This project would consist of reconfiguring one of the COE's spoil disposal areas by creating channels to allow water to access the interior of the area. These channels would provide a mechanism for marsh vegetation to colonize what is currently bare sediment, and would provide access for aquatic fauna to utilize the new marsh. Marsh vegetation could be planted to supplement natural colonization to speed the provision of service flows, or, a larger area could be left to naturally colonize without active planting. Spoil deposition areas that are already being successfully colonized would not be appropriate for this type of project; instead an area that is either not becoming vegetated or is doing so at a very slow rate would be chosen.

5.4.1.3.2 Environmental and Socioeconomic Impacts

This project would impact only bare sediments, and so would have little adverse environmental impacts. It would not be expected to have significant adverse socioeconomic impacts.

5.4.1.3.3 Evaluation

Although this type of project is believed to be technically feasible and would be relatively inexpensive, this project would not be expected to benefit as many resources, to such a high degree, as would the crevasse project. Implementation of this type of marsh creation alternative would not adversely impact ecologically valuable habitat, and would not affect public health or safety. One potential problem with this type of project is that there is little information to guide the Trustees in estimating the provision of service flows, unlike the situation for creation of a splay marsh. Therefore, the Trustees could not accurately determine the amount of restoration necessary without additional study. While this type of project appears to be a very promising alternative, it does not meet all the selection criteria as well as the selected alternative does.

5.4.1.4 Non-Selected Alternative: Deposit Dredge Material to Create Marsh Islands

Marsh has been created in the delta area by using dredge material to form islands at an elevation suitable for establishment of marsh previously, and this method was suggested to the Trustees for consideration as a restoration alternative.

5.4.1.4.1 Project Description

This project would consist of dredging material from the area at the confluence of Dennis, Loomis, and Johnson Passes, and re-depositing that material as small islands in the shallow open-water area known as Sawdust Bend. The material would be deposited so that, after settling, it would be at an elevation suitable for marsh vegetation. Vegetation would be allowed to colonize these islands naturally.

5.4.1.4.2 Environmental and Socioeconomic Impacts

There would be minor environmental impacts associated with dredging and then depositing the dredged material. These impacts would be primarily in the borrow and fill areas, although an increase in turbidity would affect water quality for a short period of time. There would be a socioeconomic benefit to navigation by opening up an area at the confluence of these passes that has shoaled up to a significant degree.

5.4.1.4.3 Evaluation

Projects of this sort have been implemented successfully in the general area; and, therefore, the likelihood of success for this type of project at this location is high. It would also be relatively inexpensive, but not as cost-effective as the crevasse project. This project would benefit resources in the area similarly to the crevasse project, except that the marsh island project would not grow beyond the original size, and would begin to erode much sooner. Scaling for this type of project

would be more expensive than scaling for a splay marsh, because less is known about these marsh island projects and additional study would be required to develop scaling parameter estimates. This project would be expected to have little effect on public health and safety and would have socioeconomic benefits by enhancing navigation. Although this project has many benefits and fits the restoration selection criteria well, the selected alternative was chosen because it will have greater overall benefits, has a greater likelihood of success, and is more cost-effective.

5.4.1.5 Non-Selected Alternative: Create Containment Dikes For The Corps Of Engineers To Fill

The COE performs maintenance dredging in many areas of the Mississippi River delta, and some of the dredged material is placed in shallow water without any containment to keep the elevation suitable for marsh development. The construction of containment to help establish elevations of spoil material from maintenance dredging suitable for the establishment of marsh was identified as a potential restoration alternative.

5.4.1.5.1 Project Description

This project would involve the construction of containment dikes for use by the COE to hold material from maintenance dredging activities to create areas at an elevation suitable for marsh establishment. Active planting of the marsh would occur once the sediment placed within the containment de-waters sufficiently.

5.4.1.5.2 Environmental and Socioeconomic Impacts

This project is not expected to have significant adverse environmental or socioeconomic impacts.

