Final Damage Assessment and Restoration Plan for the Former Empire Oil Refinery Gainesville, Texas

July 10, 2008

Prepared by:

Final Damage Assessment and Restoration Plan for the Former Empire Oil Refinery Gainesville, Texas

Note to Reader:
The Damage Assessment and Restoration Plan (DARP) is intended to inform members of the public on the Texas Natural Resource Trustees' assessment of the natural resource injuries and service losses described herein and the restoration actions which the Trustees have selected to compensate the public for those injuries and losses. No substantive comments on the Draft DARP were received by the Trustees during the public comment period, which ended March 7, 2008. The Trustees therefore present this document as the Final DARP for the Former Empire Oil Refinery.

Executive Summary:
This Final Damage Assessment and Restoration Plan (DARP) has been prepared by State and Federal Natural Resource Trustees to address natural resources and services injured or lost due to releases of oily products and hazardous substances from the former Empire Oil Refinery located in Gainesville, Texas ("Site"). The designated natural resource trustee agencies involved in the development of this document are the United States Department of the Interior (DOI) represented by the U.S. Fish and Wildlife Service (USFWS), Texas Commission on Environmental Quality (TCEQ), Texas General Land Office (GLO) and the Texas Parks and Wildlife Department (TPWD) (collectively, the "Trustees").

Located on approximately 200 acres of land, northwest of the City of Gainesville in Cooke County, Texas, the former Empire Oil Refinery was owned and operated by Empire Oil Company from approximately 1916 until the 1930s. Empire Oil was a wholly-owned subsidiary of City Service (Cities) and later merged with Cities around 1933. They continued refining activities at the Site until 1935. In 1982, Occidental Petroleum Corporation (OPC) purchased Cities and acquired 95% of Cities assets, with the remaining 5% of Cities assets and associated liabilities being sold to Canadian Occidental Offshore Production Company (COOPCO). Through an indemnity agreement between COOPCO and OPC, OXY USA, a subsidiary of OPC, assumed the liability for the former Empire Oil Site even though they were not a title holder to the property.

Remnants of the former refinery, including tank pads and the open oil storage pits containing an undetermined amount of product and waste material, remained onsite after operations ceased in 1935. In October 2000, the USFWS in conjunction with other State and Federal Agencies responded to an anonymous complaint about the Site. It was during this complaint investigation that 51 waste-coated dead birds and 4 dead turtles trapped in the oily wastes were observed within the Northern Pit. Additional wildlife mortalities were observed in the outer ring of the Northern Pit and included: 1 waste-coated dead bird; 1 dead turtle; and 1 waste-coated dead raccoon. Immediately south and adjacent to the outer ring of the Northern Pit, product sheen was observed in Pecan Creek. Contamination was observed in the grassland area immediately adjacent to Pecan Creek and southwest of the Northern Pit. This area appeared to be a series of old tank pads and dikes with visual signs of oily product mixed in the soil. Investigation

of the Southern Pit identified seven dead turtles as well as sheens and salt staining of soils and sediments.

On March 21, 2001, OXY USA entered into the TCEQ Voluntary Cleanup Program (VCP, Case No. 1325) to remediate the Site, focusing on the Northern Pit first, to reduce the imminent threat to migratory avian species and other wildlife. Emergency remediation of the Northern Pit was completed by December 2001. In conjunction with emergency remedial activities at the Site, the Trustees and OXY USA began discussions regarding impacts to natural resources. In 2003, the Trustees made the initial determination that releases of hazardous substances from the facility into the terrestrial and aquatic habitats associated with the Site had occurred. The Trustees also determined that the releases of these hazardous substances posed a direct and indirect threat to natural resources for which the Federal and/or State Governments may assert trusteeship under the Comprehensive Environmental Response Compensation and Liability Act (42 U.S.C. sec.9601 et seq.), the Clean Water Act (33 U.S.C. sec. 1321 et seq.), the Oil Pollution Act (33 U.S.C. 2701 et seq.), and the Texas Hazardous Substances Spill Prevention and Control Act (Water Code, Chapter 26, Subchapter G). The natural resources potentially affected at the Site are the various terrestrial and aquatic habitats and the associated services provided by these habitats, that have been affected or potentially affected by the contaminants at the Site including but not limited to: surface waters, submerged lands, sediments, wetlands, grasslands, upland woods and riparian habitats, migratory avian species (including shore birds, Colonial water birds, waterfowl, and raptors), wildlife, fisheries and other aquatic organisms.

To facilitate the assessment and achieve a cost effective resolution of natural resource injuries at the Site, the Trustees worked with OXY USA and the TCEQ VCP to develop and review site specific data collection and ecological risk assessment. Information collected and developed in this collaborative manner was used as part of the injury assessment process. After evaluation of the site specific data was completed, it was determined that a minimum of 133 acres of constructed, enhanced, or restored habitat would be required to offset all injuries at the Site. This would include a minimum of 99.74 acres of wetlands or aquatic habitat, 29.17 acres of upland prairie and 3.55 acres of riparian / bottomland hardwoods.

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 releases of hazardous substances. These restoration actions make the public whole by providing compensation for injuries and losses to natural resources. Based on a thorough evaluation, the Trustees have concluded that primary restoration coupled with creation of new habitat is feasible and the most appropriate restoration option for the services injured. Therefore the enhancement and construction of habitat (primary restoration) at and adjacent to the Former Empire Oil Refinery Site was selected as the preferred restoration alternative.

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1.0 Introduction and Site Summary

This Final Damage Assessment and Restoration Plan (DARP) has been prepared by State and Federal Natural Resource Trustees to address natural resources and services injured or lost due to releases of oily products and hazardous substances from the former Empire Oil Refinery located in Gainesville, Texas ("Site"). The designated natural resource trustee agencies involved in the development of this document are the United States Department of the Interior (DOI) represented by the U.S. Fish and Wildlife Service (USFWS), Texas Commission on Environmental Quality (TCEQ), Texas General Land Office (GLO) and the Texas Parks and Wildlife Department (TPWD) (collectively, the "Trustees").

The DARP is intended to inform members of the public on the Trustees' assessment of the natural resource injuries and service losses described herein and present the selected restoration actions to compensate the public for those injuries and losses. No substantive comments on the Draft DARP were received by the Trustees during the public comment period, which ended March 7, 2008. The Trustees therefore present this document as the Final DARP for the Former Empire Oil Refinery. Had the Trustees received any substantive responses during the public comment period they would have been considered prior to finalizing this DARP and a summary of the comments and the Trustees' responses thereto would have been included in this Final DARP.

1.1 Overview of the Site and Releases of Hazardous Substances

Located on approximately 200 acres of land, within and adjacent to the City of Gainesville in Cooke County, Texas, the former Empire Oil Refinery was owned and operated by Empire Oil Company from approximately 1916 until the 1930s. Empire Oil was an affiliate of Cities Service (Cities) and later merged with Cities around 1933. Refining activities continued at the Site until 1935. In 1982, Occidental Petroleum Corporation (OPC) acquired Cities and after reorganizing the assets, subsequently sold stock of the reorganized Cities to Canadian Occidental Offshore Production Company (COOPCO) with all of the associated liability. As a result of an indemnity agreement between COOPCO and OPC, OXY USA, a subsidiary of OPC, has accepted responsibility for the former Empire Oil Site, Gainesville site, even though it was not a title holder to the property.

The 200 acre property is divided north to south by Pecan Creek, an intermittent tributary to the Elm Fork of the Trinity River. Significant ecological features of the Site include a large wetland located in the northeast corner of the property, fed by springs and an un-named tributary to Pecan Creek. The wetland has been enhanced by beaver activity and is of significant wildlife and migratory bird value. Other smaller wetlands were associated with the outer rings of the large earthen pit on the north end of the property and along the small riparian corridors located along the eastern end of Pecan Creek and the small intermittent creek leading from the former tank pads to the historic pond. The remainder of the Site is dominated by maintained pastureland and has been regularly grazed for cattle production.

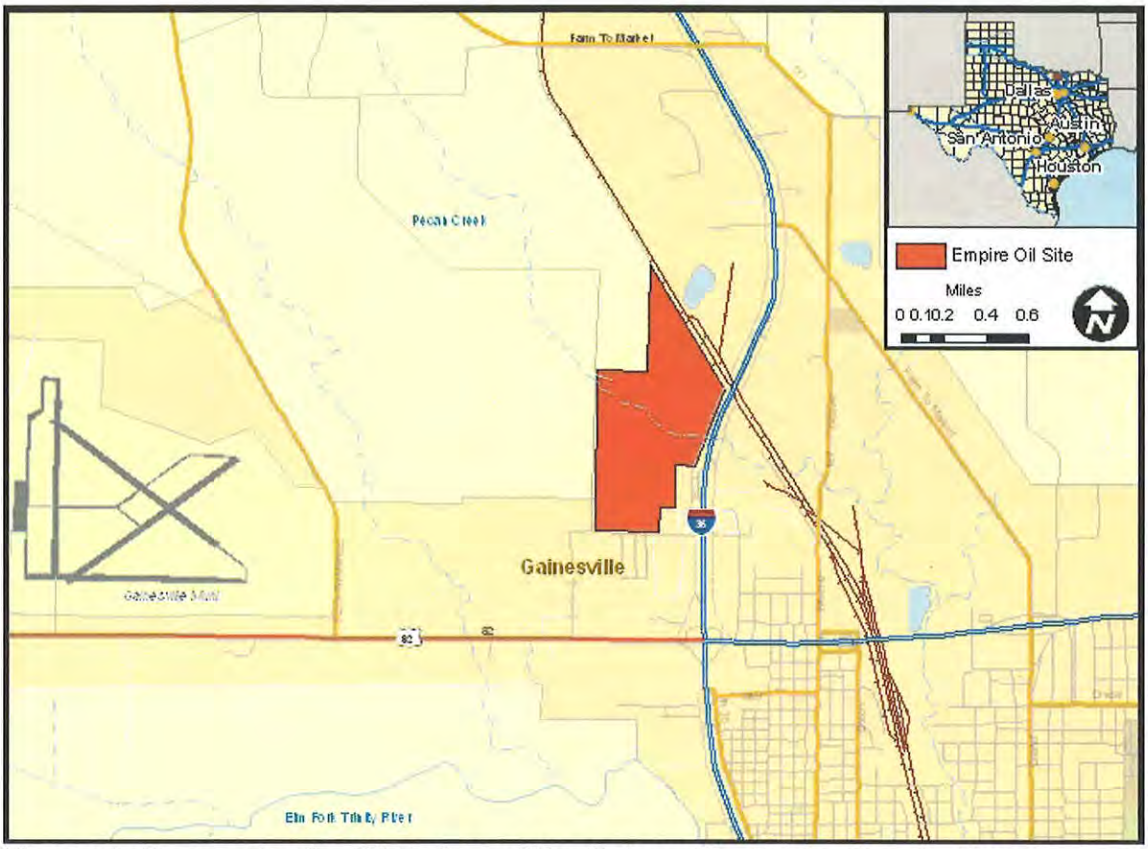

Figure 1: Former Empire Oil Refinery Site, Gainesville, Cooke County, Texas

Remnant refinery structures on the Site consisted of two round earthen and concrete pits and nine former tank pads. The two circular concrete lined storage pits are the dominant features of the Site, each approximately 2.9 acres in size and 25 feet deep and had a capacity of 340,000 barrels (14.3 million gallons). The large pits are referred to as the Northern Pit and the Southern Pit which are located at the northern and southern ends of the property. Each pit had what appeared to be a secondary containment ring approximately 90 feet wide and 20 feet deep. While detailed operational records are not available, it is assumed that the original function of these pits was to store petroleum base products; however products other than petroleum hydrocarbon material were identified in both the Northern and Southern Pits.

