

## **FINAL DAMAGE ASSESSMENT AND RESTORATION PLAN**

### **FOR**

### **THE OCTOBER 1998 CRUDE OIL DISCHARGE INTO MARCELINAS CREEK IN KARNES COUNTY, TEXAS**

OCTOBER 2015

#### **PREPARED BY:**

Texas Commission on Environmental Quality

Texas General Land Office

Texas Parks and Wildlife Department

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



## **NOTE TO READER:**

This Final Damage Assessment and Restoration Plan (DARP) is intended to inform members of the public and to solicit their comments on the Texas Natural Resource Trustees' assessment of the natural resource injuries and service losses described herein and the restoration actions which the Trustees propose to implement in order to compensate the public for those injuries and losses. No comments were received by the Trustees during the public comment period for this DARP; therefore, the Trustees will proceed with the implementation of the selected restoration alternative.

## **EXECUTIVE SUMMARY:**

On October 19, 1998, a 50,000-barrel above-ground storage tank owned by Koch Pipeline Company, L.P. (Koch) collapsed and discharged approximately 963 barrels of a crude oil mix into Marcelinas Creek. The spill occurred approximately one mile northwest of the city of Falls City, Karnes County, Texas. Oil entered Marcelinas Creek at flood stage and was transported approximately six miles to a collection point downstream of the County Road 237 bridge. Impacts to natural resources included heavy oiling of the riparian corridor and upland habitat due to the higher water elevations during the flood event. Impacts to aquatic environments were also observed.

During initial response activities, Koch activated emergency crews the day of the spill and boomed several locations along the creek; generally containing the oil just below the County Road 237 bridge. As flood waters receded, the oil coated the trees, shrubs, and ground from the highest point of flooding to the normal creek elevation. Heavy equipment was used during cleanup of the creek at the banks near the County Road 237 bridge and at other locations upstream to cut paths and remove vegetation for response operations and access.

The Texas Commission on Environmental Quality, the Texas General Land Office, the Texas Parks and Wildlife Department, and the U.S. Fish and Wildlife Service acting on behalf of the Department of the Interior (collectively known as the Trustees) are responsible under state and/or federal law as designated Natural Resources Trustees to assess injuries and seek compensation for natural resources injured or services lost as the result of discharges of oil. The Trustees determined that the discharge of crude oil, in conjunction with response actions undertaken by Koch, injured or potentially injured natural resources, and that restoration of these resources and the associated lost ecological services should be pursued. Natural resources and/or services impacted as a result of the spill and spill response included the creek water column, creek sediments and benthic organisms living in sediments, riparian habitat, improved and unimproved pasture, and terrestrial biota in the vicinity of the creek. Response actions also caused the loss of habitat and habitat services along the spill Site.

In cooperation with Koch, the Trustees performed a restoration-based assessment to address potential or actual natural resource injuries and lost services resulting from the spill. The Trustees and Koch jointly

performed site investigations to assess lost natural resource services resulting from the discharge and the associated response actions. Results from site investigations and Habitat Equivalency Analysis were used to determine the scale of restoration necessary to compensate for injuries to natural resources and lost services provided by those resources.

In accordance with OPA, the Trustees evaluated a reasonable range of restoration alternatives to compensate for injuries to natural resources and lost services. After examining restoration alternatives and potential restoration sites, the Trustees have identified the 88-acre Goliad State Park and Historic Site, Kelly Tract Addition and Restoration, as the restoration alternative selected for implementation. The Trustees sought public input on the Draft DARP in August 2015 and, receiving no comments, determined that the most appropriate compensation for natural resources damages recovered for the spill would be implementation of the selected restoration alternative.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

DARP	Damage Assessment and Restoration Plan
DOI	Department of Interior
DSAY	Discounted Service Acre Year
EA	Environmental Assessment
ESA	Endangered Species Act
GLO	Texas General Land Office
HEA	Habitat Equivalency Analysis
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
OPA	Oil Pollution Act
RP	Responsible Party
TCEQ	Texas Commission on Environmental Quality
TPWD	Texas Parks and Wildlife Department
USFWS	U.S. Fish and Wildlife Service

## **1 INTRODUCTION AND INCIDENT SUMMARY**

This Final Damage Assessment and Restoration Plan (DARP) has been prepared by the Texas Commission on Environmental Quality (TCEQ), the Texas General Land Office (GLO), the Texas Parks and Wildlife Department (TPWD), and the U.S. Fish and Wildlife Service (USFWS) acting on behalf of the Department of the Interior (DOI) (collectively known as the Trustees) to address natural resources and services injured or lost as a result of the discharge of an estimated 963 barrels (40,446 gallons) of crude oil into Marcelinas Creek in Karnes County, Texas. The Texas Railroad Commission (RRC), the state's designated response agency for this discharge and the U.S. Environmental Protection Agency, designated Koch Pipeline Company, L.P. (Koch) as the responsible party (RP) for the October 19, 1998 spill. The Trustees are responsible under state and/or federal law to assess, recover, and seek compensation for natural resources injured and/or services lost as the result of unauthorized discharges of oil and or release of hazardous substances to the environment.

This Final DARP is intended to inform members of the public on the Trustees' assessment of the natural resource injuries and service losses described herein and the proposed restoration actions to compensate the public for those injuries and losses. Public input was solicited by the Trustees during the public comment period and the Trustees received no comments at that time.

### **1.1 Overview of the Incident**

At approximately 0030 hours on October 19, 1998, a 50,000-barrel above-ground storage tank owned by Koch collapsed, resulting in an unauthorized discharge of approximately 963 barrels of a crude oil mix into Marcelinas Creek during a heavy rainfall and flood event (the Incident) near Falls City in Karnes County, Texas (Figure 1). The Incident impacted approximately six miles of Marcelinas Creek and the adjacent riparian area; in some places, oil flowed overland through adjacent pasture containing coastal Bermuda and native grasses. Figure 2 depicts the impacts of oiling and boundaries where oil was observed.



Figure 1. Spill Location





Figure 2. Portion of Marcelinas Creek Impacted by Spill

The response actions taken did not contemplate or provide for the restoration of injuries to natural resources. Based upon site visits, personal observations, and sediment data, the Trustees determined that actual and/ or potential injuries to natural resources and services occurred and restoration planning was necessary.

## **1.2 Natural Resources Injuries**

Restoration planning is needed (1) to evaluate the magnitude of actual and potential injuries to natural resources and natural resource services, and (2) to use that information to determine the need for, and scale of, restoration actions. Natural resource services are the ecological and public services that natural resources provide, such as foraging and nesting habitat for bird populations, structural and ecological habitat for aquatic invertebrates, or fishing, hiking, swimming, nature photography, and other similar recreational or educational services. Restoration planning provides the link between the injury and the 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, thereby providing a factual basis for evaluating the need for, type of, and scale of restoration actions. Consistent with the Oil Pollution Act of 1990 (OPA, 33 U.S.C. §§2701 *et seq.*), the goal of the proposed restoration actions presented in this DARP is to make the environment and the public whole for injuries to, or lost use of, natural resources and services resulting from the Incident. This will be accomplished through the restoration, rehabilitation, replacement, or acquisition (collectively referred to as restoration) of equivalent natural resources and services. The specific goals for this action are to restore the following natural resources affected by the spill: the creek water column, creek sediments and benthic organisms living in the sediments, riparian habitat, improved and unimproved pasture, and terrestrial and aquatic biota in the vicinity of the creek. Response actions also caused loss of habitat and services at the Site to riparian and upland areas.

## **1.3 Natural Resource Trustees and Authorities**

This Final DARP has been prepared jointly by the TCEQ, GLO, TPWD, and USFWS acting on behalf of the DOI as designated Natural Resource Trustees (Trustees) pursuant to OPA (33 U.S.C. §2706) and the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR §§300.600 and 300.605) for natural resources injured by the 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 a discharge of oil. Applicable laws and regulations regarding natural resources damage assessment and restoration planning include:

- OPA of 1990 (33 U.S.C. §§2701 *et seq.*)
- Natural Resource Damage Assessment Regulations under OPA (15 CFR Part 990)

- Executive Order (EO) 12777 (implements OPA and §311 of the Clean Water Act), as amended by EO 13286 and EO 13638
- National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300, Subpart G)
- National Environmental Policy Act (NEPA, 42 U.S.C. §§4321 et seq.)=

### **1.3.1 Overview of OPA Requirements**

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. Federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries and implement restoration. Section 1006(e)(1) of OPA (33 U.S.C. §2706(e)(1)) requires the President, acting through the Under Secretary of Commerce for NOAA, to promulgate regulations for the assessment of natural resource damages resulting from a discharge or substantial threat of a discharge of oil. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. The process emphasizes both public involvement and participation by the responsible party or parties.

Under OPA (33 U.S.C. §2706(d)), Trustees can recover:

- the cost of restoring, rehabilitating, replacing, or acquiring the equivalent of the damaged natural resources (“primary restoration”);
- the diminution in value of those injured natural resources pending restoration (“compensatory restoration”); and
- the reasonable assessment costs.