5.4.1.5.3 Evaluation

This project is technically feasible in theory, although its success would depend upon the activities of the COE, which would are outside of Trustee control. Additionally, there would be no guarantee as to when the dredging work would be done by the COE, which would make scaling the project very difficult.

5.4.2 **Evaluation of Recreational Access Enhancement Projects**

The Trustees selected enhancement of recreational access as the compensatory restoration project for recreational losses. Because enhancement of recreational access is a broad category that could include many types of actions and sites, the Trustees completed the second step of the selection process: the development of a range of project-specific recreational access enhancement alternatives and selection of a preferred alternative which was submitted for public review and comment.

5.4.2.1 Preliminary List of Recreational Access Enhancement Alternatives

The Trustees and the RP actively solicited restoration ideas and input from appropriate staff within

Plaquemines Parish, state and federal agencies and from other interested parties. The suggestions received were:

1. construction of boat dock to improve recreational access at Freshwater Reservoir on PAL;
2. upgrade boat ramp at Fort Jackson; and
3. improvement of access and public camping grounds at DWR.

These alternatives were evaluated using the same OPA restoration selection criteria as were used to evaluate among the broader types of restoration alternatives as discussed in Section 5.3.

5.4.2.2 Selected Alternative: Construction of Boat Dock to Improve Recreational Access at Freshwater Reservoir on PAL

Fishing and hunting are prime uses of PAL. This alternative would serve to enhance access to an unimproved area that is often used as a campground by anglers and hunters, and was very strongly supported by PAL staff. Implementation of this alternative is expected to increase recreational use of this area.

5.4.2.2.1 Project Description

The main component of this alternative is to construct a dock at the Freshwater Reservoir on PAL that will improve access to this area. The specific design of the dock is being developed by PAL personnel and representatives of the RPs, and is subject to approval by the Trustees. The dock is anticipated to be a T-shaped dock. The dock will be constructed of treated wood pilings with treated decking on top. Additionally, small improvements will be made in the area used for camping, consisting of the construction of several picnic tables and grill pits. The proposed design of the dock project has been evaluated by the Trustees to ensure that the facility adequately enhances recreational access opportunities, thereby compensating the public for the loss of access to resources during the Westchester spill.

5.4.2.2.2 Restoration Objectives

The objective of this project is to increase access to, and use of, the area, thereby compensating for the loss of access and use caused by the incident.

5.4.2.2.3 Restoration Scaling Approach

Given the relatively small level of recreational loss, the Trustees have determined that valuation of the replacement services could not be performed within a reasonable timeframe and at a reasonable cost. Therefore, the Trustees are selecting a restoration project that has a cost equivalent to the estimated value of lost services, consistent with 15 C.F.R. § 990.53(d)(3)(ii). To accomplish this, the Trustees compared the cost for the Trustees to construct the dock to the estimated injury range. The project is judged sufficient since the estimated Trustees' implementation cost is comparable to the high end of the preliminary recreational lost use injury range estimate (Moore, 2001). In

evaluating the estimated cost of implementation, the Trustees' approach was to use medium to high estimates for individual components of the project, thereby guaranteeing completion of the project[7].

5.4.2.2.4 Probability of Success

The unimproved area is already used as a campground by anglers and hunters. Refuge personnel believe that the dock will increase access to, and recreational use of, this area in PAL; the other amenities provided will also improve the recreational experience, thus potentially attracting new anglers and hunters to the site. Thus, the Trustees feel that there is a very high probability of success in compensating for the recreational losses.

5.4.2.2.5 Performance Criteria

For the recreational projects, the performance criteria are simply that the actual construction matches the construction details as outlined in permits and the project specifications required by the Trustees.

5.4.2.2.6 Environmental and Socioeconomic Impacts

No significant adverse environmental or socioeconomic impacts are expected from implementation of this restoration alternative. The primary environmental impact will be to the small area of waterbottom that will be covered by the construction of the dock.