The Northern Pit had approximately 47,000 barrels (2 million gallons) of mixed oily waste material remaining in it in 2001. The integrity of the concrete lining of this pit had been compromised with numerous cracks which allowed substances to seep from the pit and contaminate the grassland area immediately to the northwest, groundwater beneath and down-gradient of the pit, and the wetlands area associated with the outer containment ring of the Northern Pit. The Southern Pit, contained subsurface hazardous materials mixed with oily products. The concrete lining associated with the Southern Pit had been breached from aging and historic demolition activities. The outer containment ring of the Southern Pit was incomplete probably due to historic demolition actions and did not exhibit the same level of contamination or wetland development as the outer ring of the Northern Pit.

In addition to the two large pits, nine old aboveground tank pads were located across the Site. Six of the old tank pads were located in the pastureland southwest of the Northern Pit. Runoff from the pits was drained by the un-named tributary that flowed into the historic pond located on the eastern boundary of the Site. A seventh pit was located to the northeast of the Northern Pit in the large wetland area. Subsurface contamination was present in the grasslands associated with old tank battery pad sites located west-southwest of the Northern Pit, and the old tank pad in the wetlands located north-northeast of the Northern Pit. Immediately to the east of the Site and Interstate Highway 35 (IH 35), two additional historic tank pads were uncovered as part of recent construction activities. While not directly associated with the main Site addressed in this DARP, the subsurface contamination associated with the two historic tank pads was removed and injuries associated with those products were considered as part of the Trustees' evaluation.

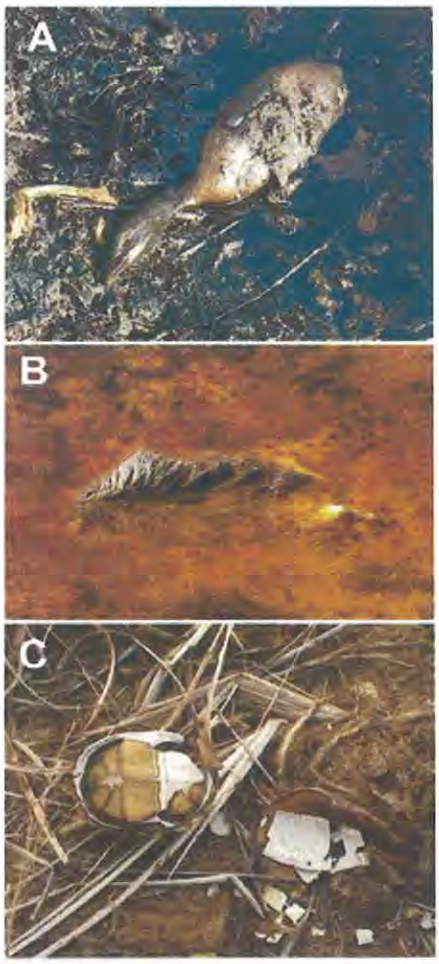

Figure 2 – Observed wildlife mortalities. (A) Oil coated bird (B) Small mammal trapped in tar / oil (C) Box Turtle

Contaminants of concern (COC) associated with the mixed oily waste at this Site that have presented both physical and toxicological injuries to natural resources include but are not limited to: petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and metals. In addition to the aforementioned contaminants, other potentially present but not fully classified hazardous substances include organochlorine, dioxin, furan and PCB compounds or like compounds. Due to limitation of the analytical methodologies available and the interference generated by the complex waste mixture, classification of many of the individual constituents within the mixed waste was difficult or impossible to achieve. This has resulted in a number of constituents that may be presenting false positive detections during the analytical process. Section 4.2 provides a more detailed discussion of these potential compounds, analytical limitations, as well as the Trustees' and OXY USA's agreed evaluation of these constituents.

1.2 Natural Resource Injuries

The former Empire Oil Refinery was in operation from 1915 until 1935. No active refinery operations were conducted at the Site after 1935. The refinery was sold to a salvage company in 1941. The following year (1942) the Myer family purchased the property for dairy operations.

Remnants of the former refinery, including tank pads and the open oil storage pits containing an undetermined amount of product and waste material, remained onsite after operations ceased in 1935. In October 2000, the USFWS in conjunction with other State and Federal Agencies responded to an anonymous complaint about the Site. It was during this complaint investigation that 51 waste-coated dead birds and 4 dead turtles trapped in the oily wastes were observed within the Northern Pit. Additional wildlife mortalities were observed in the outer ring of the Northern Pit and included: 1 waste-coated dead bird, 1 dead turtle, and 1 waste-coated dead raccoon (Figure 2). Immediately south and adjacent to the outer ring of the Northern Pit, product sheen was observed in Pecan Creek. Contamination was observed in the grassland area immediately adjacent to Pecan Creek and southwest of the Northern Pit. This area appeared to be a series of old tank pads and dikes with visual signs of oily product mixed in the soil. Investigation of the Southern Pit identified 7 dead turtles as well as sheens and salt staining of soils and sediments.

The results of the investigation were provided to the U.S. Environmental Protection Agency (EPA), Region VI Emergency Response Division with a recommendation for emergency clean-up to prevent the further loss of wildlife resources and potential impacts to human health. As part of EPA's investigation of the Site, past property owners and activities were researched. Results of EPA site history research indicated that OXY USA was the potentially responsible party and notification was made. On March 21, 2001, OXY USA entered into the TCEQ Voluntary Cleanup Program (VCP, Case No. 1325) to remediate the Site, focusing on the emergency remediation of the Northern Pit first, to reduce the imminent threat to migratory avian species and other wildlife (Figure 3). Emergency remediation of the Northern Pit was completed in December 2001.

Figure 3 Emergency Remedial Activities Spring/Winter 2001. (A) Northern Pit waste oil removal. (B/C) Stabilization and removal of waste materials.

In conjunction with emergency remedial activities at the Site, the Trustees and OXY USA began discussions regarding impacts to natural resources. In 2003, the Trustees made the initial determination that releases of hazardous substances from the historical refinery structures or facilities ("facilities") into the terrestrial and aquatic habitats associated with the Site had occurred. The Trustees also determined that the releases of hazardous substances posed a direct and indirect threat to natural resources for which the Federal and/or State Governments may assert trusteeship under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA, 42 U.S.C. sec.9601 et seq.), the Clean Water Act (33 U.S.C. sec. 1321 et seq.), the Oil Pollution Act (33 U.S.C. 2701 et seq.), and the Texas Hazardous Substances Spill Prevention and Control Act (Water Code, Chapter 26, Subchapter G). The natural resources potentially affected at the Site are the various terrestrial and aquatic habitats and the associated services provided by

these habitats including but not limited to: surface waters, submerged lands, sediments, wetlands, grassland, upland woods and riparian habitats, migratory avian species (including shore birds, Colonial water birds, waterfowl, and raptors), wildlife, fisheries and other aquatic organisms. The Trustees made a further determination that additional assessment of the injuries and restoration planning were warranted. To facilitate the assessment and achieve a cost effective resolution to natural resource injuries at the Site, the Trustees worked with OXY USA and the TCEQ VCP to develop and review Site specific data collection and ecological risk assessment.

1.3 Authority and Legal Requirements

The Trustees are responsible for evaluating potential injuries to natural resources and resource service losses resulting from releases of hazardous substances at the Site pursuant to Section 107(f) of CERCLA (42 U.S.C. Section 9607(f)), the Federal Water Pollution Control Act (also known as the Clean Water Act, 33 U.S.C. Section 1251, et seq.), and other applicable federal or state laws, including Subpart G of the National Oil and Hazardous Substances Contingency Plan (40 C.F.R. Sections 300.600 through 300.615), and regulations at 43 C.F.R. Part 11 which are applicable to natural resource damage assessments (NRDA) under CERCLA. Payment of the cost of actions appropriate to restore, replace or acquire resources or resource services equivalent to those lost (collectively, restoration actions) is the primary method for compensating the public for injuries to natural resources. The goal of this process is to make the environment and public whole using restoration actions to compensate for resources injured or lost that have occurred or may occur in the future associated with the release.

The Trustees have prepared this DARP jointly. Each author agency is a designated Natural Resource Trustee under Section 107(f) of CERCLA (43 U.S.C. Section 9607(f)). As a designated Trustee, each agency is authorized to act on behalf of the public to assess and recover natural resource damages where natural resources and resource services are injured, lost, or destroyed as a result of releases of hazardous substances designated by CERCLA.

1.3.1 Overview of CERCLA Natural Resource Damage Assessment Procedures

Damages recovered by Trustees for natural resource injuries or service losses due to releases of hazardous substances must be used to restore, replace or acquire natural resources or services equivalent to those lost (42 U.S.C. Section 9607(f)(1)). The costs of restoration actions are a preferred measure of natural resource damages under CERCLA.

The goal of the injury assessment is to determine the effect of the hazardous substances associated with releases at the Site on natural resources and services. The injury assessment evaluates the need, type of, and scale of restoration actions as well as which restoration alternatives would provide ecological service benefits comparable to assessed losses. This Final DARP provides the plan developed by the Trustees for restoring ecological services. It identifies and evaluates a reasonable range of restoration alternatives, identifies the preferred restoration alternative, and includes any changes made due comments received during the public comment period for the Draft DARP. The Trustees have determined that the preferred restoration actions will fully compensate for ecological injuries and service losses until the system returns to baseline condition.

1.3.2 Restoration Under CERCLA

Restoration actions for natural resource injuries and service losses under CERCLA are

compensatory in nature and not punitive. Primary restoration, when undertaken, enhances the return of injured natural resources and services to their baseline condition. Compensatory restoration actions compensate for resource injuries and services losses during the interim period, until recovery to baseline occurs.

Removal and remedial actions (collectively, "response actions") are conducted or overseen by various federal and/or state response agencies and focus on controlling exposure to released hazardous substances, by removing, neutralizing, or isolating them in order to protect human health and the environment from the threat of harm. Although response actions can reduce the need for restoration, the two types of actions are separate and distinct. Trustees may allow for natural recovery as an alternative for achieving primary restoration in situations where feasible or cost-effective primary restoration actions are not available.

The Trustees have concluded that the recommended remedial alternative of stabilization, removal and onsite burial of oily waste materials is effective in eliminating the future risk to ecological receptors, but does not fully compensate for injuries to natural resources. The Trustees further concluded that compensatory restoration would be required to compensate for these losses.

The scale of the required compensatory restoration depends both on the scale of the resource injuries and how quickly that resource and its associated services return to baseline. Remedial actions that facilitate or speed resource recovery reduce interim losses and the compensatory restoration required to offset those losses. Resource injuries and service losses caused by implementation of remedial actions are also losses that may be compensated through appropriate restoration actions.

1.3.3 National Environmental Protection Act (NEPA) Compliance

Restoration of natural resources under CERCLA which involves federal Trustee agencies must comply with the National Environmental Protection Act (NEPA, 42 U.S.C. Section 4321, et seq.) and the Council on Environmental Quality (CEQ) regulations implementing NEPA at 40 C.F.R. Part 1500. The process outlined in CERCLA for NRDA selection of restoration alternatives is substantially similar to NEPA and therefore is in compliance with NEPA and the CEQ regulations. This 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. Based on the previous information the Trustees determined that as proposed, the preferred restoration alternative meets the criteria for Categorical Exclusion from further environmental assessment (EA) or environmental impact statement evaluation as provided by the Department of Interior Revised NEPA Implementation Procedures (Department of the Interior, 1996).