Incident, oil, and natural resources are defined under OPA (33 U.S.C. §2701):

- Incident means “any occurrence or series of occurrences having the same origin, involving one or more vessels, facilities, or any combination thereof, resulting in the discharge or substantial threat of discharge of oil.”
- Oil means “oil of any kind or in any form, including petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil, but does not include any substance which is specifically listed or designated as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601) and which is subject to the provisions of this Act.”
- Natural resources include “land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the exclusive economic zone), any State or local government or Indian tribe, or any foreign government.”

### **1.3.2 Natural Resource Damage Assessment Regulations under OPA**

As described in OPA, a natural resource damage assessment (NRDA) consists of three phases: (1) Preassessment, (2) Restoration Planning, and (3) Restoration Implementation. Based on early available information collected during the preassessment phase, the Trustees make a preliminary determination as to whether natural resources and/or services have been injured and/or are likely to be injured by the discharge. Through coordination with response agencies (in this case, the EPA and the RRC On-Scene Coordinator), the Trustees next determine whether the oil spill response actions will eliminate the injury or the threat of injury to natural resources. If injuries are expected to continue and feasible restoration alternatives exist to address such injuries, the Trustees may proceed with the restoration planning phase. Restoration planning also may be necessary if injuries are not expected to endure but are nevertheless suspected to have resulted in interim losses of natural resources and/or services from the date of the incident until the date of recovery.

Before initiating a NRDA, the Trustees must determine that:

- an incident has occurred;
- the incident is not from a public vessel;
- the incident is not from an onshore facility subject to the Trans-Alaska Pipeline Authority Act;
- the incident is not permitted under federal, state, or local law; and
- public trust natural resources and/or services may have been or may be injured as a result of the incident (15 CFR §990.41).

Injury is defined in the regulations as “an observable or measurable adverse change in a natural resource or impairment of a natural resource service” and incorporates the terms “destruction,” “loss,” and “loss of use”(15 CFR §990.30).

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 associated restoration actions. This phase provides the link between injury and restoration and has two basic components: (1) injury assessment, and (2) 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.

During the restoration planning phase, the Trustees must:

- identify a reasonable range of restoration alternatives;
- evaluate and select the preferred alternative(s);
- develop a Restoration Plan presenting the alternative(s) to the public;
- solicit public comment on the Restoration Plan; and
- incorporate comments into a Final Restoration Plan.

### **1.3.3 National Oil and Hazardous Substances Pollution Contingency Plan**

The National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan (NCP), is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP is the result of the federal government's efforts to develop a national response capability and promote overall coordination among the hierarchy of responders and contingency plans. Federal agencies are designated as Natural Resource Trustees according to the regulations in 40 CFR Part 300, Subpart G.

### **1.3.4 National Environmental Policy Act**

NEPA requires an assessment of any federal action that may impact the environment. NEPA applies to restoration actions undertaken by federal Trustees, except where a categorical exclusion or other exception to NEPA applies. Restoration of natural resources under OPA which involves Federal Trustee agencies must comply with the National Environmental Policy Act (42 U.S.C. §§4321 *et seq.*) and the Council on Environmental Quality (CEQ) regulations implementing NEPA at 40 CFR Parts 1500-1508. The process outlined in OPA for NRDA selection of restoration alternatives is substantially similar to NEPA and therefore is consistent with NEPA and the CEQ regulations. This Final DARP summarizes the current environmental setting, describes the purpose and need for action, identifies alternative actions, assesses their applicability and environmental consequences, and summarizes Trustee actions taken to facilitate opportunities for public participation in the decision-making process. The Trustees determined that, as proposed, the selected restoration alternative meets the criteria for Categorical Exclusion from further environmental assessment or environmental impact statement evaluation as provided by the DOI Revised NEPA Implementation Procedures (DOI 1996), specifically 516 DM 6 Appendix 1, Section A (4) and B (11).

## **1.4 Coordination and Settlement with the Responsible Party**

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

The Trustees and Koch jointly performed site investigations to assess injured natural resources and lost services resulting from the discharge and the associated response actions. During the assessment phase, the types of resources, acreage, and habitat types affected by the spill were quantified. Appropriate scientific methodologies were used to determine the nature and extent of natural resource injuries and ultimately determine the appropriate level of compensation for settlement.

## **1.5 Public Participation**

Public review of the Draft DARP is an integral component of the restoration planning process. Through the public review process, the Trustees seek public comment on the methods used to define and

quantify natural resource injuries and service losses and the proposal to restore injured natural resources or replace lost resource services. This Final DARP provides the public with current information about the nature and extent of the natural resource injuries identified and restoration alternatives evaluated.

The Draft DARP was made available to the public for a 30-day comment period from August 21, 2015-September 21, 2015. The deadline for submitting written comments on the Draft DARP was specified in a public notice placed in the Texas Register. The Trustees received no comments during the comment period and finalized the Draft DARP. Public review of the DARP was consistent with all state and federal laws and regulations that apply to the NRDA process, including the OPA regulations, NEPA, and the regulations implementing NEPA at 40 CFR Parts 1500-1508.

## **2 AFFECTED ENVIRONMENT**

This section describes the physical environment, biological resources, federal and state endangered and/or threatened species, protected areas, and historic and cultural resources affected by, or within the area affected by, the Incident. The description of these resources focuses primarily on the natural resources and services that are relevant to the discussion of injuries and restoration projects presented in this document.

### **2.1 Physical Environment**

The area in which the Incident occurred can be classified as the East Central Texas Plains ecoregion. The East Central Texas Plains are characterized by a more forested area than the adjacent prairie ecoregions. It contains a diverse selection of hardwoods and post oak savanna, characterized by a mix of post oak woods, improved pasture or rangeland, and invasive mesquite to the south. A thick understory of yaupon (*Ilex vomitoria*) and Ashe Juniper (*Juniperus ashei*) occurs in some parts. Soils in the area are generally characterized as sandy or sandy loam.

### **2.2 Biological Resources**

The Incident impacted approximately six miles of Marcelinas Creek; in some places, oil flowed overland through adjacent pasture containing coastal Bermuda (*Cynodon dactylon*) and native grasses. The riparian area downstream of the point of discharge was heavily oiled. Hackberry (*Celtis laevigata* var. *laevigata*), Texas persimmon (*Diospyros texana*), black willow (*Salix nigra*), American elm (*Ulmus americana*), Ashe Juniper (*Juniperus ashei*), pecan (*Carya illinoensis*), and other riparian vegetation were coated by bands of oil of varying widths. As oil moved downstream, a persistent flooding event pushed water over the banks of Marcelinas Creek, transporting the oil laterally beyond the banks and re-oiling the riparian zone as flood waters receded.

Surface waters and associated biota within Marcelinas Creek sustained injury due to the Incident. Fish, reptiles, amphibians, and aquatic invertebrates such as snails and crawfish sustained acute effects due

to the persistent nature of the crude oil. Chronic effects were likely to have occurred in biota observed in contact with the oil such as amphibians and reptiles. Further impacts resulted from clearing of vegetation as part of response activities and movement of heavy equipment near the County Road 237 bridge. Avian resources and small mammals which utilized the affected area were adversely impacted through direct contact with the oil. The oiling of riparian vegetation also resulted in a loss of nesting, mating, and feeding habitat.

## **2.3 Threatened and Endangered Species**

The federal Endangered Species Act (ESA) of 1973 (16 USC Section §1531 *et seq.*) and the Texas Parks and Wildlife Code (Title 31, Section 65 *et seq.*) direct federal and state agencies to protect and conserve listed endangered and threatened animals. These statutes also protect listed plants on public lands and prohibit their commercial sale, import and export. The habitat of endangered and threatened species takes on special importance because of these laws and because conservation of the species requires careful management. Critical habitat is a specific geographic area(s) that contains features essential for the conservation and recovery of a federally listed threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. In general, the historical distribution of a species that appears on the threatened and endangered list can be more widespread than is observed currently. A critical habitat designation protects areas that are necessary for the conservation and recovery of the species.

In evaluating the injuries from the Incident, the Trustees considered the known distribution and potential occurrence of threatened and endangered species.

## **3 INJURY AND SERVICE LOSS EVALUATION**

This section describes the potential injuries and quantifies the potential ecological service losses caused by the Incident and subsequent response actions. It begins with an overview of the Trustees' preassessment evaluation, notice of intent for restoration planning, assessment strategy, and description of the habitat equivalency analysis (HEA). The remainder of the section presents the profile of the spilled material, the injury categories, the evaluation methodology, and a description of injured resources .

### **3.1 Preassessment Evaluation**

The preassessment phase is the initial step undertaken by the Trustees as part of the NRDA process for an oil spill. During the preassessment phase, Trustees collect the necessary information to make critical determinations that shape the remainder of the NRDA. The preassessment is based on the specific circumstances of a given incident and helps the trustees determine whether NRDA actions under OPA are justified and make the necessary preliminary determinations regarding the type of injury assessment and restoration actions that may be pursued. The preassessment serves to document the Trustees

decision-making process as well as coordinate other matters that may be considered during the preassessment phase including data collection, opening the Administrative Record, coordination, and emergency restoration.

The preassessment phase as described in the NRDA regulations pursuant to OPA has three threshold requirements that must be met before restoration planning can proceed:

- an incident has occurred as defined by OPA § 990.30;
- the incident was not a permitted action; and
- natural resources under trusteeship may have been or may be injured as a result of the incident.