5.4.2.2.7 Evaluation

This project is technically feasible, and there is a strong likelihood of success of the project. The construction of a dock in the PAL will help improve access to the natural resources of the area by hunters and anglers, and refuge officials believe that use of this area will increase as a result of this project. There will be slight impacts to the waterbottom of the pass when the dock is built, but overall few impacts are expected. The presence of the dock should benefit the public by making boarding and exiting boats easier, and thus safer. The project is also very cost-effective. The additional amenities to the adjacent area used as a campground should also serve to increase usage of the area, thereby increasing access to the natural resources of PAL. This alternative was therefore selected to compensate for recreational lost use resulting from the Westchester incident.

5.4.2.3 Non-Selected Alternative: Upgrade Boat Ramp At Fort Jackson

Fort Jackson is within the area affected by the spill, and is used as a launch site to access the Mississippi River. Improvements in the launching facility would enhance access to the river.

[7] This approach is consistent with what Trustees would do if they were to actually receive a financial settlement and seek to choose a project for implementation. This minimizes the possibility of cost overruns in a Trustee implementation scenario that could result in an unfinished project and no ability to seek additional funds for completion.

5.4.2.3.1 Project Description

The project, as originally conceived, was to make improvements to a boat ramp at Fort Jackson. Upon examination of the site, however, no actual boat ramp was located. A number of sites where boats were launched were found in the area, but none of these appeared to be good candidates for upgrading. There were also some safety and security concerns about the Fort Jackson site and its desirability for use in increasing recreational access. The cost of construction of a new boat ramp would far exceed the value of the loss, as estimated by the Trustees (Section 4.4.4.2)

5.4.2.3.2 Environmental and Socioeconomic Impacts

Little adverse environmental or socioeconomic impact would be expected to result from this project.

5.4.2.3.3 Evaluation

A number of considerations make this proposed alternative less desirable than the dock at PAL. Although the upgrading of boat launch facilities in the Fort Jackson area would be expected to increase access, the existing facilities for launching boats are not conducive to improvement at a cost consistent with the magnitude of the injury.

5.4.2.4 Non-Selected Alternative: Improvement of access and public camping grounds at DWR

Fishing and hunting are prime uses of DWR. This alternative would serve to enhance access to a campground and make minor enhancements. Implementation of this alternative would be expected to increase public use of this area.

5.4.2.4.1 Project Description

The Trustees received general ideas on improvements for public access and enhancement of camping grounds at DWR. The information received suggests that the types of projects available are basically similar to those at PAL.

5.4.2.4.2 Environmental and Socioeconomic Impacts

Little adverse environmental or socioeconomic impact would be expected to result from this project, although the lack of more specific information makes it difficult to address this issue more completely.

5.4.2.4.3 Evaluation

Given that the preferred (now selected) alternative at PAL was believed to be similar to what could be done at DWR, the projects would probably be similar in terms of their consistency with the restoration selection criteria. Given that the preferred (now selected) ecological restoration project is at PAL, then possible cost-savings could occur by also constructing the recreational project at

PAL. Additionally, the location of a recreational access enhancement close to the site of the splay marsh created as a restoration alternative for the ecological injuries is attractive because splay marshes are good waterfowl hunting areas, which is another factor favoring the project at PAL over that at DWR.

5.5 RESTORATION SUMMARY

The Trustees determined that natural recovery (no action) was the appropriate primary restoration alternative to address all ecological and recreational injuries resulting from this incident. After evaluating a number of different potential types of restoration actions, the Trustees selected marsh creation as the appropriate form of restoration to address ecological injuries and recreational access enhancement as the appropriate form of restoration to address recreational losses. Table 5-1 summarizes the restoration alternative selection process.