1.3.4 Public Participation

Public review of the Draft DARP is an integral part of the restoration planning process. Through public review, the Trustees seek comment on the analyses used to define and quantify natural resource injuries and service losses and the methods being proposed to restore injured natural resources or replace lost resource services. The Draft DARP provided 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 (Feb 1, 2008 – March 7, 2008). Public notices were provided in both the Texas Register and the Gainesville Daily Register. No substantive comments were received by the Trustees during the public comment period. Had substantive comment been received the Trustees would have considered these comments before finalizing the DARP. Since no substantive comments were received by the Trustees, the Trustees present this document as the Final DARP for the Former Empire Oil Refinery.. Public review of the Draft DARP was consistent with all applicable laws and regulations that apply to the natural resource damage assessment process.

2.0 AFFECTED ENVIRONMENT

The former Empire Oil Refinery is located on approximately 200 acres in northwest Gainesville, Cooke County, Texas. Set in the Cross Timbers and Prairies Ecological Region of Texas at the intersection of the East Cross Timbers, Fort Worth Prairie, and West Cross Timbers sub-region (Diggs et. al., 1999) (Figure 4). The terrain was historically dominated by mostly treeless vegetative communities, characterized by gently sloping flat surface features with thin soil over hard layers of resistant limestone and vast tall-grass native prairies. Sparse riparian and wetland communities are primarily restricted to the major waterway and potholes.

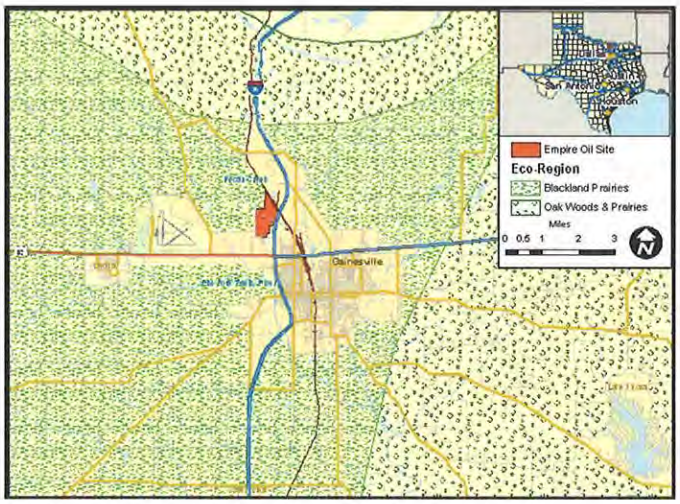

Figure 4 Former Empire Oil Refinery Site Ecological Region.

Extensive modification due to farming, livestock grazing and development and urban sprawl has degraded most of the historical prairie grasses in this region. The former Empire Oil Refinery Site was historically a combination between prairie and intermittent streams and creeks. Since the closure of the former Empire Oil Refinery, the Site has been primarily used as pastureland. The grasslands have become highly modified with commercially viable grass crops, while the riparian habitat has expanded and developed into a more complex wetland structure as a result of old berms, dikes and road construction. Modification has resulted in a more diverse habitat utilized by a wide range of wildlife and bird species (Figure 5). The Site's strategic location along both the eastern and western migratory bird flyways, as well as, the increase in available wetland habitat have made this Site an ideal loafing ground for migratory waterfowl species and over-wintering shoreline birds. In addition to various avian species, beaver, bobcat and other various small mammals, reptiles and amphibians have been observed at the Site.

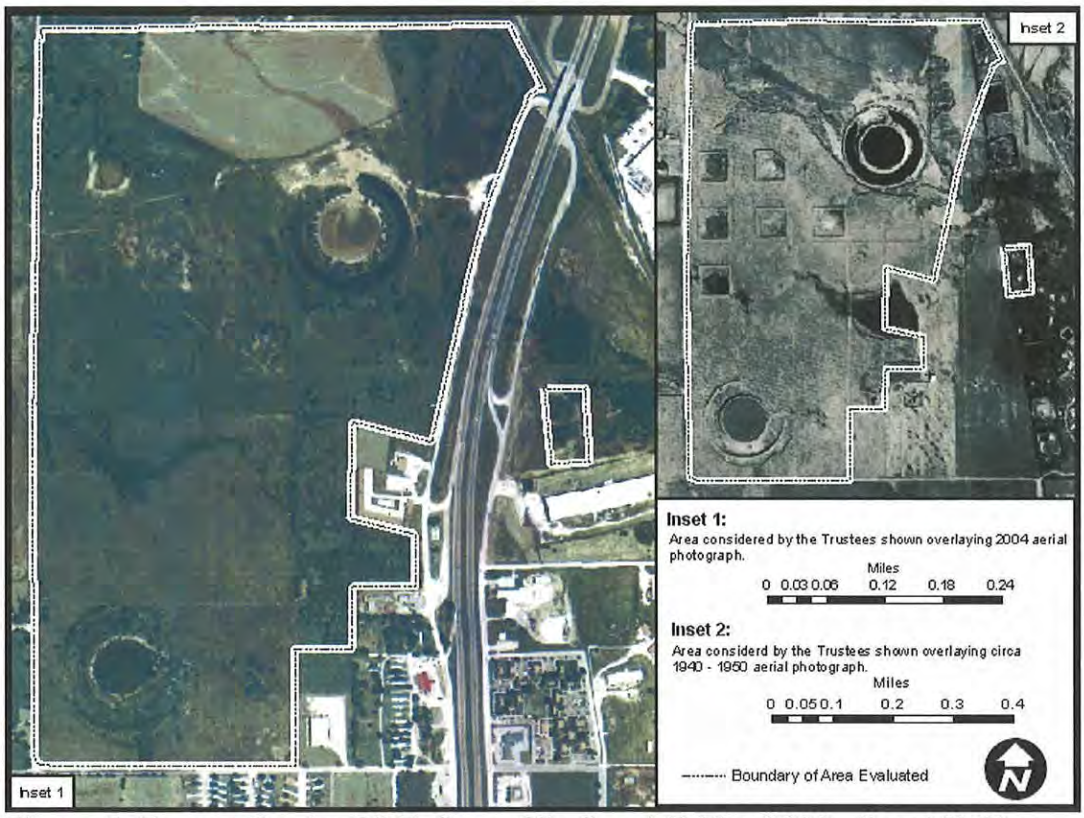

Figure 5: Former Empire Oil Refinery Site (Inset 1) May 2002, (Inset 2) Circa 1940.

3.0 INJURY AND SERVICE LOSSES DUE TO RESPONSE ACTIONS AT THE SITE

Response actions are conducted by potentially responsible parties (PRP), EPA, or state response agencies and focus on controlling exposure to released hazardous substances, 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 (43 C.F.R. Section 11.15).

The Trustees have reason to believe that the response actions undertaken during the event did not prevent, remedy or compensate for any potential injuries to or losses of natural resources under their jurisdiction. The Trustees have concluded that there is a compensable injury resulting from the response actions taken.

4.0 INJURY AND SERVICE LOSS EVALUATION

This section describes the potential injuries and quantifies the potential ecological service losses caused by the releases of hazardous substances from the Site. It begins with an overview that describes the Trustees' assessment strategy. The remainder of the section presents the results of Trustee assessments for the specific resources affected by the releases from the Site, including the approaches used to determine potential injuries and quantify potential service losses.

4.1 Assessment Strategy

The goal of this assessment is to determine the nature and extent of injuries to natural resources and to quantify the resulting resources and services lost. For this Site, the Trustees have pursued a cooperative assessment approach that is closely linked to the emergency response actions at the Site. This integration is advantageous because much of the data needed for the emergency response are useful in evaluating injuries. The integrated approach permits data sharing, resulting in time and/or cost savings. Moreover, integration explicitly recognizes that response action decisions and NRDA primary restoration decisions are interdependent. Remedial decisions can affect the amount and type of primary restoration required at the Site. Thus, the integrated approach promotes efficiency in the overall process.

This assessment was designed for injury assessment and restoration planning to occur in parallel, an approach that is termed a "restoration-based approach". Under a restoration-based approach, the focus of the assessment is on quantifying the injuries and/or losses in natural resources and services in ways that facilitate identification and scaling of restoration alternatives that will provide to the public the same level, type, and quality of services that were lost. This restoration-based assessment approach is consistent with DOI regulations, which allow restoration planning to be included as part of the Assessment Plan phase where available data are sufficient to support concurrent development of assessment and restoration planning (43 C.F.R. Section 11.31).

This injury assessment process occurs in two stages: injury evaluation, and resource and service loss quantification. The Trustees utilized soil, sediment, ground and surface water data collected as part of the remedial investigation and scientific literature to evaluate potential injury to resources. Based on information from these sources and with an understanding of the function of the ecosystem present at the Site, the Trustees were able to evaluate injury to natural resources. The Trustees considered several factors when making this evaluation, including, but not limited to:

- natural resources and services of concern;
- evidence indicating exposure, pathway, and injury;
- mechanism by which injury occurred;
- type, degree, spatial and temporal extent of injury; and
- types of restoration actions that are appropriate and feasible.

For each resource category (either a group of organisms or a habitat type) potentially affected, the Trustees determined whether an injury is likely to occur or has occurred, identified the nature of the injury, and identified a pathway linking the injury to the Site. In order to undertake this effort, an understanding of the contaminants present at the Site is necessary. The evaluation of the contaminant of concern is described in the next section. With an understanding of the contaminant, it is possible to evaluate those resources that could be adversely affected.

4.2 Contaminant of Concern

Contaminants of concern associated with the mixed oily waste at this Site that have presented both physical and toxicological injuries to natural resources include, but are not limited to: petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and metals. Petroleum hydrocarbons and PAHs are known carcinogens and can be highly toxic in an aquatic

environment. PAHs are organic contaminants that tend to adsorb to particulates and sediments. PAHs can bioaccumulate but do not tend to biomagnify because PAHs are rapidly metabolized (Eisler, 1987). PAHs are not very soluble in water and have a strong affinity for particles in aquatic systems, particularly fine particles with high organic content. Fine particles containing PAHs are easily transported downstream with prevailing water currents. The PAHs with high solubility (such as naphthalene) may remain dissolved in surface water, while those with lower solubility are likely to form associations with colloidal material or suspended particulates. Hence, PAHs are commonly associated with suspended particulates in aquatic systems. While PAHs associated with suspended particulates may be photochemically degraded, biodegraded, transported to other areas, and incorporated into aquatic biota, deposition and consolidation with bedded sediments probably represents one of the most important environmental fate processes for this class of compounds. Hence, sediments represent the major environmental sink for these compounds.

Water-borne PAHs can be acutely lethal to invertebrates, fish, and amphibians; long-term exposure to sub-lethal levels can impair survival, growth and reproduction. Similarly, exposure to sediment-associated PAHs can adversely affect the survival, growth, and reproduction of benthic invertebrates. Fish investigations have shown that exposure to PAH contamination can induce mortality and a variety of internal and external abnormalities. Sediments heavily contaminated with industrial waste PAHs have directly caused increased body burdens and increased frequency of liver neoplasia in fishes (Eisler, 1987).