The Trustees must also make the further determination to conduct restoration planning. OPA requires the Trustees to make the following determinations prior to proceeding with restoration planning (15 CFR §990.42(a)):

- injuries to natural resources that the Trustees have trusteeship over are likely to or have been injured;
- response actions taken have not or are not expected to compensate for natural resource injuries; and
- primary or compensatory restoration actions are feasible.

The Trustees made an early decision to conduct a preassessment to determine if a NRDA was necessary. Beginning October 30, 1998, Trustee agencies had representatives on-site observing and participating in response activities. The information collected during the preassessment phase for the Incident satisfied the three conditions listed above and confirmed the need for restoration planning to address injuries to natural resources as a result of the spill. In accordance with 15 CFR §990.42, the Trustees determined that the requisite conditions existed to justify proceeding with a NRDA and restoration planning beyond the preassessment phase.

### **3.2 Notice of Intent to Conduct Restoration Planning**

The Trustees determined that the October 1998 spill met the criteria of an OPA incident by discharging oil into the navigable waters of the United State. It was further determined that this discharge was not an authorized or permitted activity and that natural resources under trusteeship of the Trustees were likely impacted by the discharge. The Trustees further determined that the response actions did not and were not anticipated to compensate for injuries to natural resources. Having satisfied the criteria listed in OPA regulations, the Trustees proceeded with damage assessment and restoration planning to address injuries to natural resources as a result of the spill. During the assessment phase, the Trustees quantified the types of resources, acreage, and habitat types affected by the spill. Appropriate scientific methodologies were used to determine the nature and extent of natural resource injuries.



The Trustees entered into a cooperative assessment with Koch on January 18, 1999. Koch and the natural resource trustees continued this cooperative relationship throughout the assessment and restoration phase of the NRDA process.

### **3.3 Name, Classification, and Toxicity of the Spilled Material**

The product discharged from a 50,000-barrel above-ground storage tank owned by Koch was a sour crude oil, used mainly for process stream, fuel, and lubricants production. The substance is also known as “Crude Oils, Desalted, Sour,” “Field Crude, Sour,” “Petroleum Oil, Sour,” “Rock Oil, Sour,” and “Sour Crude.” Sour crude oil is a mixture of aliphatic and aromatic hydrocarbons and contains concentrations of hydrogen sulfide, approximately >20ppm or 0.5%, as well as 0.1 % benzene. As a Transportation of Dangerous Goods Packaging Group II, the substance has a boiling point of 35 degrees Celsius (°C) or above and a flash point of less than 23 °C. Specifically, the boiling point range of sour crude oil is 38-500+ °C and the flash point is <-40 °C.

Crude oil toxicity is well documented and has been studied in great detail in recent decades. Crude oil toxicity can cause injury in two primary ways: physical and biochemical. Physical injury occurs when the oil coats or smothers plants and animals living in and around the affected area of discharge. Biochemical injury occurs because the chemical properties that make up oil can cause lethal effects to biological organisms. All crude oil contains two major components: volatile organic compounds (VOC's) and polyaromatic hydrocarbons (PAH's). VOC's give oil its distinctive odor. They can be carcinogenic and acutely toxic if inhaled although they generally dissipate in a relatively short time following a spill. PAH's in oil act in a different way than VOC's. These compounds tend to persist in the environment for many years and can continue to cause harm to biological organisms over time. It is important to note that the effects of crude oil in the environment can have short-term and long-term effects.

In general, crude oil and petroleum products vary greatly in toxicity, but can have deleterious effects on plants and animals living near the spill location. The toxic effects for the discharge at Marcelinas Creek were most evident in the acute toxic effects to wildlife and plant mortality over time.

### **3.4 Assessment Strategy**

The Trustees conducted site surveys to document natural resource injuries and recovery at the Site. Information gathered during surveys allowed the Trustees to quantify the reduction in ecological services provided by the impacted habitat and associated ecological communities over time. The surveys also assisted in the determination of the recovery rate of affected habitat. The Trustees used photographic, global positioning system data, and a geographical information system to document and quantify impacts and recovery. The Trustees also quantified the value of resources and services provided by the evaluated restoration alternatives as part of the assessment. The scale (or size) of the restoration action must provide enough value to adequately offset the value of the injury and service losses. The process of determining the size of restoration is called restoration scaling. Restoration

scaling requires a framework for quantifying the value of losses and for quantifying the benefits of restoration so the losses and benefits can be compared. The Trustees used the HEA methodology to quantify losses and scale the benefits of proposed restoration projects. The data collected during the preassessment, response, and subsequent site surveys were evaluated and used to determine appropriate inputs for the HEA.

### **3.5 Description of Injured Resources and Services**

To facilitate the identification and quantification of actual or potential injuries at the Site, the Trustees divided the impacted area into habitat types. This section provides a general description of the habitats that have been impacted or potentially impacted by the Incident. Descriptions of these habitats and their associated flora and fauna were taken from field notes and reports concerning the site.

During this event, oil caused injury to biota in wooded, upland, and aquatic habitats. Initially, the oil entered Marcelinas Creek as floodwaters pushed the creek out of its banks. As the waters rose, oil coated trees, shrubs and pasture throughout the surrounding area. As flood waters receded, and the response work began, oil re-coated these areas and became entrained in areas within the creek and outside the riparian corridor. Injury to resources and the services provided by these resources did occur to wildlife and biota within these affected areas as documented below.

#### **3.5.1 Injury Due to Crude Oil Spills**

To facilitate the identification and quantification of actual or potential injuries at the site, the Trustees divided the impacted area into habitat types. This section provides a general description of the habitats that have been impacted or potentially impacted by the Incident. Descriptions of these habitats and their associated flora and fauna were taken from field notes and reports concerning the site.

During this event, oil caused injury to biota in wooded, upland, and aquatic habitats. Initially, the oil entered Marcelinas Creek as floodwaters pushed the creek out of its banks. As the waters rose, oil coated trees, shrubs and pasture throughout the surrounding area. As flood waters receded, and the response work began, oil re-coated these areas and became entrained in areas within the creek and outside the riparian corridor. Injury to resources and the services provided by these resources did occur to wildlife and biota within these affected areas as documented below.

#### **3.5.2 Injury Due to Response Actions**

Response actions may be conducted by the RP, EPA, or state response agencies and focus on controlling exposure to released hazardous substances or crude oil products by removing, neutralizing, or isolating them in order to protect human health and the environment from the threat of harm. Response actions are separate and distinct from the damage assessment process. However, at times, response actions can cause additional injuries to natural resources. When such injuries result from response actions, the additional injuries are included in the damage assessment (15 CFR §990.51).

The Trustees believe that the response actions undertaken during the event did not prevent, remedy, or compensate for potential injuries to or losses of natural resources under their jurisdiction. The Trustees have concluded that a compensable injury resulted from the Incident and response actions taken. Response actions during this spill caused physical injury to the trees, understory and due to movement of heavy equipment, the banks of the creek at the County Road 237 bridge and at other locations upstream. Impacts from the response actions were documented and considered as part of the injury evaluation for this damage assessment.

### **3.6 Description of Habitat Equivalency Analysis**

HEA is an approach to restoration scaling that has been used successfully for scaling restoration actions at a number of locations in Texas and around the United States (NOAA 2000). Losses are quantified as lost habitat resources and services. The restoration projects are to provide comparable habitat resources and services. The scale of the restoration projects is that which provides approximate equivalency between the lost and restored habitat resources and services. Restoration of habitat of the same type, quality, and comparable value should be provided to compensate for the resource and service losses so that the total losses approximately equal the total restoration benefits.

The HEA requires the development of injury parameters to quantify lost habitat resources and services. The parameters needed to estimate losses include the area of habitat injury, the degree of injury within that habitat, and how that degree of injury changes over time. The losses are quantified or converted to habitat acres and then quantified by year as lost service acre-years, where a service acre-year is the loss of one acre of habitat and its resources and services for a year.

Additional parameters are necessary to quantify the benefits of restoration actions in a HEA. They include: the date habitat restoration action begins, the time until the habitat provides full services, the level of services provided between the time when the restoration action begins and when it provides full services, and the relative services of the created or enhanced habitat compared to the injured habitat prior to injury. These parameters, along with the size of a restoration action, the developmental pressure on the restoration area, and the discount rate, define the discounted service acre-year (DSAY) benefits, described below, that result from a restoration action.

Because the spill related losses and service gains associated with restoration occur in different time periods, their values are not directly comparable. People place more value on the use or consumption of goods and services in the present rather than postponing their use or consumption to some future time. To make the losses and gains that occur in different time periods comparable, a discount factor is applied both to create a common metric called a (DSAY). In general, HEA is a technique that balances “debits” (habitat or other injuries) that have occurred as a result of a discharge of oil against compensatory “credits” (habitat restoration projects) and uses a discount factor to account for the difference in time that the restoration services are delivered. The aim is to determine the size of the restoration action such that the DSAY benefits offset the losses.

Inputs to the HEA for injuries to biota and aquatic communities, ground cover and vegetative habitat, and wooded riparian habitat were based on several different factors and assumptions that are discussed in Sections 3 and 4. However, a number of generic, conservative assumptions were associated with all of the areas that were assessed:

- the discount rate is 3%,
- the base year (the year from which a discount is applied) is the year 2010,
- the onset of injury was calculated beginning in 1998, and
- restoration will be initiated in 2015.