TABLE 5-1
EVALUATION OF RESTORATION ALTERNATIVES

Injured Resource/Service	Primary Restoration Alternatives	Compensatory Restoration Alternatives
Delta Marsh and Freshwater Vegetated Habitats	**Natural Recovery**	No Compensation Required
		Marsh Creation
Rip-Rap Habitat	**Natural Recovery**	No Compensation Required
		Placement of Additional Rip-rap
		Marsh Creation
Sandflat Habitat	**Natural Recovery**	No Compensation Required
		Create Additional Sandflat Area
		Marsh Creation
Aquatic Fauna	**Natural Recovery**	No Compensation Required
		Oyster Reef Creation
		Restock fauna
		Marsh Creation
Birds	**Natural Recovery**	No Compensation Required
		Nest Site Enhancement/Protection
		Habitat Modification
		Oyster Reef Creation
		Marsh Creation
Recreational Use	**Natural Recovery**	No Compensation Required
		Increase Recreational Access

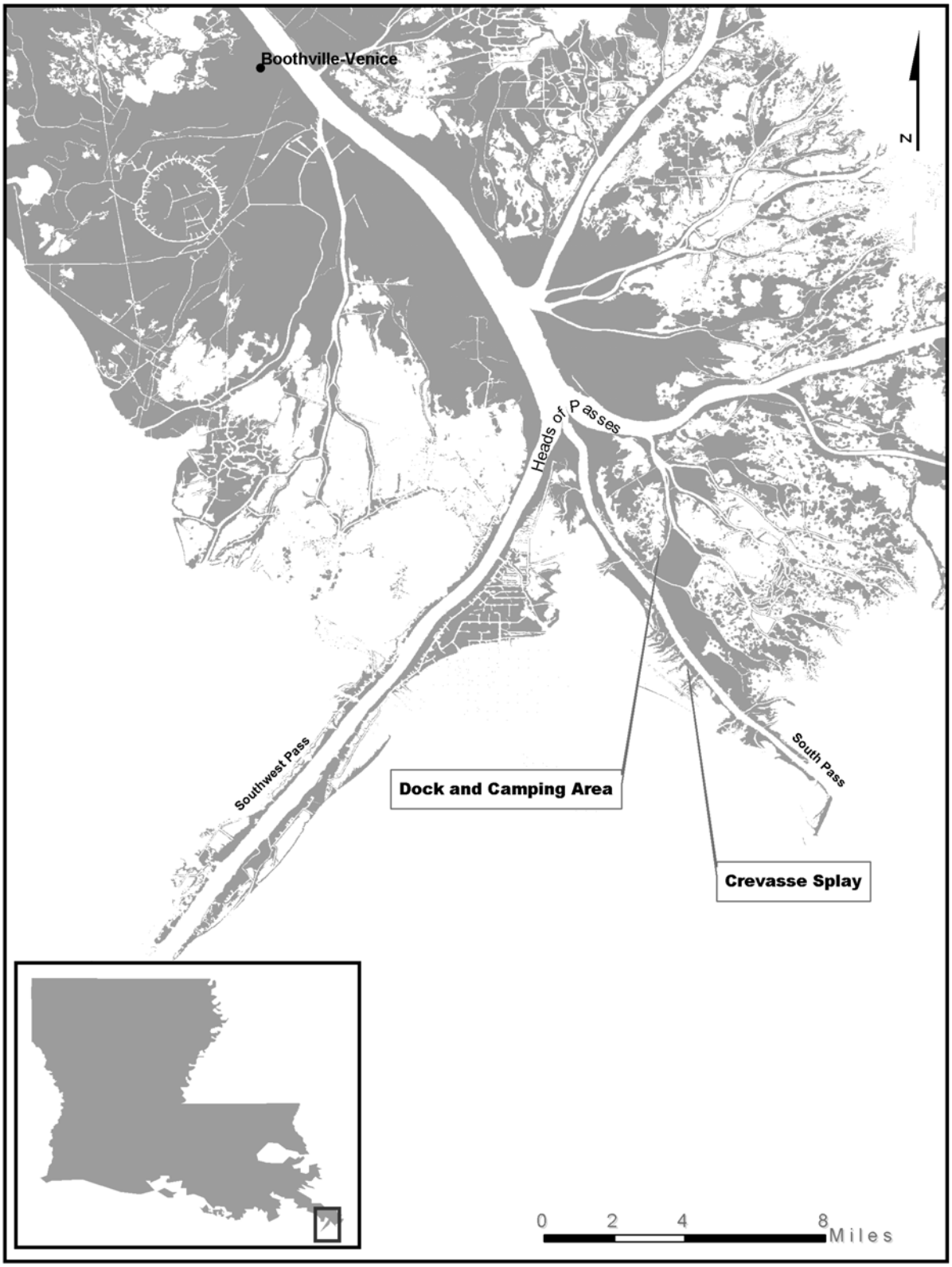
Selected alternatives in bold; the natural recovery and no compensation required alternatives are equivalent to the No Action NEPA alternative.