Metals differ from other potentially toxic contaminants in that they are naturally present in the environment. Metals may be found in soil, sediments, surface waters and oceans throughout the world as a result of various geologic and weathering processes. Although some metals may be noted as essential elements, all metals can pose a risk of toxicity at a given concentration due to their reactive nature (Rainbow, 1996). Metals may be potentially toxic in both elemental form or when chemically combined with other elements or chemicals to produce complex compounds (Linder, et. al., 2000). The EPA has identified 17 priority metals commonly associated with industrial waste Sites that pose a potential risk to both human health and the environment (EPA, 2005). These metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, vanadium, and zinc. Exposure to these metals is driven by their bioavailability, route of exposure and the duration of exposure. Although specific effects are metal or compound specific, in most cases, metals affect biological organisms similarly. In general metals or metal compounds attack multiple systems of an organism and the targets for toxicity are specific biochemical processes and/or membranes of cells and organelles. The toxic effect usually involves an interaction between the free metal ion or metal compound and the toxicological target (e.g., the metabolism of the toxic metal may be similar to a metabolically related essential element).

In addition to the aforementioned contaminants, a series of other potentially present but not fully classifiable hazardous substances were noted during laboratory analysis of the waste materials found onsite. Due to the limitation of the analytical methodologies available and the interference generated by the complex waste mixture, classification of many of the individual constituents within the mixed waste was difficult or impossible to achieve. This has resulted in a number of constituents that may be presenting false positive during the analytical process.

Some of the unclassifiable constituents may have included organochlorine, dioxin, furan and PCB compounds or like compounds. Given the complex nature of the mixture, time, cost, analytical limitations and relatively confined distribution of waste materials onsite, as well as the association with more readily identifiable contaminants, it was determined that further refinement of the contaminants in the waste mixture was unwarranted. The nature and extent of the contamination was assumed to be commingled and thus was based on the more readily identifiable metal and PAH compounds identified in the waste mixture.

4.3 Injury Determination and Quantification

In order to determine and quantify injuries to natural resources that potentially or actually occurred at the Site, the Trustees used an integrated approach incorporating data from the remedial site investigation, site surveys, computer aided analysis tools, literature and professional judgment. From this information the Trustees were able to quantify the amount of compensatory restoration required to offset lost use of ecological services provided by the various habitats and associated services onsite. Compensation for interim lost use resulting from historical releases of hazardous substances, remedial actions and post-removal conditions in the creek, riparian wetland and upland areas were considered as part of this evaluation.

Site surveys conducted by the Trustees were used to document the habitat types present, extent of visual contamination, and observed wildlife mortalities onsite. As previously noted, wildlife mortalities included, turtles, small mammals and birds. The site surveys also characterized the habitat types present onsite (i.e. riparian, wetlands, grassland etc.) as well as observable areas of contamination. Using global positioning equipment impacted areas and habitats were mapped using ArcView, a geographic information system (Figure 6). This information allowed the Trustees to evaluate potential or actual impacts to the various communities found at the Site, and was incorporated into the habitat equivalency analysis.

Waste materials from the historic operations at the Site were evaluated as part of the remedial investigation and considered as part of the Trustees' evaluation of the Site. As discussed in Section 4.2, the complex nature of the waste materials made complete classification of all the contaminants present impossible or impracticable. However, given the known toxicity of some of the potentially present contaminants and the degree of uncertainty associated with not fully classifying the waste materials onsite, a method for adequately characterizing the potential impacts from these compounds was necessary. After evaluating the classes of potentially present compound, the Trustees determined that if reasonably conservative assumptions were maintained throughout the evaluation of impacts to natural resources and any remedy selected for the cleanup, that a reasonable level of protection to the environment and Trustee resources could be maintained. For example when evaluating impacts from various constituents more weight would be placed on selecting protective cleanup levels that approached the no observed adverse effects level (NOAEL) or a remedial option that returned Site conditions to background contaminants levels. In maintaining this level of conservatism, the Trustees are confident that appropriately protective cleanup levels and the compensatory restoration project discussed herein would compensate for lost natural resource services.

The remedy selected was also considered as part of the evaluation of injuries associated with the Site. The Trustees worked with OXY USA and the TCEQ remedial division to minimize impacts of the selected remedy on natural resource services. As part of the evaluation, the Trustees considered various remedial options and the potential interim losses to existing services that these actions may have had at the Site. Using this methodology allowed OXY USA and the TCEQ to select the most appropriate remedy that produced minimal interim losses to ecological services while cost effectively eliminating hazardous substances onsite.

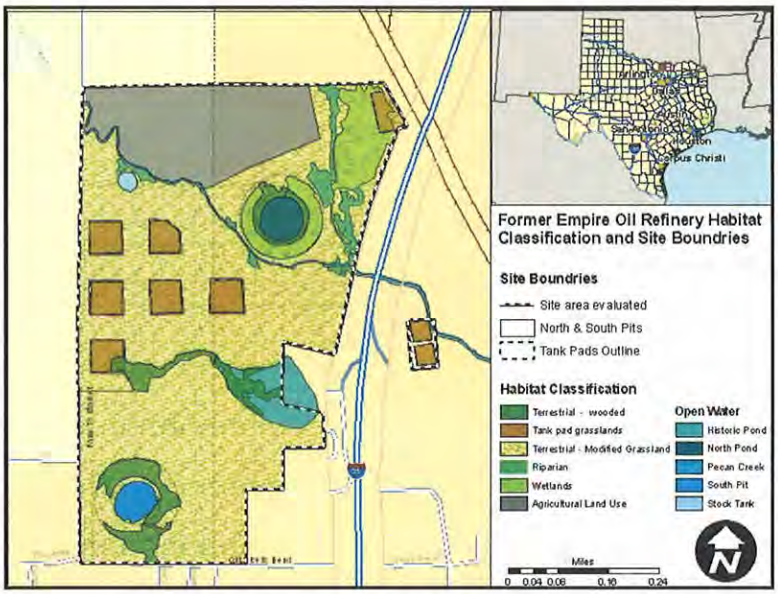

Figure 6: Habitat designations for the Former Empire Oil Refinery Site

The information collected as part of the site investigation and remedial actions was used to determine the compensatory restoration required to offset the lost use of ecological services provided by the various habitats and associated services onsite. Compensation for interim lost use resulting from historical and post-removal conditions in the creek, as well as the clearing of riparian vegetation to enable the removal action, were calculated utilizing a combination of Habitat Equivalency Analysis (HEA) and estimated habitat restoration costs. 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 services associated with the release of oily waste products to the environment over the time required for the lost services to recover to pre-release levels. 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, the inputs for the HEA were based on observations and measurements taken during the site investigation, as well as, the best professional judgment of technical experts (HEA, 1995). HEA is an appropriate tool for this case since: 1) the primary category of lost services pertains to the ecological functions of the area rather than human uses, 2) feasible restoration/habitat creation projects exist that provide services comparable to those lost, and 3) it represents a cost effective method for assessing damages that relies on existing information and the best professional judgment of qualified biologists rather than costly, site-specific studies. A more complete description of the HEA method is provided in Section 6.1 and Appendix A.

5.0 RESTORATION ALTERNATIVES

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 releases of hazardous

substances. These restoration actions make the public whole by providing compensation for injuries and losses to natural resources. The restoration planning process has two components: compensatory restoration and primary restoration. 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. In contrast, primary restoration actions are actions designed to return injured resources and services to their baseline levels.

In accordance with NRDA regulations, the Trustees developed appropriate restoration alternatives and selected the preferred alternative to address resource injuries and losses of services. The Trustees first identified and evaluated general alternatives capable of serving as primary and compensatory restoration for the injured natural resources and/or services. As part of the effort to develop general 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 Site. General alternatives considered by the Trustees included no action, creation of habitat, restoration of existing habitat and preservation of high quality habitat.

Some restoration 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. The Trustees preferentially seek to restore injured natural resources in-kind (e.g., create new wetlands to compensate for lost wetland 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 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.

The cooperative assessment approach used at this Site, enabled the Trustees to cost effectively integrate into the remedial decision-making process. Working cooperatively through the remedial process, the Trustees, OXY USA and the TCEQ VCP evaluated various restoration alternatives that could be incorporated with the preferred remedial action at the Site. While the preferred remedy was agreed to minimize impacts on natural resource services, the Trustees have concluded that the preferred remedy would result in further impacts to natural resource services at the Site and extend the period of time required for natural resource services to return to their baseline condition without further primary restoration actions. The scope of this Final DARP addresses both primary and compensatory restoration alternatives.

Table 5-1 contains the list of general restoration alternatives considered by the Trustees and identifies those selected as preferred, pursuant to the Trustees' evaluation of restoration alternatives in Section 7.0. The logic for selecting alternatives that provide different resources or services as compensation is described in detail in Section 5.2.

Table 5-1 - General Restoration Alternatives Considered for Each Injury

Injured Resource/Service	Compensatory Restoration Alternative [a]
Aquatic / Wetland	No Compensation
	Wetland Restoration
	Wetland Creation
	Wetland Restoration / Creation
	Acquisition & Preservation of Wetland
Riparian / Bottomland Hardwoods	No Compensation
	Riparian / Bottomland Hardwoods Restoration
	Riparian / Bottomland Hardwoods Creation
	Riparian / Bottomland Hardwoods Restoration / Creation
	Acquisition & Preservation of Riparian / Bottomland Hardwoods
Upland / Prairie	No Compensation
	Upland / Prairie Restoration
	Upland / Prairie Creation
	Upland / Prairie Restoration / Creation
	Acquisition & Preservation of Upland / Prairie

Notes:
[a] Preferred Restoration Alternatives (identified in Section 5.2) are in bold

5.1 Selection Criteria

Once a reasonable range of restoration alternatives is developed, the NRDA regulations require the Trustees to identify the preferred restoration alternatives based on certain criteria, including the following:

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), acquisition of state or federal permits, and acquisition of the land needed to complete a project and the potential liability from project construction. Although a monitoring program does increase the cost of an alternative, the presence of an adequate monitoring component is considered a positive attribute because documenting project performance is important.

The extent to which each alternative is expected to meet the Trustees' goals and objectives in compensating for interim losses: The primary goal of any compensatory restoration project is to provide a level and quality of resources and services comparable to those lost. Thus, the ability of the restoration project to provide comparable resources and services is an important consideration. Specifically, the Trustees consider the potential relative productivity of restored habitat and whether the habitat is being created or enhanced. Habitats that would be constructed with or on contaminated sediments will provide fewer benefits and thus would not rank as high in the evaluation process. If habitat is created from clean sediment overlying contaminated sediment, thus isolating the contaminated sediment, then habitat

created would provide a similar level of services to a "clean" habitat. Additionally, the isolation of the contaminants would be a positive effect. Finally, future site management issues and the opportunity for conservation easements are also considered because they can influence the extent that a restoration action meets objectives.

The likelihood of success of each alternative: The Trustees consider technical factors that represent risk to either the success of project construction or the long-term viability of the habitats involved. For example, high rates of subsidence at a project site are considered a risk to long-term existence of constructed habitats. Alternatives that are susceptible to future degradation or loss through contaminant releases or erosion are considered less viable. The Trustees also consider whether difficulties in project implementation are likely and whether long-term maintenance of project features will be necessary and/or feasible. Sustainability of a given restoration action is a measure of the vulnerability to natural or human-induced factors following implementation and the need for future maintenance actions to achieve restoration objectives.

The extent to which each alternative will prevent future injury as a result of the release and will avoid collateral injury as a result of implementing the alternative: For example, the possibility of the project site being contaminated is considered, as is the potential for use of contaminated dredged sediments in the project. The isolation of the contaminants under less contaminated material would be considered positively. Compatibility of the project with the surrounding land use and potential conflicts with any endangered species are also considered.