### **3.7 Injury Quantification**

Data collected during the response, preassessment, and subsequent site surveys were used in the quantification of lost services due to the unauthorized discharge of oil. This information was then used for the HEA. The principal concept underlying this methodology is that the public can be compensated for past and future losses of natural resource services through a habitat replacement project that provides resource services of at least the same level and type as those lost.

HEA characterizes the reduction of natural resource service losses associated with the discharge of oil to the environment over the time required for the lost services to recover to pre-incident level. The concept of services refers to those functions a natural resource provides to the habitat and its associated biotic components as a whole. As previously noted and consistent with previously accepted application of HEA, the inputs for the HEA were based on observations and measurements taken during and after the Incident as well as the best professional judgment of technical experts (NOAA 2000).

The Trustees assessed injuries resulting from the spill of oil into the environment, including interim lost use of habitat. Interim lost use can be defined as the reduction in services from the time of the injury until services return to baseline. Consideration for the actions taken during and after the response, which may have increased or reduced injuries, were included in the interim lost use calculations.

Habitats evaluated for this spill included wooded, upland (pasture and ground cover), and aquatic. Wooded habitats included those areas associated with the riparian corridor along Marcelinas Creek and trees outside of the riparian area that were oiled as a result of the flooding. Upland components were broken into two subcategories: terrestrial and wet. Upland terrestrial was characterized by grassland and pasture habitat affected by the spill. The wet portion of the upland category included those low lying areas near the creek that are wet. The aquatic component included the impacted tributary waters and those resources associated with this habitat.

Table 3-1 outlines the ecological evaluation criteria for each habitat type and the associated injury determination. Appendix A lists the habitats and contains all HEA parameters and calculations of these injury scenarios.

**Table 1. Habitat injury evaluation by habitat type**

Habitat	Lost (Acres)	Lost (DSAY)
Wooded – Riparian and Upland	91.9	462.67
Ground Cover – Terrestrial and Wet	19.4	54.76
Aquatic	2.6	1.29

Notes: DSAY – Discounted Service Acre Years

## **4 RESTORATION PLANNING**

The goal of OPA is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving the discharge or substantial threat of a discharge of oil. OPA recommends that this goal be achieved by returning injured natural resources to their baseline condition and by compensating for any interim losses of natural resources and services that occur during the period of recovery to baseline or pre-spill condition.

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 natural resources injured or lost as a result of discharges of oil. The restoration planning process has two components: primary restoration and compensatory restoration. Primary restoration activities are actions designed to return injured resources and services to their baseline levels on a natural recovery (no action) or accelerated (active restoration actions) time frame. Compensatory restoration is any action taken to compensate for interim losses of natural resources and services, pending return of the resources and their services to baseline level.

NEPA requires the Trustees to consider a “No Action” alternative, and OPA recommends that Trustees consider the equivalent (natural recovery) under primary restoration. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending environmental recovery. The principal advantages of this approach are the ease of implementation and the absence of monetary costs. The Trustees may select natural recovery under three conditions: (1) if feasible, (2) if cost-effective primary restoration is not available, or (3) if injured resources would recover quickly to baseline without human intervention. Alternative primary restoration activities can range from natural recovery to actions that prevent interference with natural recovery to more intensive actions expected to return injured natural resources and services to baseline faster than natural recovery.

Compensatory restoration is action taken to compensate for the interim losses of natural resources or services pending recovery to baseline conditions. The type and scale of compensatory restoration may depend on the nature of the primary restoration and the level and rate of recovery of the injured natural resources or services given the primary restoration action. When identifying the compensatory

restoration components of the restoration alternatives, the Trustees should first consider compensatory restoration actions that provide resources and services of the same type and quality and of comparable value as those lost. If compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, Trustees then consider other compensatory restoration actions that will provide resources and services of at least comparable type and quality as those lost. When services of the same type and quality and of comparable value can be provided, the OPA regulations prescribe the “service-to-service” scaling approach to determine the appropriate scale of compensatory restoration.

In accordance with NRDA regulations, the Trustees developed appropriate restoration alternatives and identified a preferred alternative to address resource injuries and losses of services. The Trustees first identified and evaluated restoration project alternatives capable of serving as compensatory restoration for the injured natural resources and/or services. As part of the effort to develop restoration alternatives, the Trustees consulted with local scientists and state agency personnel to get their perspective on the benefits and feasibility of various types of restoration alternatives. These efforts were important in assisting the Trustees in identifying projects that are potentially feasible, have strong net environmental benefits, and meet restoration requirements to compensate for injuries resulting from the Incident.

Some compensatory alternatives considered by the Trustees would provide similar resources and/or services to those injured, while other alternatives would compensate by providing a comparable resource enhancement or preservation. The Trustees preferentially seek to restore injured natural resources in-kind (e.g., create new wetlands to compensate for lost aquatic function) 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 or feasible, or may not otherwise fit the restoration selection criteria, and in those instances, enhancement or acquisition 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.

#### **4.1 Evaluation Criteria for Selecting Preferred Restoration Alternatives**

Once a reasonable range of restoration alternatives is developed, OPA NRDA regulations (15 CFR §990.54) require the Trustees to identify preferred restoration alternatives based on the criteria listed below. The criteria are not ranked in order of priority.

**The cost to carry out the alternative:** The benefits of a project relative to its cost are a major factor in evaluating restoration alternatives. In addition, the Trustees consider the total cost of the project. Factors that can affect and increase the costs of implementing the restoration alternatives may include project timing, access to the project site (for example with heavy equipment), obtaining state or federal

permits, acquiring the land needed to complete a project, and potential liability from project construction.

**The extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resource and services to baseline and/or compensating for interim losses:** The fundamental goal of any compensatory restoration project is to provide resources and services of the same quality that were lost. Thus, the ability of the restoration project to provide comparable resources and services is an important consideration in the project selection process. Projects that restore, rehabilitate, replace, enhance, or acquire the equivalent of the resources and services injured by the spill are preferred to projects that benefit other comparable resources or services. To quantify the provision of resources and services, the Trustees must consider the potential relative productivity of the restored habitat. Finally, future site management issues and the opportunity for conservation easements are also considered because they can influence the extent that the project meets objectives. The proposed alternative must comply with all applicable federal or state laws and regulations.

**The likelihood of success of each alternative:** The Trustees consider technical factors that represent either risk to the success of project construction or the long-term viability of the resources and services involved. For example, project sites with high subsidence rates are problematic due to concerns about the long-term existence of constructed habitats. An alternative that is susceptible to future degradation or loss through contaminant releases or erosion is considered less viable. Sites that require long-term maintenance of project features are less feasible. A proven track record demonstrating success of projects utilizing a similar or identical restoration technique can be used to satisfy these evaluation criteria.

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: Alternatives should avoid or minimize adverse impacts to the environment and the associated natural resources. Projects should not contaminate the surrounding area or conflict with the viability of endangered species populations. Projects should be compatible with surrounding land use.

**The extent to which each alternative benefits more than one natural resource and/or service:** This concept is related to the interrelationships among natural resources and between natural resources and the services they provide. Projects that provide benefits to more than one resource and/or service yield more benefits.

**The effect of each alternative on public health and safety:** Projects that would negatively affect public health or safety are inappropriate.

The regulations allow the Trustees to prioritize these criteria, and to use additional criteria as appropriate. The key criterion for the Trustees are the extent to which an alternative will compensate

for losses and the likelihood of its success as these criterion most clearly indicate whether the goal of making the public whole from losses resulting from the discharge is met.

## **4.2 Restoration Scaling**

As previously discussed in Section 3, HEA was used to scale the size of the restoration project necessary to compensate for lost resources and services they provide. Input parameters for the HEA calculations to determine lost services include acreage affected, the estimated level of services at the time of the injury, number of months or years of impact and how many months or years until full recovery can be achieved. A summary of the injury parameter values for the HEA is shown in Appendix A. In order to determine the scale of restoration required, the result of the injury evaluation is then compared to the HEA evaluation of the benefits associated with restoration alternatives.

Injuries were scaled based on the habitat type, percent decline in services provided by that habitat type, and the type of restoration to be undertaken. As previously discussed in Section 3.4, injuries were determined by habitat type. Injuries were grouped into three distinct categories that accounted for the majority of lost services; wooded, ground cover, and aquatic habitat. Appendix A provides a detailed description of the HEA calculations used to determine base injuries and the minimum acreage requirements for construction and preservation projects. The injured acreage was a mixture of grassy uplands, scrub/shrub vegetation, riparian and upland hardwoods (wooded), and aquatic habitats. To facilitate restoration planning, the Trustees chose to convert the injury values for all habitat types to a single habitat type, using conversion factors based on the relative productivity of the various habitats. The Trustees identified dense wooded habitat as the restoration goal, so injuries were converted into this common habitat metric. Based on the relative ecological services provided by each habitat, a habitat specific conversion factor was applied to convert each wooded vegetation type (sparse, medium, scrub) and upland vegetation type to the common habitat metric. Once the dense wooded habitat equivalent values were calculated for each affected habitat, it was possible to use the results of the HEA analyses to determine the restoration acreage requirements for both the preservation and construction scenarios. Appendix A provides a summary of the total DSAYs, conversion factors, relative values assigned for each habitat and the preservation and construction requirements associated with the restoration alternative.