The Trustees selected marsh splay creation off South Pass on the PAL as the restoration action to compensate for injuries to habitats, aquatic fauna, and birds (Figure 2). The Trustees chose this project from a broad range of alternatives that included oyster reef creation, enhancement or protection of bird nest sites, and placement of additional rip-rap. The project selected is expected to create more marsh than is required to compensate for the ecological injuries, over the first fifteen years following its construction.

The Trustees selected construction of a dock along with smaller complimentary recreational amenities near the dock at the Freshwater Reservoir on PAL as the restoration action to compensate for lost human recreational use, primarily hunting and fishing, resulting from the Westchester

incident (Figure 2). An unimproved area on PAL that has been used by anglers and hunters as a campground will be enhanced by the construction of a dock to allow better access to the area, as well as minor improvements to the campground itself. Other restoration actions considered include enhancement of boat launching facilities at Fort Jackson and construction of access and recreational amenities on DWR.

FIGURE 2. Sites of proposed restoration actions to compensate for ecological and recreational injuries resulting from the Westchester incident.



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FINDING OF NO SIGNIFICANT IMPACT

Having reviewed the attached environmental assessment and the available information relative to the proposed actions in the Mississippi River delta, Louisiana, the undersigned has determined that there will be no significant environmental impacts from the proposed actions. Accordingly, preparation of an environmental impact statement on these issues is not required by Section 102 (2)(c) of the National Environmental Policy Act (42 U.S.C § 4332(2)(c)) or its implementing regulations.

_____ Date _____

William T. Hogarth
Assistant Administrator for Fisheries
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U. S. Department of Commerce

Appendix A Administrative Record Index (through December 20, 2001)

Record	Date	Title or Description
1	N/A	NRDA- One Page LOSCO Handout
2	N/A	Louisiana Oil Spill Prevention and Response Act
3	3/20/99	Natural Resource Damage Assessment Rule, Vol. 25, No. 3
4	8/96	Guidance Documents for Natural Resource Damage Assessments Under OPA 90 (NOAA CD)
5	11/28/00	National Response Center Incident Report: NRC #549451
6	11/28/00	Louisiana State Police Incident Report: LSP #00-07111 (7:46:41 PM)
7	11/29/00	Louisiana State Police Incident Report: LSP #00-07111 (8:55:39 AM)
8	11/30/00	Spill Report Update from Welcome Duncan (RRT-VI Coor.) to Primary Regional Response Team Members
9	12/02/00	SCAT Reports
10	12/08/00	Curry, Mark, 2000. Memorandum to John Kern and Lisa DiPinto (NOAA). Subject: Evaluation of Rip-rap and Revetment Habitat in the Lower Mississippi River
11	12/08/00	Tri-State Bird Rescue & Research, Inc.- End of Day Report
12	11/30-12/11/00	Field Notes: Warren Lorentz (LOSCO)
13	12/11/00	Field Notes and Photographs with Descriptions: John Kern (NOAA)
14	1/31/01	Helicopter Flight Line Maps (Polaris Applied Science, Inc.)
15	2/01/01	Letter Inviting Plaquemines Parish, Polaris Applied Science, Inc., and Terriberry, Carroll & Yancey, LLP to Provide Potential Compensatory Restoration Projects
16	2/02/01	Tri-State Bird Rescue & Research, Inc.- End of Spill Report
17	2/13/01	Charlie Hebert (USFWS) Raw Data Field Notes
18	3/15/01	Letter to Polaris Applied Science, Inc., Terriberry, Carroll & Yancey, LLP, and Sarah Burgess (Gard Services) Regarding the Current Status of Trustee Actions on the Westchester Oil Spill
19	3/21/01	Letter from Terriberry, Carroll & Yancey, LLP Accepting the Invitation to Participate in a Cooperative NRDA
20	3/22/01	Tech. Papers: Primary Productivity of Crevasse Plants Versus Salt Marsh
21	4/13/01	Technical Memorandum: Splay Marsh Restoration Assumptions (Tom Moore and John Kern, NOAA)
22	4/17/01	Letter Inviting the Responsible Party to Participate in a Cooperative NRDA
23	4/17/01	Notice of Intent to Gary Mauseth (Polaris Applied Science, Inc.) and Steve Mattesky (Terriberry, Carroll & Yancey, LLP)
24	5/17/01	Notice of Intent to Victoria Caridas (Plaquemines Parish Government)
25	5/21/01	Notice of Intent Published in State Register