The extent to which each alternative benefits more than one natural resource or service: This criterion addresses 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. For example, certain types of marsh restoration projects could improve fish habitat such that recreational users experience higher catch rates. Although recreational benefits are not explicitly evaluated in this DARP, opportunities for a restoration alternative to provide these added benefits are considered a positive feature of the alternative.

The effect of each alternative on public health and safety: Projects that would negatively affect public health or safety are not appropriate.

The regulations give the Trustees discretion to prioritize these criteria and to use additional criteria as appropriate. For this Site, the key criterion for the Trustees was the second in the list because it is the criterion that most clearly indicates whether the goal of making the public whole from losses resulting from the release is met. The Trustees also recognized the importance of public participation in the restoration planning process, as well as the acceptance of the projects by the community. Alternatives that are complementary with other community development plans/goals are considered more favorably. The Trustees also considered public access and recreational opportunities provided by a project as positive attributes.

5.2 Evaluation of Restoration Alternatives

Based on a thorough evaluation of a number of factors, including the criteria listed above, the Trustees have selected the preferred restoration alternative for compensatory restoration of injured natural resources and/or services (Table 5-1). The Trustees have concluded that

primary restoration coupled with creation of new compensatory habitat is the most appropriate restoration option for the services injured. Information supporting the Trustees' selection of restoration alternatives is provided throughout the remainder of this section. In compliance with CERCLA and NEPA, the Draft DARP was presented for public comment and review. Comments received by the Trustees were evaluated and incorporated into this Final DARP as appropriate.

DOI NRDA regulations require the Trustees to evaluate the "No Action" alternative, which for compensatory restoration equates to "No Compensation." 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 service in question. Using this injury determination, the Trustees determined that compensation for losses of service is required for the types of interim losses due to the release of hazardous substances to the environment. While natural recovery would occur over varying time scales for the various injured resources, the interim losses suffered would not be compensated under the "no-action" alternative. In addition, the Trustees have determined that the nature of the remedy would not allow all of the previous services provided to return to baseline and therefore it is appropriate to consider primary restoration as an alternative for injuries. The Trustees have determined that the "no action" alternative (i.e., no compensatory restoration) is not preferred.

6.0 SCALE OF RESTORATION

Sections 3 and 4 addressed the injuries to natural resources and services from Site contamination. The injuries are the primary and interim losses that occurred from the release and remediation of hazardous substances at the Site. In Section 5, the compensatory restoration alternatives were identified and evaluated. The evaluation of restoration alternatives resulted in the Trustees selecting construction and restoration as the appropriate first priority for primary and compensatory restoration for natural resource damages.

The focus of this section is the determination of the size or scale of the restoration action. The scale of the restoration action should be that which provides the value to just offset the value of the losses. The process of determining the size of restoration is called restoration scaling.

Restoration scaling requires a framework for quantifying the injury or losses and for quantifying the benefits of restoration so the losses and benefits can be compared. The Trustees used information gained from remedial and site investigations and HEA as the framework for quantifying losses and benefits. The process of scaling using HEA for this DARP is summarized below.

6.1 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 Unites States. 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 equivalency between the lost and restored habitat resources and services. Restoration habitat of the same type, quality, and of comparable value should be provided to compensate for the resource and service losses so that the total losses 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 degree of injury is determined by the condition of key or representative resources or services in the habitat (for example, primary production or macrofaunal density). The losses are 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.

Because the losses occur in different time periods, they 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 that occur in different time periods comparable, a discount factor is applied to the losses to determine discounted service acre-years (DSAYs). In general, HEA is a technique that balances "debits" (habitat loss or other injuries) that have occurred as a result of releases of hazardous substances against compensatory "credits" (habitat restoration projects) and uses a discount factor to account for the difference in time that the restoration services are delivered.

Other parameters are necessary to quantify the benefits of restoration actions in a HEA. They include when the 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 before the injury. These parameters, along with the size of a restoration action and the discount rate, define the DSAY benefits that result from a restoration action. The task is to determine the size of the restoration action such that the DSAY benefits just offset the losses.

To simplify the assessment for the Site, the Trustees normalized all injuries to three habitat types (wetlands, riparian/bottomland hardwood, prairie), so that to the extent possible, injuries could be proportioned to a specific habitat type that would be created or enhanced to provide compensation.

6.2 Interim Loss of Habitat Function

The Trustees assessed injuries resulting from the release of hazardous substances into the environment from the Site. As discussed in Section 4.3, the Trustees identified three primary categories of injury at the Site. These included injuries to aquatic/wetland, riparian/bottomland hardwoods and upland prairie communities. Data collected by the Trustees, OXY USA and TCEQ during the remedial investigation and supplementary investigations were reviewed as sources of information. Injuries were scaled based on the number of acres 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. Injuries were reported as DSAYs for each community type and were then converted to an appropriately scaled acreage for construction or restoration of the specific habitat type. A summary of the injury and restoration parameters and values are provided in Appendix A.

As part of the injury evaluation, the timing and implementation of the remedy and potential restoration project were considered. Since habitats on the Site matured or were altered over time, these changes were considered as well. For example, activities unrelated to the refinery

operations resulted in the creation of new wetlands in the northeast corner of the property. While this habitat did not exist during the operation of the facility, the function of this wetland was impacted by contaminants of concern from soils in and around old tank pads that were subsequently inundated when the wetland was created. Using historical aerial photographs and Site and regional information that was available, the Trustees estimated the duration or inception of existing or new and old habitat types and adjusted the HEA accordingly. Habitats that were present during or post refinery operations that were altered or removed from the Site are referred to as "Historical" and are referenced as such in the HEA tables in Appendix A.

While injuries were evaluated for specific habitats within a category or historical presence, all injuries were summarized within the three primary habitat categories (i.e. aquatic/wetland, riparian/bottomland hard woods, upland/prairie) to facilitate restoration planning. After evaluation it was determined that a minimum of 133 acres of constructed, enhanced or restored habitat would be required to offset all injuries at the Site. Table 6-1 provides a summary of the minimum number of acres required to offset ecological service losses for each habitat type.

Table 6-1: Minimum acres required for compensation of lost natural resource services

Habitat Type to be created	Acres
Aquatic / Wetland	100
Upland Woods / Riparian	4
Upland / Prairie	29
Total	133

7.0 Evaluation of Restoration Project Location

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 releases at the Site. To meet that objective, the benefits of restoration actions must be related, or have an appropriate nexus, to the natural resource injuries and losses from the Site. 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 hazardous substance releases, and

- Potential for restoration at or near the area where natural resource injuries/service losses occurred.

To achieve this fundamental objective, the Trustees determined that the preferred restoration alternative must have an ecological and a geographical relationship to injured resources and lost services. Furthermore, CERCLA requires the Trustees to consider primary restoration when feasible and cost effective. The Trustees approached restoration planning with the view that the injured natural resources/lost services are part of an integrated ecological system and that Pecan Creek and the Elm fork of the Trinity River in Cooke County, Texas represents the

relevant geographical area for restoration actions. Areas outside of this are considered less geographically relevant for restoration alternatives.

7.1 Project Alternatives Analysis

In Section 5.0 the Trustees evaluated various options for restoration of injuries to natural resources and determined their feasibility as per CERLA. The Trustees concluded that primary restoration with enhancement and construction of additional habitat is both feasible and appropriate for the compensation of lost natural resource services. Furthermore sufficient space and habitat exist within the boundaries of the Site to accommodate additional compensatory restoration through construction and enhancement onsite. Since primary restoration at the Site is the preferred restoration methodology, is the most proximal to the injury and would compensate for those services directly impacted at the Site, the Trustees have determined that no further evaluation of offsite restoration alternatives is warranted.

7.2 Preferred Restoration Alternative

The enhancement and construction of habitat (primary restoration) at and adjacent to the Former Empire Oil Refinery Site are the preferred restoration alternative. The Trustees working in conjunction with OXY USA and the TCEQ developed a restoration plan that would be mutually beneficial to the remedial actions at the Site and the need to restore and compensate for injuries to natural resources. Compensation for these injuries requires a minimum of 99.74 acres of wetlands, 3.55 acres of riparian/bottomland hardwoods and 29.17 acres of upland / prairie restoration as described in Section 6.2. To accommodate both restoration and remedial actions at the Site, it was determined that approximately 99 acres of the former refinery Site along with an additional 43 acres owned by OXY USA adjacent to the property would be included as part of the proposed restoration (Figure 7).

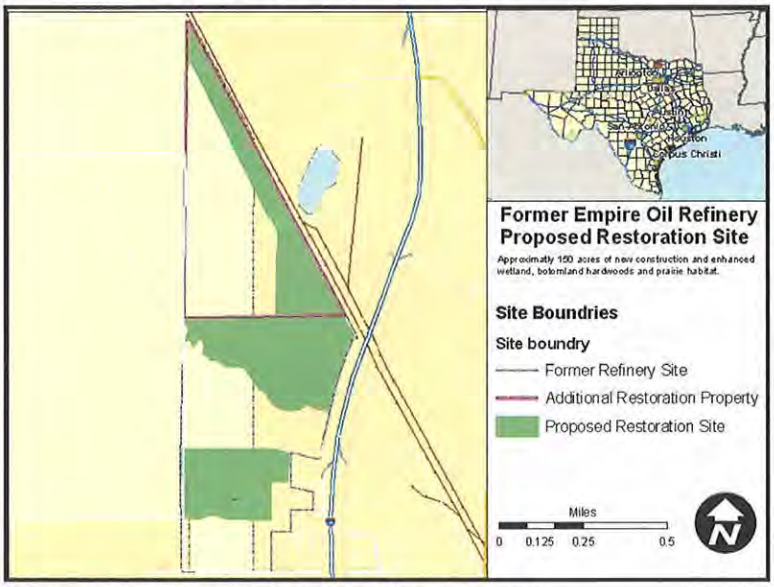

Figure 7: Proposed restoration property.

The restoration site would be divided into 8 segments by habitat type and restoration actions. Segment 1 through 6 would provide aquatic and wetland habitat services, while Segment 7 would enhance and construct riparian/ bottomland hard woods and Segment 8 would provide for lost upland / prairie services. Figure 8 shows the conceptual design encompassing the various habitat types the project would provide. Segments 1 through 6 would consist of the construction of a series of depressions, berms, dikes and dams to enhance water retention and foster wetland development. The goal of construction at Segments 1 through 6 is to develop a mosaic of open water, wet and moist soils that support a variety of submerged and emergent aquatic vegetation. Segment 7 would focus enhancement efforts along the existing wet

weather drainage in the central part of the Site. In this Segment, existing riparian habitat would be augmented with additional native tree species and water features to promote a more diverse habitat. Segment 8 encompasses not only the restoration of native prairie lands, but is integral in the selected remedial alternative. In Segment 8, the former Northern Pit and outer dike would be used to place stabilized materials from the Southern Pit and tank pads. An approved cap over this structure would then be augmented with native prairie grassland species to help prevent erosion while enhancing native habitat and plant species diversity.

The Trustees have evaluated the existing habitat, space and remedial actions and concluded that the primary restoration project at and adjacent to the Former Empire Oil Refinery Site, Gainesville, Texas is feasible. This project will provide comparable ecological services to those injured, provide enhancement of those services directly impacted by the Site, and gain additional ecological benefits similar to those injured from the enhancement and construction of additional habitat at the Site. In addition, since this project could be implemented in conjunction with ongoing remedial actions, cost savings and increased chance of success improve the cost effectiveness and timely implementation of the restoration action. The Trustees have therefore selected a mixture of primary and compensatory restoration at and adjacent to the Site as the restoration alternative.