## **4.3 Restoration Alternatives Considered**

As previously discussed and in accordance with OPA, the Trustees developed a reasonable range of restoration alternatives to address resource injuries and loss of services. Implementation of primary restoration to return the injured area back to baseline levels was infeasible and not considered to be cost-effective. The injuries considered for compensatory restoration consisted of the interim lost services associated with the wooded, ground cover, and aquatic habitats. During restoration planning, the Trustees evaluated what actions, if any, were appropriate to replace equivalent ecological services lost due to exposure to oil as a result of the Incident. Some alternatives considered by the Trustees



would provide similar resources and/or services to those injured, while other alternatives would compensate by providing a comparable resource or service.

The following subsections discuss a range of possible alternatives for restoration, provide an evaluation of each alternative as compared to the selection criteria in Section 4.1, and describe the alternative selected by the Trustees. The region where the Incident occurred presented particular challenges to find viable project alternatives that met effective restoration planning goals and OPA criteria due to the limited availability of cost effective projects with similar resources and services as those affected by the Incident. Those alternatives are described below.

#### **4.3.1 *Alternative 1 - No action***

The Trustees evaluated the No Action alternative, which would provide no compensation beyond natural attenuation for injuries at the Site. Under this alternative, the Trustees would take no direct action to obtain compensation for interim losses, pending recovery, associated with the injured resource and/or lost service in question. This alternative would be appropriate where no significant interim losses were incurred as a result of the oil spill at the Site, or where actions to provide compensation for those losses are not cost-effective.

The principal advantages of this approach are the ease of implementation and the absence of monetary costs. The Trustees may select the no-action alternative under three conditions: (1) if feasible, (2) if cost-effective primary restoration is not available, or (3) if injured resources would recover quickly to baseline without human intervention. The No Action alternative is not appropriate for the Incident because the Trustees have determined that there were significant interim losses of natural resource services and that the No Action alternative would not provide compensation for lost use of natural resources and services. Further, it is inconsistent with OPA because interim ecological service losses have occurred, the public and the environment would not be made whole (compensated) through this alternative, and where cost-effective methods to achieve compensation are available. The Trustees have not proposed to select the No Action alternative as the preferred restoration alternative.

#### **4.3.2 *Alternative 2 – Habitat Construction***

This alternative would involve the creation of wooded, ground cover and aquatic habitats to offset the injuries to the habitats affected by the Incident. The creation of aquatic habitat in the form of freshwater open water/wetland habitat is technically feasible. However, this process requires re-contouring existing habitats to the correct hydrology for wetland inundation and providing connection to existing fresh water bodies. Vegetation of the wetland areas would be accomplished by planting native species and eliminating invasive species. The habitat would be monitored for sustained growth of native species dependent upon an aquatic habitat.

Woodland and upland construction is also technically feasible. The correct ground preparation and contouring would create the appropriate elevation and hydrology for successful planting of native

canopy, midstory, and ground cover species. The habitat would have to be monitored after planting and invasive species would have to be eliminated to sustain to ensure the growth of native species.

While considering this option, the Trustees examined projects that would create the type of habitat that sustained injury from the Incident. While technically feasible and meeting the OPA criteria, this type of restoration maybe be appropriate under the right conditions but can prove costly with varying levels of success.

#### **4.3.3 *Alternative 3 – Acquisition and preservation of existing high quality habitat***

This alternative would provide protection for existing habitats with similar ecological services to those habitats impacted by the Incident. These habitats should support a diverse set of flora and fauna similar to those affected, in addition to having some intrinsically unique value at threat of being lost.

Acquisition and preservation of dense wooded property similar to that impacted by the spill, typically can be cost-effective, technically feasible, and would have a high certainty of success. This alternative meets all the selection criteria described by OPA, and property is available with similar characteristics in sufficient quantity and exists within the same watershed as the spill Site.

The Trustees identified properties within the East Central Texas Plains in the vicinity of the spill Site that provide ecological services similar to those impacted and have unique habitats threatened by current land use and development. Acquiring these properties avoids additional injury to existing habitat and has the beneficial collateral effects of protecting the surrounding watershed.

The Trustees considered a number of properties under this alternative. Some of those properties included:

- The Swan Lake Ranch Conservation Project – This project would use funds from the oil spill settlement to pool with funds from other partners to acquire a conservation easement on approximately 3,500 acres of coastal habitat in the Guadalupe River Delta. The project is part of the San Antonio Estuary ecosystem on the Texas mid-coast.
- The Wild River Ranch Conservation Project – This alternative would seek to acquire 200 acres in a conservation easement in perpetuity. The property lies on the northern border of the Guadalupe River in Kendall, County.
- Old San Antonio River Road Conservation Project – This alternative would seek to acquire 191 acres of riparian and upland habitat along the San Antonio River near Victoria Texas.

#### **4.3.4 *Alternative 4 – Acquisition, preservation, and enhancement of habitat***

Property that has high quality or intrinsically unique qualities is not always readily available. In these cases the acquisition of property for enhancement and preservation may be more appropriate.

Examples of this would be a riparian area that has been affected by agricultural practices or lumbering being enhanced through elevation adjustments and hydrological modifications. The area would be

allowed to naturally re-colonize with native species, or fringe vegetation could be planted to accelerate recovery to a pre-disturbed condition. These modifications would create additional services to compensate for natural resource services lost from the Incident.

The Trustees considered projects under this alternative, including:

- San Antonio Water Systems (SAWS) Mitchell Lake Project – Located near Mitchell Lake just south of San Antonio, this alternative would seek to acquire land along the riparian corridor below Cottonmouth Creek, as well as enhancing freshwater ponds, upland plants, and construct on-site wetlands.
- Goliad State Park and Historic Site, Kelly Tract Acquisition and Enhancement Project – This alternative would seek to acquire 88 acres of riparian and upland habitat along the San Antonio River and enhance an additional 30 acres of native bottomland forested habitat.

#### **4.3.5 Non-Selected Restoration Alternatives**

The Trustees determined the following projects were not preferred alternatives for restoration. It has already been stated why the No Action alternative and Habitat Construction alternatives were not proposed for selection within Sections 4.3.1 and 4.3.1.1. The following paragraphs describe the other specific projects within Alternatives 3 and 4 that were considered but not proposed for selection.

**The Swan Lake Conservation Project** - The proposed project seeks to acquire approximately 3,500 acres of coastal habitat in the Guadalupe River Delta. The proposed conservation tract consisted of approximately 78% coastal wetland habitat, including both freshwater and estuarine environments. While this project met several goals of the evaluation criteria, such as the cost to carry out the project, benefit to multiple natural resources, and ease of implementation, the Trustees do not propose to select this project due to its lack of proximity to the Incident location and the inability of the project to provide a strong relation, or nexus, to injured habitat (e.g., freshwater riparian and upland habitat).

**The Wild River Ranch Conservation Project** - This alternative would seek to acquire 200 acres in a conservation easement in perpetuity. Located in the Texas Hill Country, this property lies on the northern border of the Guadalupe River in Kendall County. The proposed property is bounded on the southwest side by the Guadalupe River and includes approximately 0.75 mile of river frontage. This property was not considered because the cost to carry out the alternative was prohibitive based on a benefit-to-cost ratio.

**Old San Antonio River Road Conservation Project** - This alternative would seek to acquire 191 acres of riparian and upland habitat along the San Antonio River near Victoria, Texas in a conservation easement in perpetuity. This project met all of the evaluation criteria requirements; however, after an extended period of negotiation, specific conditions of the easement could not be agreed upon by the landowner and the Trustees.

**San Antonio Water Systems (SAWS) Mitchell Lake Project** – This alternative would seek to acquire land along the mouth of Cottonmouth Creek and includes enhancement of freshwater ponds, planting of upland vegetation, and construction of wetlands. A portion of this project would allow water to be released from Lake Mitchell to Cottonmouth Creek, further enhancing downstream flows. Although this project is in proximity to the Incident location and would provide enhancement to similar resources affected by the Incident, the costs were prohibitive due to scale and proximity to the City of San Antonio without long-term partnered funding.

## **5 SELECTED RESTORATION ALTERNATIVE**

Having concluded the alternatives analysis required by OPA, the Trustees have identified the Goliad State Park and Historic Site, Kelly Tract Addition Acquisition and Enhancement Project from Alternative 4 as the selected alternative (Figure 3). This alternative meets all the selection criteria and best meets the Trustees' goals and objectives in compensating for interim losses from this incident. It is technically feasible and cost-effective to implement.

After consideration of public comment and issuance of this Final DARP, the site will be transferred and managed as a unit of the Goliad State Park and Historic Site (GSPHS). TPWD would develop a Public Use Plan for the site, or would expand the GSPHS Public Use Plan to include this tract to guide future public access, development, stewardship, recreational use, and interpretation of the site. TPWD would also develop a Resource Management Plan to include this tract to guide protection, restoration, monitoring and management of the site's natural and cultural resources.

By obtaining this property, TPWD acknowledges that the tract is acquired for the primary purpose of restoring and managing habitat that protects natural resources at the site, particularly those affected by the Incident. The Trustees also acknowledge that the property would be managed to investigate, preserve and interpret the historical significance of the site, including the role in early Texas history.