Record	Date	Title or Description
26	5/22/01	Notice of Intent Published in The Advocate and The Plaquemines Gazette Newspapers
27	11/29-2/2/01	Press Releases from Joint Information Center
28	12/05/00	Technical Report: What Would Cause the Oil to Remobilize
29	1/29/01	Summary of Trustee Meeting
	5/15/01	Summary of Trustee and Responsible Party Meeting
	6/12/01	Summary of Trustee, Responsible Party, and Plaquemines Parish Government Meeting
	6/31/01	Summary of Trustee and Responsible Party Conference Call
30	8/29/01	Letters to Polaris, Terriberry, Carroll & Yancey, LLP and Sarah Burgess (Gard Services) Regarding the Draft DARP/EA and Public Comment Period
31	N/A	Information Management Report CD (NOAA)
32	N/A	Response/NRDA Pictures CD: LOSCO, USFWS, and NOAA
33	N/A	All Files Produced in the Incident Command Center During Response CD
34	9/05/01	Habitat Equivalency Analysis Model Results (Toben Galvin, NOAA)
35	9/05/01	Technical Memorandum: Recreational Hunting and Fishing Economic Losses from the M/V Westchester Oil Spill of November 28, 2000, Lower Mississippi River, Louisiana (Toben Galvin, NOAA)
36	9/05/01	Technical Memorandum: Faunal Injuries and Compensatory Restoration Requirements for the M/V Westchester Oil Spill of November 28, 2000, Lower Mississippi River, Louisiana (Toben Galvin, NOAA)
37	9/17/01	Preassessment Data Report M/T Westchester Oil Spill Mississippi River Mile 38, Louisiana (Research Planning, Inc.)
38	9/20/01	Public Notice: Availability and Request for Comments on a Draft Damage Assessment and Restoration Plan/Environmental Assessment for the Westchester Incident
39	12/22/95	Draft Damage Assessment and Restoration Plan/Environmental Assessment for Dixon Bay, Louisiana (Trustees)
40	03/97	Technical Paper by Mark E. Boyer, James O. Harris, and R. Eugene Turner: Constructed Crevasses and Land Gain in the Mississippi River Delta, Published in Restoration Ecology Volume 5, pages 85-92)
41	4/01	Technical Report: M/T Westchester Spill in the Mississippi River, November 2000: Modeling of Physical Fates and Biological Injuries (Deborah French-McCay and Christopher Glagan, Applied Science Associates)
42	9/27/01	Letters to Polaris, Terriberry, Carroll & Yancey, LLP and Sarah Burgess (Gard Services) Regarding the Public Review Draft DARP/EA