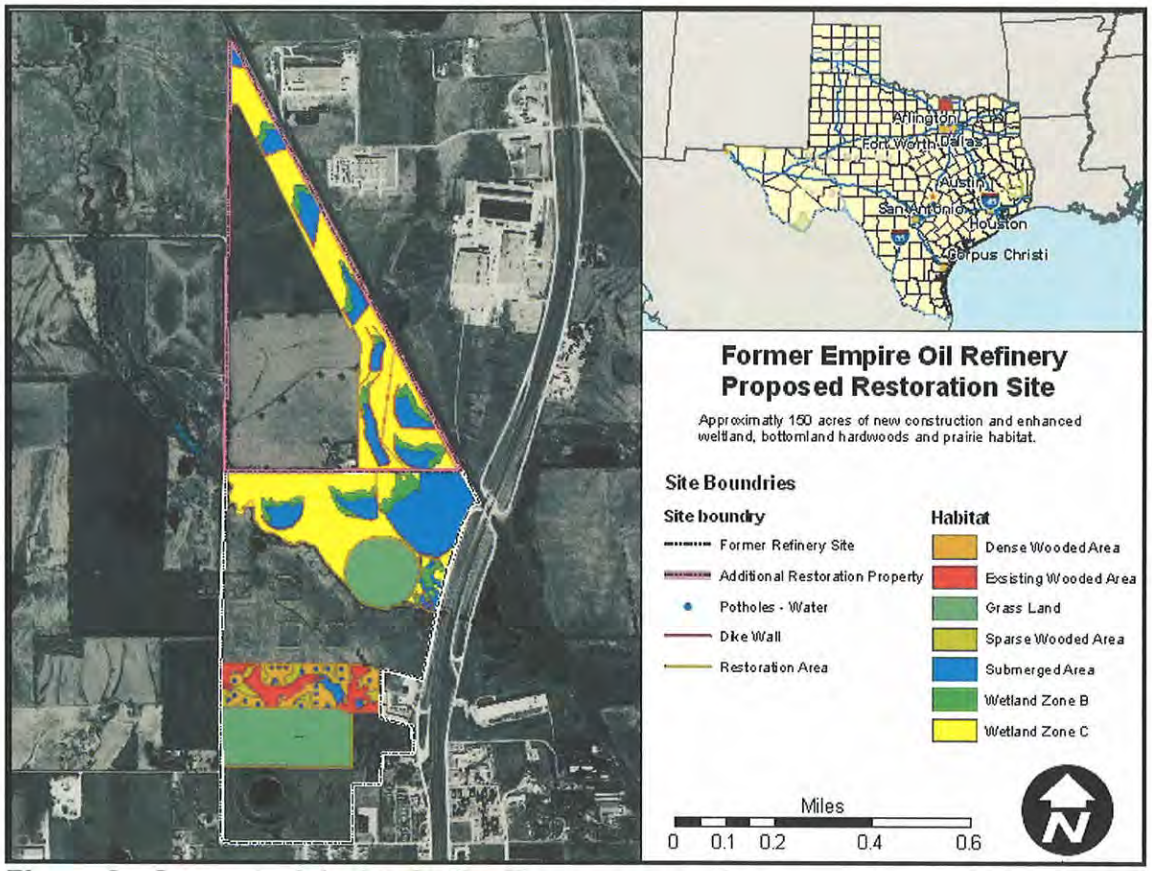

Figure 8: Conceptual design for the Former Empire Oil Refinery Site restoration project.

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Appendix A –Habitat Equivalency Analysis Information Used in this Assessment

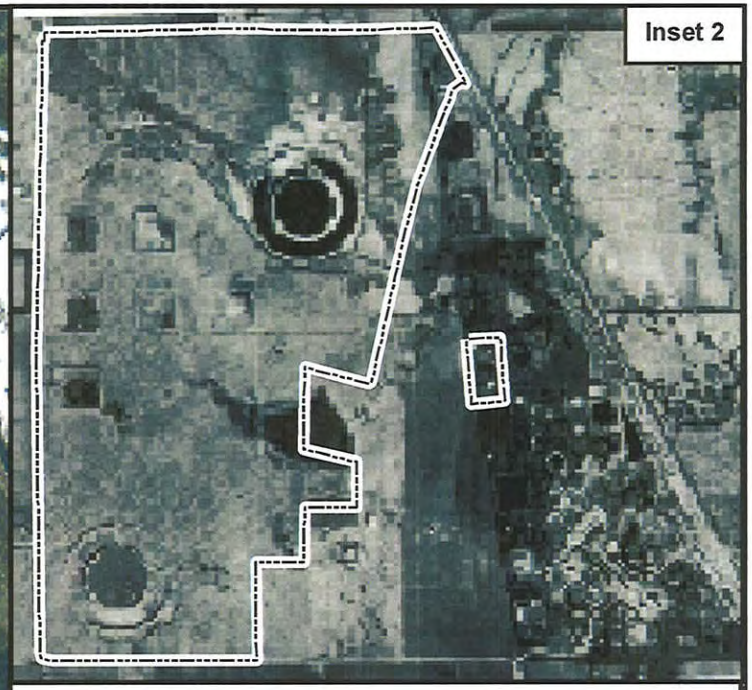
Table A-1: Habitat Equivalency Analysis Assumptions

HEA Inputs: Injury & Restoration Scenario Summary	Terrestrial Old Tank Pads	Terrestrial Modified Grass	Aquatic N. Pit	Aquatic Pecan Creek	Aquatic S. Pit	Aquatic Stock Tank	Aquatic Historic Pond	Wetlands NE Property	Wetlands Outer Ring N. Pit
Injury / Restoration Input Values:									
Area_Injured__acres	12.10	115.73	2.43	2.64	2.08	0.47	7.00	7.31	3.88
Base_Year	2002	2002	2002	2002	2002	2002	2002	2002	2002
Initial_Year_of_Injury	1935	1935	1935	1935	1935	1935	1935	1961	1935
End_of_1_Recovery_Phase	1942	1942	2002	2002	2005	2005	1942	2002	2002
End_of_2_Recovery_Phase	2002	2002	2003	2003	2005	2005	1965	2005	2003
End_of_3_Recovery_Phase	2005	2005	2005	2005	2005	2005	1966	2005	2005
End_of_4_Recovery_Phase	2005	2005	2005	2005	2005	2005	1966	2005	2005
End_of_5_Recovery_Phase	2005	2005	2005	2005	2005	2005	1966	2005	2005
End_Recovery_Period	2005	2005	2005	2005	2005	2005	1966	2005	2005
Initial_Level_of_Injury	20.00	10.00	50.00	20.00	50.00	5.00	5.00	25.00	56.00
End_of_1_Recovery_Phase_Injury	20.00	7.00	50.00	10.00	50.00	0.00	5.00	10.00	56.00
End_of_2_Recovery_Phase_Injury	5.00	2.00	15.00	5.00	50.00	0.00	5.00	0.00	75.00
End_of_3_Recovery_Phase_Injury	0.00	0.00	15.00	0.00	50.00	0.00	0.00	0.00	75.00
End_of_4_Recovery_Phase_Injury	0.00	0.00	15.00	0.00	50.00	0.00	0.00	0.00	75.00
End_of_5_Recovery_Phase_Injury	0.00	0.00	15.00	0.00	50.00	0.00	0.00	0.00	75.00
Area_Restoration__acres	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ratio	3.00	3.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00
Base_Restoration_Year	2002	2002	2002	2002	2002	2002	2002	2002	2002
Initial_Year_of_Restoration	2006	2006	2006	2006	2006	2006	2006	2006	2006
End_of_1_Restoration_Phase	2015	2015	2010	2010	2010	2010	2010	2010	2010
End_of_2_Restoration_Phase	2305	2305	2035	2035	2035	2035	2035	2035	2035
End_of_3_Restoration_Phase	2305	2305	2035	2035	2035	2035	2035	2035	2035
End_of_4_Restoration_Phase	2305	2305	2035	2035	2035	2035	2035	2035	2035
End_of_5_Restoration_Phase	2305	2305	2035	2035	2035	2035	2035	2035	2035
End_Restoration_Period	2305	2305	2035	2035	2035	2035	2035	2035	2035
Initial_Level_of_Restoration_Se	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
End_of_1_Restoration_Phase_Serv	90.00	90.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
End_of_2_Restoration_Phase_Serv	90.00	90.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
End_of_3_Restoration_Phase_Serv	90.00	90.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
End_of_4_Restoration_Phase_Serv	90.00	90.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
End_of_5_Restoration_Phase_Serv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Result Summary:									
Total_DSAY_Loss	410.34	1474.70	262.31	93.92	226.20	3.38	51.72	113.45	474.89
Total_DSAY_Gain	72.31	72.31	12.81	51.25	12.81	12.81	12.81	12.81	12.81
Total_Acers	5.67	20.39	20.47	1.83	17.65	0.26	4.04	8.85	37.06

Table A-1: Habitat Equivalency Analysis Assumptions Continued

HEA Inputs: Injury & Restoration Scenario Summary	Riparian	Terrestrial Upland Woods	Terrestrial Historic Tank Pads E. IH 35	Terrestrial Upland Woods Historic Pond Area	Terrestrial Historic Grasslands NE Wetland	Terrestrial NE. Wetland Tank Pad	Terrestrial Historic Grasslands for Riparian / Upland Woods
Injury / Restoration Input Values:							
Area_Injured__acres	4.35	8.50	1.28	1.92	6.23	1.08	12.85
Base_Year	2002	2002	2002	2002	2002	2002	2002
Initial_Year_of_Injury	1942	1942	1935	1965	1935	1935	1935
End_of_1_Recovery_Phase	2002	2002	1942	2002	1942	1942	1942
End_of_2_Recovery_Phase	2005	2005	1961	2005	1961	1961	1942
End_of_3_Recovery_Phase	2005	2005	1962	2005	1962	1962	1942
End_of_4_Recovery_Phase	2005	2005	1962	2005	1962	1962	1942
End_of_5_Recovery_Phase	2005	2005	1962	2005	1962	1962	1942
End_Recovery_Period	2005	2005	1962	2005	1962	1962	1942
Initial_Level_of_Injury	10.00	7.00	20.00	5.00	10.00	20.00	10.00
End_of_1_Recovery_Phase_Injury	5.00	2.00	20.00	2.00	7.00	20.00	7.00
End_of_2_Recovery_Phase_Injury	0.00	0.00	16.00	0.00	5.00	16.67	0.00
End_of_3_Recovery_Phase_Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
End_of_4_Recovery_Phase_Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
End_of_5_Recovery_Phase_Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area_Restoration__acres	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ratio	0.00	0.00	3.00	0.00	3.00	3.00	3.00
Base_Restoration_Year	2002	2002	2002	2002	2002	2002	2002
Initial_Year_of_Restoration	2006	2006	2006	2006	2006	2006	2006
End_of_1_Restoration_Phase	2050	2050	2015	2050	2015	2015	2015
End_of_2_Restoration_Phase	2305	2305	2305	2305	2305	2305	2305
End_of_3_Restoration_Phase	2305	2305	2305	2305	2305	2305	2305
End_of_4_Restoration_Phase	2305	2305	2305	2305	2305	2305	2305
End_of_5_Restoration_Phase	2305	2305	2305	2305	2305	2305	2305
End_Restoration_Period	2305	2305	2305	2305	2305	2305	2305
Initial_Level_of_Restoration_Se	0.00	0.00	0.00	0.00	0.00	0.00	0.00
End_of_1_Restoration_Phase_Serv	90.00	90.00	90.00	90.00	90.00	90.00	90.00
End_of_2_Restoration_Phase_Serv	90.00	90.00	90.00	90.00	90.00	90.00	90.00
End_of_3_Restoration_Phase_Serv	90.00	90.00	90.00	90.00	90.00	90.00	90.00
End_of_4_Restoration_Phase_Serv	90.00	90.00	90.00	90.00	90.00	90.00	90.00
End_of_5_Restoration_Phase_Serv	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Result Summary:							
Total_DSAY_Loss	19.72	22.45	32.46	1.13	58.24	27.78	53.74
Total_DSAY_Gain	15.36	15.36	72.31	15.36	72.31	72.31	72.31
Total_Acers	1.28	1.46	0.45	0.07	0.81	0.38	0.74

ATTACHMENT B



Attachment B Site Map

Former Empire Oil Refinery Gainesville, Texas

Area associated with the former Empire Oil Refinery considered as part of the natural resource damage assessment.