This tract provides 19 acres of diverse and mature riparian zone directly adjacent to the San Antonio River which would be managed to preserve the diversity, productivity and health of those trees and habitat along the river. Other portions of the tract, comprising a total of 30 acres, would be enhanced through the planting of a woody vegetation mosaic that most closely resembles those found historically in the area. The Trustees would work with TPWD to determine the appropriate management goals and actions needed at the site. This work would ultimately inform the Resource Management Plan for long term success of the tract.



Figure 3. Location and Map of Goliad Property

## **6 CONCLUSION**

As described above, the overall objective of the restoration process is to make the environment and public whole for injuries to natural resources and/or service losses resulting from the Incident. To meet that objective, the benefits of restoration actions must have an appropriate nexus to the natural resource injuries and losses due to the discharge of oil. The relationships that must be considered include the following:

- equivalency of created or enhanced resources or services to those affected or potentially affected by the discharge of oil; and
- potential for restoration at or near the area where natural resource injuries/service losses occurred.

The Trustees approached restoration planning with the view that the injured natural resources and lost services are part of an integrated ecological system. The selected preservation and enhancement project of contiguous riparian hardwood, upland, and aquatic habitat along the San Antonio River provides the most relevant ecological benefits within the geographical area targeted for restoration actions.

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## **Appendix A: Habitat Equivalency Analysis**



## Koch Marcellinas Creek

Base year = 2010, Restoration Implementation = 2015

Table 1. Summary of injury HEA results.

Habitat Types	Wooded Habitats			Ground Cover		Aquatic
	Lost DSAY's	Relative Value	Dense Wood Equivalent Lost DSAY's	Terrestrial Lost DSAY's	Wet Lost DSAY's	Lost DSAY's
Sparse Woody Vegetation	13.08	0.30	3.92	5.30		
Medium Woody Vegetation	67.90	0.80	54.32	27.49		
Dense Woody Vegetation	491.49	1.00	491.49	198.90		
Scrub Woody Vegetation	47.68	0.60	28.61	17.15		
Grassland Vegetation				24.97		
Wet Grassland Vegetation					4.30	
Marcellinas Creek						2.11
<b>TOTAL</b>			578.34	273.81	4.30	2.11

Table 2. Summary of habitat construction requirement calculations.

Habitat Segment	Wooded	Ground Cover		Aquatic
		Terrestrial	Wet	
Total lost DSAY's	578.34	273.81	4.30	2.11
DSAY Credit/acre constructed	17.48	27.86	21.96	11.37
Acres to be Constructed <sup>1</sup>	33.09	9.83	0.20	0.19
Habitat Segment Relative Value (%)	0.80	0.20	0.30	
Complete Wooded Habitat Equivalent <sup>2</sup>	26.48	1.97	0.06	
<b>Total Wooded Habitat Construction</b>		28.50		0.19

<sup>1</sup> Determined by dividing total lost DSAY's by DSAY credit per acre of constructed habitat

<sup>2</sup> Determined by multiplying acres to be constructed by the habitat segment relative value

Table 3. Summary of habitat preservation requirements

Habitat Segment	Wooded	Ground Cover		Aquatic
		Terrestrial	Wet	
Total lost DSAY's	578.34	273.81	4.30	2.11
Habitat Segment Relative Value (%)	0.80	0.20	0.30	
Wooded habitat equivalent	462.67	54.76	1.29	
Total wooded habitat equivalent DSAY's		518.73		
		Hamilton Property 2012 implementation		
Preservation options	Generic	Conserved	Non-Conserved	
DSAY Credit/acre preserved	2.06	2.30	3.01	
Preservation acreage required	251.91	70.60	118.42	
<b>Total Acreage Required</b>	251.91	189.02		

Table 4. Evaluation of Goliad Tract preservation and restoration requirements

Goliad Tract evaluation				
Woodland equivalent DSAY lost	Goliad Tract Woodland Preservation DSAY	Remainder Woodland Requirement DSAY	Goliad tract Construction Value (DSAY) per acre	Construction Required (acres)
518.73	55.65	463.07	15.6	29.6

Calculation of Total Discounted Acre-Years of Resources Services Gained

Scenario : Goliad Property Preservation - woodlands  
Area Constructed (acres) : 19.0  
Base Year : 2010

	% services	Time (mo)	Year	Percent of Resource Services Provided (Beginning of Period)	Percent of Resource Services Provided (End of Period)	Percent of Resource Services Provided (Average of Period)	Acre-years of Resource Services Provided	Discount Factor	Discounted Acre-years of Resource Services Provided
Initial level of injury	0	1998	1998	0.00	0.00	0.00	0.00	1.43	0.00
End of First Restoration Phase	0	2015	1999	0.00	0.00	0.00	0.00	1.38	0.00
End of Second Restoration Phase	15	2045	2000	0.00	0.00	0.00	0.00	1.34	0.00
End of Third Restoration Phase	15	2203	2001	0.00	0.00	0.00	0.00	1.30	0.00
End of Fourth Restoration Phase	15	2203	2002	0.00	0.00	0.00	0.00	1.27	0.00
End of Fifth Restoration Phase	0	2203	2003	0.00	0.00	0.00	0.00	1.23	0.00
End of restoration period	0	2203	2004	0.00	0.00	0.00	0.00	1.19	0.00
			2005	0.00	0.00	0.00	0.00	1.16	0.00
			2006	0.00	0.00	0.00	0.00	1.13	0.00
			2007	0.00	0.00	0.00	0.00	1.09	0.00
			2008	0.00	0.00	0.00	0.00	1.06	0.00
			2009	0.00	0.00	0.00	0.00	1.03	0.00
			2010	0.00	0.00	0.00	0.00	1.00	0.00
			2011	0.00	0.00	0.00	0.00	0.97	0.00
			2012	0.00	0.00	0.00	0.00	0.94	0.00
			2013	0.00	0.00	0.00	0.00	0.92	0.00
			2014	0.00	0.00	0.00	0.00	0.89	0.00
			2015	0.00	0.50	0.25	0.05	0.86	0.04
			2016	0.50	1.00	0.75	0.14	0.84	0.12
			2017	1.00	1.50	1.25	0.24	0.81	0.19
			2018	1.50	2.00	1.75	0.33	0.79	0.26
			2019	2.00	2.50	2.25	0.43	0.77	0.33
			2020	2.50	3.00	2.75	0.52	0.74	0.39
			2021	3.00	3.50	3.25	0.62	0.72	0.45
			2022	3.50	4.00	3.75	0.71	0.70	0.50
			2023	4.00	4.50	4.25	0.81	0.68	0.55
			2024	4.50	5.00	4.75	0.90	0.66	0.60
			2025	5.00	5.50	5.25	1.00	0.64	0.64
			2026	5.50	6.00	5.75	1.09	0.62	0.68
			2027	6.00	6.50	6.25	1.19	0.61	0.72
			2028	6.50	7.00	6.75	1.28	0.59	0.75
			2029	7.00	7.50	7.25	1.38	0.57	0.79
			2030	7.50	8.00	7.75	1.47	0.55	0.82
			2031	8.00	8.50	8.25	1.57	0.54	0.84
			2032	8.50	9.00	8.75	1.66	0.52	0.87
			2033	9.00	9.50	9.25	1.76	0.51	0.89
			2034	9.50	10.00	9.75	1.85	0.49	0.91
			2035	10.00	10.50	10.25	1.95	0.48	0.93
			2036	10.50	11.00	10.75	2.04	0.46	0.95
			2037	11.00	11.50	11.25	2.14	0.45	0.96
			2038	11.50	12.00	11.75	2.23	0.44	0.98
			2039	12.00	12.50	12.25	2.33	0.42	0.99
			2040	12.50	13.00	12.75	2.42	0.41	1.00
			2041	13.00	13.50	13.25	2.52	0.40	1.01
			2042	13.50	14.00	13.75	2.61	0.39	1.01
			2043	14.00	14.50	14.25	2.71	0.38	1.02
			2044	14.50	15.00	14.75	2.80	0.37	1.03
			2045	15.00	15.00	15.00	2.85	0.36	1.01
			2046	15.00	15.00	15.00	2.85	0.35	0.98
			2047	15.00	15.00	15.00	2.85	0.33	0.95
			2048	15.00	15.00	15.00	2.85	0.33	0.93
			2049	15.00	15.00	15.00	2.85	0.32	0.90
			2050	15.00	15.00	15.00	2.85	0.31	0.87
			2051	15.00	15.00	15.00	2.85	0.30	0.85
			2052	15.00	15.00	15.00	2.85	0.29	0.82
			2053	15.00	15.00	15.00	2.85	0.28	0.80
			2054	15.00	15.00	15.00	2.85	0.27	0.78
			2055	15.00	15.00	15.00	2.85	0.26	0.75
			2056	15.00	15.00	15.00	2.85	0.26	0.73
			2057	15.00	15.00	15.00	2.85	0.25	0.71
			2058	15.00	15.00	15.00	2.85	0.24	0.69
			2059	15.00	15.00	15.00	2.85	0.23	0.67
			2060	15.00	15.00	15.00	2.85	0.23	0.65
			2061	15.00	15.00	15.00	2.85	0.22	0.63
			2062	15.00	15.00	15.00	2.85	0.22	0.61
			2063	15.00	15.00	15.00	2.85	0.21	0.59
			2064	15.00	15.00	15.00	2.85	0.20	0.58
			2065	15.00	15.00	15.00	2.85	0.20	0.56
			2066	15.00	15.00	15.00	2.85	0.19	0.54
			2067	15.00	15.00	15.00	2.85	0.19	0.53
			2068	15.00	15.00	15.00	2.85	0.18	0.51
			2069	15.00	15.00	15.00	2.85	0.17	0.50
			2070	15.00	15.00	15.00	2.85	0.17	0.48
			2071	15.00	15.00	15.00	2.85	0.16	0.47
			2072	15.00	15.00	15.00	2.85	0.16	0.46
			2073	15.00	15.00	15.00	2.85	0.16	0.44
			2074	15.00	15.00	15.00	2.85	0.15	0.43
			2075	15.00	15.00	15.00	2.85	0.15	0.42
			2076	15.00	15.00	15.00	2.85	0.14	0.41
			2077	15.00	15.00	15.00	2.85	0.14	0.39
TOTAL LOST DSAY	55.65								