Record	Date	Title or Description
43	10/4/01	Memorandum from Tom Moore (NOAA) to Georgia Cranmore (NOAA) Regarding the Endangered Species Act Section 7 Consultation
44	10/4/01	Letter from Tom Moore (NOAA) to David Fruge (USFWS) Regarding the Endangered Species Act Section 7 Consultation
45	10/15/01	Memorandum from Tom Moore (NOAA) to Andreas Mager (Office of Habitat Conservation: M/V Westchester Oil Spill Restoration EFH Coordination
46	10/29/01	Memorandum from Tom Moore (NOAA) to Joseph E. Powers, Ph.D. (NOAA) Regarding the Endangered Species Act Section 7 Consultation
47	10/30/01	Letter from Russell Watson (USFWS) to Tom Moore (NOAA): Regarding the Endangered Species Act Section 7 Consultation
48	11/5/01	Letter from Russell Watson (USFWS) to Warren Lorentz (LOSCO): Comments on the Draft DARP/EA
49	12/20/01	Memorandum from Tom Moore (NOAA) to the Administrative Record Regarding the M/V Westchester Oil Spill Recreational Project

Appendix B COMPLIANCE WITH KEY STATUTES, REGULATIONS AND POLICIES

Oil Pollution Act of 1990 (OPA), 33 U.S.C. § 2701, et seq., 15 C.F.R. Part 990
OPA establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. OPA provides a framework for conducting sound natural resource damage assessments that achieve restoration. The process emphasizes both public involvement and participation by the RPs. The Trustees have conducted this assessment in accordance with the OPA regulations.

National Environmental Policy Act (NEPA), 42 U.S.C. § 4321, et seq., 40 C.F.R. § 1500, et seq.
An Environmental Assessment (EA) was prepared for the selected restoration projects as part of the DARP. The EA evaluated the affects of implementing the crevasse project and recreation project. The NEPA process concluded with a finding of no significant impact (FONSI), following public review of the draft EA and the finalization of the EA.

Clean Water Act (CWA), 33 U.S.C. § 1251, et seq.
The CWA is the principal law governing pollution control and water quality of the nation's waterways. Section 404 of the law authorizes a permit program for the beneficial uses of dredged or fill material. The COE administers the program. In general, restoration projects, which move significant amounts of material into or out of waters or wetlands, for example, hydrologic restoration of marshes, require 404 permits. Under 401 of the CWA, restoration projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards. All necessary 404 permits will be obtained for the selected projects.

Rivers and Harbors Act, 33 U.S.C. § 401, et seq.
The Rivers and Harbors Act regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waterways and vests the COE with authority to regulate discharges of fill and other materials into such waters. Restoration actions that comply with the substantive requirements of Section 404 of the CWA will also comply with the substantive requirements of Section 10 of the Rivers and Harbors Act.

Coastal Zone Management Act (CZMA), 16 U.S.C. § 1451, et seq., 15 C.F.R. Part 923
The goal of the CZMA is to preserve, protect, develop, and, where possible, restore and enhance the nation's coastal resources. The federal government provides grants to states with federally approved coastal management programs. Section 1456 of the CZMA requires that any federal action inside or outside the coastal zone shall be consistent, to the maximum extent practicable, with the enforceable policies of the approved state management programs. No federal license or permit may be granted without giving the state the opportunity to concur that the project is consistent with the state's coastal policies. The regulations outline the consistency procedures that will be followed by the Trustees. The Trustees believe that the selected restoration actions are consistent with the Louisiana Coastal Management Plan and will seek concurrence from the state.

Endangered Species Act (ESA), 16 U.S.C. § 1531, et. seq., 50 C.F.R. Parts 17, 222, 223 & 224
The ESA directs all federal agencies to assist in the conservation of threatened and endangered species to the extent their authority allows. Protection of wildlife and preservation of habitat are the central objectives in this effort. The U.S. Department of Commerce (through NOAA) and DOI (through USFWS) publish lists of endangered and threatened species. Section 7 of the Act requires that federal agencies consult with these departments to minimize the effects of federal actions on these listed species.