Inset 1:
Area considered by the Trustees shown overlaying 2004 aerial photograph.

Inset 2:
Area considerd by the Trustees shown overlaying circa 1940 - 1950 aerial photograph.

---------- Boundary of Area Evaluated

Inset 1: Kilometers
0 0.05 0.1 0.2 0.3 0.4

Inset 2: Kilometers
0 0.1 0.2 0.4 0.6 0.8

N

ATTACHMENT C

NATURAL RESOURCE DAMAGE ASSESSMENT MONITORING AND REPORTING WORK PLAN FOR THE FORMER EMPIRE OIL REFINERY SITE GAINESVILLE, TEXAS

December 5, 2012

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1 Introduction

The purpose of developing a success criteria and monitoring plan is to describe how the restoration project will receive ultimate acceptance by the Trustees for compensation of lost natural resource services. The goal of the plan is to clearly outline the actions that must be taken prior to final project certification. This plan identifies the success criteria that must be met, describes how the success criteria are to be achieved, and explains when corrective measures may be required to achieve the minimum success criteria. The Trustees will provide OXY USA Inc. (OXY USA) with a final project certification once all measures have been successfully implemented or completed.

Restoration monitoring occurs after the completion and certification of the restoration project construction. Monitoring is generally divided into three distinct categories; Milestones, Grow-out (Phase I) and Maintenance (Phase II) monitoring. Milestone are key steps that must be achieved during the Phase I establishment process and are intended to ensure the project is on schedule to meet Phase I success criteria. Phase I monitoring is designed to insure that the project is developing into a successfully ecological resource. Phase II monitoring begins after Phase I monitoring has been completed and is designed to insure the long term stability and viability of the project.

This document takes into consideration that OXY USA, of its own accord, responsibility and risk, has undertaken construction, initial planting and establishment criteria for the restoration project in advance of public review and comment on the Damage Assessment and Restoration Plan (DARP) and Consent Decree. Since the project proposed as the preferred restoration alternative received no public comment and has been accepted as final and is in an advanced stage of completion, this document will focus on post-planting success and viability as specified in the Phase I and Phase II success criteria (Sections 2 and 3). OXY USA will be responsible for meeting the success criteria, any corrective actions required as well as providing reports specified within this document and the Consent Decree.

1.1 Background

The former Empire Oil Refinery was owned and operated by Empire Oil Company in Gainesville, Texas. The refinery was built in 1916 and operated until 1935. The property contains two round pits and six former tank pads. The two round pits are referred to as the Northern Pit and the Southern Pit located at the northern and southern ends of the property, respectively. In addition, what appear to be six aboveground tank pads are located southwest of the Northern Pit. It is not known what was stored or contained (other than a petroleum hydrocarbon material) in the Northern or Southern Pits, or how they were operated. This information is based on a January 21, 1942 aerial photograph and a recent survey of the property.

In September 2000, it was discovered that exposed petroleum hydrocarbon material in the Northern Pit Inner Pond was posing a potential or actual threat to wildlife. Several species of birds and other wildlife were killed because of exposure to the petroleum hydrocarbons. In mid-November, Texas Rail Road Commission, Texas Commission on Environmental Quality (TCEQ), United States Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), and Texas Parks and Wildlife Department (TPWD) representatives visited the site. It was determined that the EPA would lead a removal effort to eliminate the petroleum hydrocarbon material from the Northern Pit to protect migratory birds and other wildlife.

In March 2001, OXY USA agreed to mitigate the immediate threat to wildlife caused by the petroleum hydrocarbons in the Northern Pit. OXY USA applied for and was granted acceptance of the site into the TCEQ's Voluntary Cleanup Program (VCP). An Interim Corrective Measure (ICM) Investigation Work Plan, dated March 1, 2001, was submitted to the VCP. The ICM Investigation was completed by April 2001, and an ICM was selected to remove the petroleum hydrocarbon material from the Northern Pit Inner Pond. The ICM was implemented in June 2001, and was completed in December 2001.

An Affected Property Assessment (APA) Work Plan was submitted in February 2002, and was approved on June 3, 2002. On June 17, 2002, the APA was started, and all field activities were completed in August 2002. The APA Report (APAR) was submitted on November 27, 2002.

Based on the Tier 1 Exclusion Criteria Checklist completed in the APAR, it was determined that a Tier 2 Ecological Risk Assessment (ERA) was required for this site. A site visit and meeting were held February 19, 2003, with the Natural Resource Trustees, TCEQ VCP Project Manager, TCEQ Ecological Risk Assessor, OXY USA, and Environeering. The Trustees included the USFWS, TPWD, TCEQ, and the Texas General Land Office (GLO). During this meeting, the surrogate species for each feeding guild were discussed and agreed upon. The ERA Report was submitted to the TCEQ and Trustees on May 4, 2004. Environeering has responded to two sets of comments from the TCEQ and Trustees, and submitted a revised ERA Report on February 4, 2005. The revised ERA Report was approved by the TCEQ in October 2006. OXY USA received a Certificate of Completion for remediation of the Site from TECQ in July 2007.

1.2 Restoration Construction

In early 2002, OXY USA and the Trustees began natural resource damage assessment settlement discussions regarding liability for natural resource damages. In July 2002, the Trustees determined the type and amount of habitat to be created to compensate for injuries to the environment caused by the

refinery operations on site. The amount of habitat was based on a reasonable worst-case scenario for the type of habitat impaired and duration of the impairment. Based on available site data and conservative assumptions, the Trustees determined the type and acres of habitat to be constructed under a reasonable worst-case scenario.

In October 2002, OXY USA presented new soil, sediment, groundwater, and surface water data. Based on these new data, the Trustees revised the reasonable worst-case scenario. In October 2006, OXY USA completed the majority of the construction for the preferred restoration project based on this revised reasonable worst-case scenario. The final restoration project includes the construction of wetlands, riparian and prairie habitats that will be preserved in perpetuity. A summary of the acreages constructed for each habitat type is presented in Table 1.1. Details of the specific construction and planting of the restoration project are presented in the October 31, 2006 Natural Resource Damage Restoration Construction Report for the Former Empire Oil Refinery Site Gainesville, Texas (Final Construction Report).

Table 1.1 Summary of habitat construction identified as the preferred restoration alternative within the DARP

Habitat To Be Constructed	Area Required (Acres)	Area Constructed (Acres)
Wetlands/Aquatic	99.74	112.97
Woodlands/Riparian	3.55	4.00
Grasslands	29.17	30.54
TOTAL	132.46	147.51

2 Success Criteria

To objectively evaluate the progress of the restoration project, success criteria were established for each habitat created. Due to the complexities of a quantitative evaluation of success criteria standards, a qualitative or surrogate measurement of habitat function will be used. If there is disagreement among OXY USA and the Trustees as to the interpretation of the qualitative data, a quantitative evaluation will be designed and implemented. OXY USA will be responsible for the implementation of the restoration project, completing the monitoring plan and meeting success criteria. The Trustees will oversee monitoring efforts, approve results, and approve corrective actions. Once site conditions have met the thresholds, it is assumed that the natural functions of the habitat have been achieved or will be achieved over time.

In all project areas, desirable species actively planted and seeded (identified in Appendix I) as well as desirable plants that naturally colonize, will be considered when evaluating success criteria. Survival of planted vegetation will be

determined based on live vegetation, and will be assessed after the plants leaf out in the spring and before leaf drop in the autumn. Vegetative cover refers to the percent of the soil or sediment surface that is obscured from view by the stems and leaves of vegetation when viewed from above. Stem density (number of plants) per acre will be expressed as the average for the total acreage planted.

Success criteria will be assessed through the use of monitoring reports, Milestones and Phase I and Phase II success criteria. Discussion of specific success criteria to be achieved during Phase I (including specific Milestones) and Phase II monitoring for each constructed habitat are provided in Subsections 2.1 through 2.3. Milestones are significant points in the development of the restoration project and are designed to work in conjunction with Phase I success criteria to help guide the project in reaching final success criteria as scheduled. Milestones are specific to each habitat type and may be achieved at any point during the Phase I monitoring, but must be achieved within three (3) years from certification of construction and planting and before a final Phase I certification is provided. Phase I monitoring and success criteria are designed to insure that the project is developing into a successful ecological resource. During this phase of the project, plants should be established and increasing in vegetative cover and propagation. Phase I monitoring begins when construction certification is issued and runs concurrently with Milestone criteria. Phase I success criteria may be achieved at any time during post construction and planting certification, however monitoring will continue for at least one (1) year and until all Milestones are achieved. If the project has not reached Milestones and/or Phase I success criteria by the end of three (3) to seven (7) years after construction and planting certification, a major corrective action will be undertaken as provided in Section 5.2.

Once the Milestones and Phase I criteria have been met and certified, the project will enter the Phase II success and monitoring criteria. Phase II monitoring is designed to insure the long term stability and viability of the project. Constructed habitats are required at a minimum to maintain vegetative cover requirement with no assistance or corrective actions. Phase II monitoring will continue until success criteria have been maintained without corrective action for two (2) consecutive years. If at the end of two (2) consecutive years without corrective action the constructed habitat has met all success criteria, the Trustees will certify that constructed habitat is complete. Once all portions of the project have been certified complete a final project certification will be provided as discussed in Section 8.