2078	15.00	15.00	15.00	2.85	0.13	0.38
2079	15.00	15.00	15.00	2.85	0.13	0.37
2080	15.00	15.00	15.00	2.85	0.13	0.36
2081	15.00	15.00	15.00	2.85	0.12	0.35
2082	15.00	15.00	15.00	2.85	0.12	0.34
2083	15.00	15.00	15.00	2.85	0.12	0.33
2084	15.00	15.00	15.00	2.85	0.11	0.32
2085	15.00	15.00	15.00	2.85	0.11	0.31
2086	15.00	15.00	15.00	2.85	0.11	0.30
2087	15.00	15.00	15.00	2.85	0.10	0.29
2088	15.00	15.00	15.00	2.85	0.10	0.28
2089	15.00	15.00	15.00	2.85	0.10	0.28
2090	15.00	15.00	15.00	2.85	0.09	0.27
2091	15.00	15.00	15.00	2.85	0.09	0.26
2092	15.00	15.00	15.00	2.85	0.09	0.25
2093	15.00	15.00	15.00	2.85	0.09	0.25
2094	15.00	15.00	15.00	2.85	0.08	0.24
2095	15.00	15.00	15.00	2.85	0.08	0.23
2096	15.00	15.00	15.00	2.85	0.08	0.22
2097	15.00	15.00	15.00	2.85	0.08	0.22
2098	15.00	15.00	15.00	2.85	0.07	0.21
2099	15.00	15.00	15.00	2.85	0.07	0.21
2100	15.00	15.00	15.00	2.85	0.07	0.20
2101	15.00	15.00	15.00	2.85	0.07	0.19
2102	15.00	15.00	15.00	2.85	0.07	0.19
2103	15.00	15.00	15.00	2.85	0.06	0.18
2104	15.00	15.00	15.00	2.85	0.06	0.18
2105	15.00	15.00	15.00	2.85	0.06	0.17
2106	15.00	15.00	15.00	2.85	0.06	0.17
2107	15.00	15.00	15.00	2.85	0.06	0.16
2108	15.00	15.00	15.00	2.85	0.06	0.16
2109	15.00	15.00	15.00	2.85	0.05	0.15
2110	15.00	15.00	15.00	2.85	0.05	0.15
2111	15.00	15.00	15.00	2.85	0.05	0.14
2112	15.00	15.00	15.00	2.85	0.05	0.14
2113	15.00	15.00	15.00	2.85	0.05	0.14
2114	15.00	15.00	15.00	2.85	0.05	0.13
2115	15.00	15.00	15.00	2.85	0.04	0.13
2116	15.00	15.00	15.00	2.85	0.04	0.12
2117	15.00	15.00	15.00	2.85	0.04	0.12
2118	15.00	15.00	15.00	2.85	0.04	0.12
2119	15.00	15.00	15.00	2.85	0.04	0.11
2120	15.00	15.00	15.00	2.85	0.04	0.11
2121	15.00	15.00	15.00	2.85	0.04	0.11
2122	15.00	15.00	15.00	2.85	0.04	0.10
2123	15.00	15.00	15.00	2.85	0.04	0.10
2124	15.00	15.00	15.00	2.85	0.03	0.10
2125	15.00	15.00	15.00	2.85	0.03	0.10
2126	15.00	15.00	15.00	2.85	0.03	0.09
2127	15.00	15.00	15.00	2.85	0.03	0.09
2128	15.00	15.00	15.00	2.85	0.03	0.09
2129	15.00	15.00	15.00	2.85	0.03	0.08
2130	15.00	15.00	15.00	2.85	0.03	0.08
2131	15.00	15.00	15.00	2.85	0.03	0.08
2132	15.00	15.00	15.00	2.85	0.03	0.08
2133	15.00	15.00	15.00	2.85	0.03	0.08
2134	15.00	15.00	15.00	2.85	0.03	0.07
2135	15.00	15.00	15.00	2.85	0.02	0.07
2136	15.00	15.00	15.00	2.85	0.02	0.07
2137	15.00	15.00	15.00	2.85	0.02	0.07
2138	15.00	15.00	15.00	2.85	0.02	0.06
2139	15.00	15.00	15.00	2.85	0.02	0.06
2140	15.00	15.00	15.00	2.85	0.02	0.06
2141	15.00	15.00	15.00	2.85	0.02	0.06
2142	15.00	15.00	15.00	2.85	0.02	0.06
2143	15.00	15.00	15.00	2.85	0.02	0.06
2144	15.00	15.00	15.00	2.85	0.02	0.05
2145	15.00	15.00	15.00	2.85	0.02	0.05
2146	15.00	15.00	15.00	2.85	0.02	0.05
2147	15.00	15.00	15.00	2.85	0.02	0.05
2148	15.00	15.00	15.00	2.85	0.02	0.05
2149	15.00	15.00	15.00	2.85	0.02	0.05
2150	15.00	15.00	15.00	2.85	0.02	0.05
2151	15.00	15.00	15.00	2.85	0.02	0.04
2152	15.00	15.00	15.00	2.85	0.02	0.04
2153	15.00	15.00	15.00	2.85	0.01	0.04
2154	15.00	15.00	15.00	2.85	0.01	0.04
2155	15.00	15.00	15.00	2.85	0.01	0.04
2156	15.00	15.00	15.00	2.85	0.01	0.04
2157	15.00	15.00	15.00	2.85	0.01	0.04
2158	15.00	15.00	15.00	2.85	0.01	0.04
2159	15.00	15.00	15.00	2.85	0.01	0.03
2160	15.00	15.00	15.00	2.85	0.01	0.03
2161	15.00	15.00	15.00	2.85	0.01	0.03
2162	15.00	15.00	15.00	2.85	0.01	0.03
2163	15.00	15.00	15.00	2.85	0.01	0.03
2164	15.00	15.00	15.00	2.85	0.01	0.03
2165	15.00	15.00	15.00	2.85	0.01	0.03
2166	15.00	15.00	15.00	2.85	0.01	0.03
2167	15.00	15.00	15.00	2.85	0.01	0.03
2168	15.00	15.00	15.00	2.85	0.01	0.03

TOTAL	55.65
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Calculation of Total Discounted Acre-Years of Resources Services Gained

Scenario : Goliad Woody restoration  
Area Constructed (acres) : 1.0  
Base Year : 2010