The restoration actions described in this DARP/EA are not expected to adversely impact any species listed under the ESA. The Trustees have initiated consultation with the USFWS and NOAA's National Marine Fisheries Service (NMFS) pursuant to the ESA to ensure that the restoration actions selected are in accordance with all applicable provisions. Correspondence with the USFWS and the NMFS is included in the administrative record.

Fish and Wildlife Conservation Act, 16 U.S.C. § 2901, et seq.
The crevasse restoration project will encourage the conservation of non-game fish and wildlife. Both the ecological and recreational projects will have no adverse affects on non-game fish and wildlife.

Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. § 661, et seq.
The FWCA requires that federal agencies consult with USFWS, NMFS, and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse affect of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the CWA, NEPA, or other federal permit, license, or review requirements. The crevasse project will have a positive effect on fish and wildlife resources. The recreation project will not adversely affect fish and wildlife resources.

Magnuson Fishery Conservation and Management Act, 16 U.S.C. § 1801, et seq.
The Magnuson Fishery Conservation and Management Act provides for stewardship of the nation's fishery resources within the Exclusive Economic Zone, covering all U.S. coastal waters 200 miles seaward from the boundary of state territorial waters. The resource management goal is to achieve and maintain the optimum yield from U.S. marine fisheries. The Act also establishes a program to promote the protection of Essential Fish Habitat (EFH) throughout state and federal waters in the planning of federal actions. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

The Trustees do not believe that the restoration alternatives will have a net adverse impact any Essential Fish Habitat as designated under the Act. The crevasse project is expected to have a positive effect in creating EFH. A determination of this finding was made with NMFS, and this correspondence is included in the administrative record.

Marine Mammal Protection Act, 16 U.S.C. § 1361, et seq.
The Marine Mammal Protection Act provides for the long-term management of and research programs for marine mammals. It places a moratorium on the taking and importing of marine mammals and marine mammal products, with limited exceptions. The U.S. Department of Commerce is responsible for whales, porpoises, seals, and sea lions. DOI is responsible for all other marine mammals. The selected restoration projects will not have an adverse effect on marine mammals.

Migratory Bird Conservation Act, 16 U.S.C. § 715, et seq.
The selected restoration projects will have no adverse affect on migratory birds. Migratory birds will benefit from the establishment of new marsh habitat.

Archeological Resources Protection Act, 16 U.S.C. § 470, et seq.
The Louisiana State Historical Preservation Office will be consulted on the selected restoration projects. At present, the Trustees are unaware of any cultural resources in the area, and no known sites or properties listed on or eligible for listing on the National Register of Historic Places are located near the selected restoration sites.

Executive Order Number 12898 (59 Fed. Reg. 7,629) – Environmental Justice
This Executive Order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on ethnic minority and low-income populations. The U.S. Environmental Protection Agency and CEQ have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under NEPA and of developing mitigation measures that disproportionate environmental effects on minority and low-income populations. The Trustees have concluded that there are no low-income or ethnic minority communities that would be adversely affected by the selected restoration projects.

Executive Order Number 11514 (35 Fed. Reg. 4,247) - Protection and Enhancement of Environmental Quality
The DARP is also an Environmental Assessment as required by NEPA.

Executive Order Number 11990 (42 Fed. Reg. 26,961) - Protection of Wetlands
The crevasse project will help ensure the protection of wetlands and the services they provide. The recreation project will not adversely affect wetlands.

Executive Order Number 12962 (60 Fed. Reg. 30,769) - Recreational Fisheries
The crevasse project will help ensure the protection of recreational fisheries and the services they provide. The recreation project will have no adverse impacts on recreational fisheries.

Executive Order Number 13112 (64 Fed. Reg. 6,183) – Invasive Species
The crevasse project will encourage the spread of native vegetation and will not cause or promote the introduction or spread of invasive species. The recreation project will not cause or promote the introduction or spread of invasive vegetation.