	% services Time (mo)	Year	Percent of Resource Services Provided (Beginning of Period)	Percent of Resource Services Provided (End of Period)	Percent of Resource Services Provided (Average of Period)	Acre-years of Resource Services Provided	Discount Factor	Discounted Acre-years of Resource Services Provided
Initial level of injury	0	1998						
End of First Restoration Phase	0	2015	1998	0.00	0.00	0.00	1.43	0.00
End of Second Restoration Phase	80	2045	1999	0.00	0.00	0.00	1.38	0.00
End of Third Restoration Phase	80	2065	2000	0.00	0.00	0.00	1.34	0.00
End of Fourth Restoration Phase	80	2215	2001	0.00	0.00	0.00	1.30	0.00
End of Fifth Restoration Phase	0	2215	2002	0.00	0.00	0.00	1.27	0.00
End of restoration period	0	2215	2003	0.00	0.00	0.00	1.23	0.00
			2004	0.00	0.00	0.00	1.19	0.00
			2005	0.00	0.00	0.00	1.16	0.00
TOTAL LOST DSAY	15.65		2006	0.00	0.00	0.00	1.13	0.00
			2007	0.00	0.00	0.00	1.09	0.00
			2008	0.00	0.00	0.00	1.06	0.00
			2009	0.00	0.00	0.00	1.03	0.00
			2010	0.00	0.00	0.00	1.00	0.00
			2011	0.00	0.00	0.00	0.97	0.00
			2012	0.00	0.00	0.00	0.94	0.00
			2013	0.00	0.00	0.00	0.92	0.00
			2014	0.00	0.00	0.00	0.89	0.00
			2015	0.00	2.67	1.33	0.86	0.01
			2016	2.67	5.33	4.00	0.84	0.03
			2017	5.33	8.00	6.67	0.81	0.05
			2018	8.00	10.67	9.33	0.79	0.07
			2019	10.67	13.33	12.00	0.77	0.09
			2020	13.33	16.00	14.67	0.74	0.11
			2021	16.00	18.67	17.33	0.72	0.13
			2022	18.67	21.33	20.00	0.70	0.14
			2023	21.33	24.00	22.67	0.68	0.15
			2024	24.00	26.67	25.33	0.66	0.17
			2025	26.67	29.33	28.00	0.64	0.18
			2026	29.33	32.00	30.67	0.62	0.19
			2027	32.00	34.67	33.33	0.61	0.20
			2028	34.67	37.33	36.00	0.59	0.21
			2029	37.33	40.00	38.67	0.57	0.22
			2030	40.00	42.67	41.33	0.55	0.23
			2031	42.67	45.33	44.00	0.54	0.24
			2032	45.33	48.00	46.67	0.52	0.24
			2033	48.00	50.67	49.33	0.51	0.25
			2034	50.67	53.33	52.00	0.52	0.26
			2035	53.33	56.00	54.67	0.55	0.26
			2036	56.00	58.67	57.33	0.57	0.27
			2037	58.67	61.33	60.00	0.60	0.27
			2038	61.33	64.00	62.67	0.63	0.27
			2039	64.00	66.67	65.33	0.65	0.28
			2040	66.67	69.33	68.00	0.68	0.28
			2041	69.33	72.00	70.67	0.71	0.28
			2042	72.00	74.67	73.33	0.73	0.28
			2043	74.67	77.33	76.00	0.76	0.29
			2044	77.33	80.00	78.67	0.79	0.29
			2045	80.00	80.00	80.00	0.80	0.28
			2046	80.00	80.00	80.00	0.80	0.28
			2047	80.00	80.00	80.00	0.80	0.27
			2048	80.00	80.00	80.00	0.80	0.26
			2049	80.00	80.00	80.00	0.80	0.25
			2050	80.00	80.00	80.00	0.80	0.25
			2051	80.00	80.00	80.00	0.80	0.24
			2052	80.00	80.00	80.00	0.80	0.23
			2053	80.00	80.00	80.00	0.80	0.22
			2054	80.00	80.00	80.00	0.80	0.22
			2055	80.00	80.00	80.00	0.80	0.21
			2056	80.00	80.00	80.00	0.80	0.21
			2057	80.00	80.00	80.00	0.80	0.20
			2058	80.00	80.00	80.00	0.80	0.19
			2059	80.00	80.00	80.00	0.80	0.19
			2060	80.00	80.00	80.00	0.80	0.18
			2061	80.00	80.00	80.00	0.80	0.18
			2062	80.00	80.00	80.00	0.80	0.17
			2063	80.00	80.00	80.00	0.80	0.17
			2064	80.00	80.00	80.00	0.80	0.16
			2065	80.00	80.00	80.00	0.80	0.16
			2066	80.00	80.00	80.00	0.80	0.15
			2067	80.00	80.00	80.00	0.80	0.15
			2068	80.00	80.00	80.00	0.80	0.14
			2069	80.00	80.00	80.00	0.80	0.14
			2070	80.00	80.00	80.00	0.80	0.14
			2071	80.00	80.00	80.00	0.80	0.13
			2072	80.00	80.00	80.00	0.80	0.13
			2073	80.00	80.00	80.00	0.80	0.12
			2074	80.00	80.00	80.00	0.80	0.12
			2075	80.00	80.00	80.00	0.80	0.12
			2076	80.00	80.00	80.00	0.80	0.11
			2077	80.00	80.00	80.00	0.80	0.11

2078	80.00	80.00	80.00	0.80	0.13	0.11
2079	80.00	80.00	80.00	0.80	0.13	0.10
2080	80.00	80.00	80.00	0.80	0.13	0.10
2081	80.00	80.00	80.00	0.80	0.12	0.10
2082	80.00	80.00	80.00	0.80	0.12	0.10
2083	80.00	80.00	80.00	0.80	0.12	0.09
2084	80.00	80.00	80.00	0.80	0.11	0.09
2085	80.00	80.00	80.00	0.80	0.11	0.09
2086	80.00	80.00	80.00	0.80	0.11	0.08
2087	80.00	80.00	80.00	0.80	0.10	0.08
2088	80.00	80.00	80.00	0.80	0.10	0.08
2089	80.00	80.00	80.00	0.80	0.10	0.08
2090	80.00	80.00	80.00	0.80	0.09	0.08
2091	80.00	80.00	80.00	0.80	0.09	0.07
2092	80.00	80.00	80.00	0.80	0.09	0.07
2093	80.00	80.00	80.00	0.80	0.09	0.07
2094	80.00	80.00	80.00	0.80	0.08	0.07
2095	80.00	80.00	80.00	0.80	0.08	0.06
2096	80.00	80.00	80.00	0.80	0.08	0.06
2097	80.00	80.00	80.00	0.80	0.08	0.06
2098	80.00	80.00	80.00	0.80	0.07	0.06
2099	80.00	80.00	80.00	0.80	0.07	0.06
2100	80.00	80.00	80.00	0.80	0.07	0.06
2101	80.00	80.00	80.00	0.80	0.07	0.05
2102	80.00	80.00	80.00	0.80	0.07	0.05
2103	80.00	80.00	80.00	0.80	0.06	0.05
2104	80.00	80.00	80.00	0.80	0.06	0.05
2105	80.00	80.00	80.00	0.80	0.06	0.05
2106	80.00	80.00	80.00	0.80	0.06	0.05
2107	80.00	80.00	80.00	0.80	0.06	0.05
2108	80.00	80.00	80.00	0.80	0.06	0.04
2109	80.00	80.00	80.00	0.80	0.05	0.04
2110	80.00	80.00	80.00	0.80	0.05	0.04
2111	80.00	80.00	80.00	0.80	0.05	0.04
2112	80.00	80.00	80.00	0.80	0.05	0.04
2113	80.00	80.00	80.00	0.80	0.05	0.04
2114	80.00	80.00	80.00	0.80	0.05	0.04
2115	80.00	80.00	80.00	0.80	0.04	0.04
2116	80.00	80.00	80.00	0.80	0.04	0.03
2117	80.00	80.00	80.00	0.80	0.04	0.03
2118	80.00	80.00	80.00	0.80	0.04	0.03
2119	80.00	80.00	80.00	0.80	0.04	0.03
2120	80.00	80.00	80.00	0.80	0.04	0.03
2121	80.00	80.00	80.00	0.80	0.04	0.03
2122	80.00	80.00	80.00	0.80	0.04	0.03
2123	80.00	80.00	80.00	0.80	0.04	0.03
2124	80.00	80.00	80.00	0.80	0.03	0.03
2125	80.00	80.00	80.00	0.80	0.03	0.03
2126	80.00	80.00	80.00	0.80	0.03	0.03
2127	80.00	80.00	80.00	0.80	0.03	0.03
2128	80.00	80.00	80.00	0.80	0.03	0.02
2129	80.00	80.00	80.00	0.80	0.03	0.02
2130	80.00	80.00	80.00	0.80	0.03	0.02
2131	80.00	80.00	80.00	0.80	0.03	0.02
2132	80.00	80.00	80.00	0.80	0.03	0.02
2133	80.00	80.00	80.00	0.80	0.03	0.02
2134	80.00	80.00	80.00	0.80	0.03	0.02
2135	80.00	80.00	80.00	0.80	0.02	0.02
2136	80.00	80.00	80.00	0.80	0.02	0.02
2137	80.00	80.00	80.00	0.80	0.02	0.02
2138	80.00	80.00	80.00	0.80	0.02	0.02
2139	80.00	80.00	80.00	0.80	0.02	0.02
2140	80.00	80.00	80.00	0.80	0.02	0.02
2141	80.00	80.00	80.00	0.80	0.02	0.02
2142	80.00	80.00	80.00	0.80	0.02	0.02
2143	80.00	80.00	80.00	0.80	0.02	0.02
2144	80.00	80.00	80.00	0.80	0.02	0.02
2145	80.00	80.00	80.00	0.80	0.02	0.01
2146	80.00	80.00	80.00	0.80	0.02	0.01
2147	80.00	80.00	80.00	0.80	0.02	0.01
2148	80.00	80.00	80.00	0.80	0.02	0.01
2149	80.00	80.00	80.00	0.80	0.02	0.01
2150	80.00	80.00	80.00	0.80	0.02	0.01
2151	80.00	80.00	80.00	0.80	0.02	0.01
2152	80.00	80.00	80.00	0.80	0.02	0.01
2153	80.00	80.00	80.00	0.80	0.01	0.01
2154	80.00	80.00	80.00	0.80	0.01	0.01
2155	80.00	80.00	80.00	0.80	0.01	0.01
2156	80.00	80.00	80.00	0.80	0.01	0.01
2157	80.00	80.00	80.00	0.80	0.01	0.01
2158	80.00	80.00	80.00	0.80	0.01	0.01
2159	80.00	80.00	80.00	0.80	0.01	0.01
2160	80.00	80.00	80.00	0.80	0.01	0.01
2161	80.00	80.00	80.00	0.80	0.01	0.01
2162	80.00	80.00	80.00	0.80	0.01	0.01
2163	80.00	80.00	80.00	0.80	0.01	0.01
2164	80.00	80.00	80.00	0.80	0.01	0.01
2165	80.00	80.00	80.00	0.80	0.01	0.01
2166	80.00	80.00	80.00	0.80	0.01	0.01
2167	80.00	80.00	80.00	0.80	0.01	0.01
2168	80.00	80.00	80.00	0.80	0.01	0.01

TOTAL	15.65
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