2.1 Success Criteria for Constructed Wetland

Success criteria are the parameters, agreed to by OXY USA and the Trustees, under this Work Plan, which measures whether the required restoration action is being achieved. The following success criteria will be monitored for the constructed wetland habitat (Table 2.1):

- Percent survival of vegetation;
- Percent of vegetative cover;
- Hydro-Period (Minimum amount of water retained);
- Control of invasive species; and
- Maintenance of berms, spillways and hardened structures.

a. *Percent survival of planted material:*

For wetland plantings, annual monitoring Milestone and Phase I surveys shall verify that at least 50% of the planted vegetation has survived initial planting plus at least one (1) additional year subsequent to planting. If necessary, in areas where 50% plant survival is not achieved, corrective measures shall be implemented by replanting at original or greater densities. The first annual monitoring event will be early summer following the first anniversary of planting.

b. *Percent vegetative cover:*

No later than two (2) years after planting, the annual monitoring surveys shall verify that the constructed wetland at least meets the minimum Milestone requirement of 30% vegetative cover of aquatic plants. If the plantings do not achieve 30% cover after two (2) years of growing time, corrective measures shall be implemented by replanting and/or re-seeding at original or greater densities. To achieve Phase I and II standards, the constructed wetland must achieve and maintain 60% vegetative cover from desirable aquatic species and, all berms, soil areas and non-hardened spillways must maintain 85% vegetative cover from desirable species. In the event success criteria are not achieved or maintained, a corrective measure shall be implemented by replanting and/or re-seeding at original or greater densities.

c. *Hydro-Period (Minimum duration and amount of water retained):*

The restoration project shall be designed and maintained such that, by the third (3) year following construction, the wetland will support a minimum of 99.74 acres of emergent vegetation and open water for at least 6 months annually.

d. *Control of non-native and invasive species:*

The relative density of non-native and invasive plant species shall be maintained at less than 10% of the vegetated cover per acre of the constructed wetland habitat and not more than 20% non-native and invasive species for constructed spillways and dikes. Non-native and invasive species shall be controlled through physical and chemical means as provided in Section 7. The following list of invasive and non-native species is to be restricted to a combined total of less than 10% vegetative cover per acre:

Water hyacinth	*Eichhornia crassipes*	*(non-native)*
Hydrilla	*Hydrilla verticillata*	*(non-native)*
Torpedo grass	*Panicum repens*	*(invasive)*
Alligator weed	*Alternanthera philoxeroides*	*(invasive)*
East Indian hygrophila	*Hygorphila polysperma*	*(non-native)*
Common Reed	*Phragmites australis*	*(invasive)*
Cattail	*Typhus spp.*	*(invasive)*
Cocklebur	*Xanthium strumarium*	*(invasive)*
Jonquapin	*Nelumbo lutea*	*(invasive)*

e. *Maintenance of berms, spillways and hardened structures:*

All dikes, berms and spillways must show no signs of significant erosion or structural failure. In the event dikes or spillways show signs of significant erosion or collapse, corrective action to stabilize those structures will be undertaken until final project certification has been received.

Table 2.1: Summary Table Success Criteria for Constructed Wetland

Success Criteria		Milestone	Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action
Description	**Criteria**	**Deadline***	**Duration****		
Percent Survival of Planted Material	50%	1 year after planting	1 Year	-	Replanting and/or re-seeding at original or greater densities
Initial Vegetative Cover	30%	2 years after planting	-	-	Replanting and/or re-seeding at original or greater densities
Vegetative Cover within Constructed Area	60%	-	1 Year	2 Years	Replanting and/or re-seeding at original or greater densities
Vegetative Cover Dikes / Spillways (Excluding Hardened Structures)	85%	-	1 Year	2 Years	Replanting and/or re-seeding at original or greater densities
Minimum Duration of Water Retained, Wetland ≥ 6 months/year)	99.75 acres	3 years after construction	1 Year	2 Years	
Non-native and Invasive Species Control, Wetlands	<10%	-	1 Year	2 Years	Controlled through physical and chemical means as provided in Sections 2.1(d) and 7
Non-native and Invasive Species Control, Dikes and Spillways	<20%	-	1 Year	2 Years	Controlled through physical and chemical means as provided in Sections 2.1(d) and 7
Maintain dikes and spillways	to spec	-	1 Year	2 Years	In the event dikes or spillways show signs of significant erosion or collapse, corrective action to stabilize those structures will be undertaken

* Maximum time allowed to meet criteria ** Minimum duration required prior to certification of monitoring criteria

2.2 Success Criteria for Riparian Enhancement

The following success criteria will be monitored for the riparian enhancement (Table 2.2):

- Planting density and
- Percent survival of vegetation

a. *Planting density:*

In order to more closely mimic the natural environment, the riparian woody habitat restoration site included patches of both dense and sparse vegetation. In the dense and sparse planting areas , an average of 193 and 48 trees/shrubs per acre, respectively, were planted in accordance with the Final Construction Report and as represented in Figure 2.1. In order to meet Phase I&II success criteria, the riparian habitat must maintain a minimum of 50% survival in each area (97 trees/shrubs in dense and 24 trees/shrubs per acre in sparse). In areas where plant density is not achieved, corrective measures shall be implemented by replanting at original or greater densities.

b. *Percent survival of bare root and transplanted stock:*

For tree and shrub plantings, annual Phase I and II monitoring surveys must document that at least 50% of the planted vegetation has survived. In each area as defined in the Final Construction Report, where 50% plant survival is not achieved, corrective measures shall be implemented by replanting at original or greater densities.

Table 2.2: Summary Table Success Criteria for Riparian Enhancement

Success Criteria			Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action
Description	**Planting Requirement**	**Criteria**	**Duration***		
Percent Survival of Planted Material		50%	1 Year	2 Years	Replanting at original or greater densities
Planting Density – Dense	193 tree/shrub per acre	97 tree/shrub per acre	1 Year	2 Years	Replanting at original or greater densities
Planting Density – Sparse	48 tree/shrub per acre	24 tree/shrub per acre	1 Year	2 Years	Replanting at original or greater densities

* Minimum duration required prior to certification of monitoring criteria

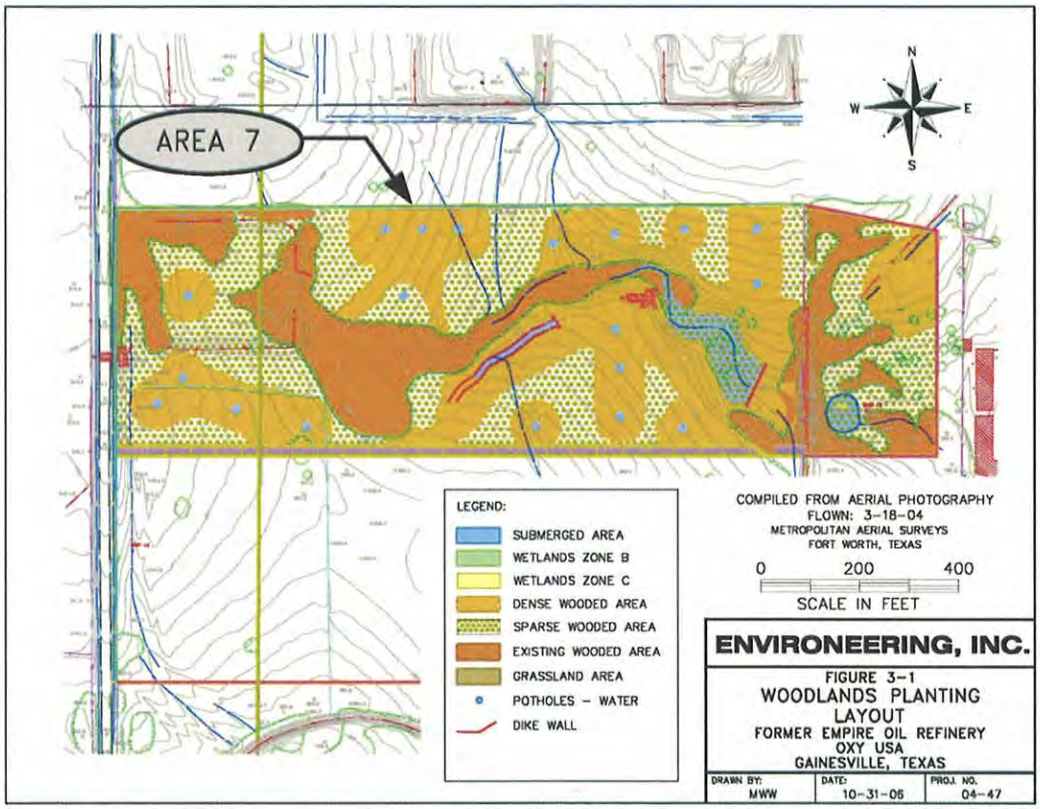

Figure 2.1: Riparian enhancement planting from Figure 3-1 in the Final Construction Report.

2.3 Success Criteria for Prairie Restoration

The following success criteria will be monitored for the prairie restoration (Table 2.3):

- Percent of vegetative cover and desirable species composition and
- Control of invasive and non-native species.

a. *Percent vegetative cover for seeded plantings:*

Seven (7) years after planting, the annual monitoring surveys shall verify that the areas that were planted have met the minimum Milestone of no less than 60% total vegetative cover, and at least 50% relative cover from desirable native species (Table A-1 in Appendix A). To achieve Phase I and II success criteria, the constructed prairie must have at least 80% total vegetative cover and at least 80% relative cover from desirable native species (Table A-1). In areas that do not meet minimum vegetation coverage and desirable species composition, corrective measures shall be implemented by replanting and/or re-seeding at original or greater densities.

b. *Control of non-native and invasive species:*

All non-native and invasive species shall be controlled through physical and chemical means as provided in Section 7. The vegetative cover for the following list of non-native species is to be restricted to less than a combined total of 20% vegetative cover per acre:

Johnsongrass (*Sorghum halpense.*)
Tall Fescue (*Festuca arundinacea*)
Yellow Sweetclover (*Melilotus officinalis*)
Bermuda grass (*Cynodon dactyloides*)

Table 2.3: Summary Table Success Criteria for Prairie Restoration

Success Criteria		Milestone	Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action
Description	**Criteria**	**Deadline***	**Duration****		
Initial Vegetative Cover	60%	7 years after planting			
Initial Native Species Composition	50%	7 years after planting			
Vegetative Cover	80%		1 Year	2 Years	Replanting and/or re-seeding at original or greater densities
Native Species Compositions	80%		1 Year	2 Years	Replanting and/or re-seeding at original or greater densities
Non-native and Invasive Species Control	< 20%		1 Year	2 Years	Controlled through physical and chemical means as provided in Sections 2.3(b) and 7

* Maximum time allowed to meet criteria ** Minimum duration required prior to certification of monitoring criteria

2.4 Adverse Conditions

The unpredictability of weather in North Central Texas, as well as the current and historical weather patterns may necessitate some accommodation for adverse weather conditions in considering the establishment and timing of planting and monitoring. In the event that below average rainfall has occurred during the Phase I monitoring, if appropriate, additional time for the establishment of the vegetation will be automatic and equivalent to the time of below monthly average rainfall but shall not exceed two (2) consecutive years. If, after the additional establishment time has elapsed, the project area still does not meet minimum vegetative cover, the Trustees and OXY USA will meet to discuss appropriate corrective measures. Corrective measures at a minimum shall include replanting and/or re-seeding at original or greater densities but may include other jointly agreed upon alternatives. Other unanticipated adverse weather or conditions that may impact the success of the project will be addressed as provided by the Consent Decree.

3 Monitoring Schedule and Criteria

Monitoring will address measurement of the foregoing success criteria, in summary:

- Constructed wetland success criteria, both in terms of meeting hydro-period and depth goals, as well as vegetation survivorship and cover;
- Riparian enhancement planting survivorship and cover;
- Prairie restoration vegetative cover and species composition.

The following subsections detail specific monitoring characteristics for each constructed habitat that will be used to gauge the success criteria specified in Section 2.

Monitoring will follow construction and planting certification in a two phase process. If after one (1) annual monitoring event, the data collected during Phase I monitoring indicates that the Phase I success criteria and Milestones have been met, OXY USA will provide its final Phase I monitoring report and request for project certification to the Lead Administrative Trustee (LAT) for Trustee evaluation. After receiving the report, the LAT may establish a date for an inspection by the Trustees or request further information before issuing a certification of acceptance as described in Section 8. Once Milestones and Phase I success criteria are achieved and approved, the project will enter Phase II monitoring. Phase II monitoring will continue until the constructed habitat continues to maintain at least the minimum success criteria without a corrective action (as defined in Section 5) for at least two (2) consecutive years. Once projects meet the Phase II monitoring criteria, OXY USA will apply to the Trustees for final project certification. Same as the Phase I request for certification, the LAT may establish a date for an inspection by the Trustees or request further information before issuing a certification of acceptance. All projects are expected to fully meet Milestones and success criteria within the third (3) year following construction and planting certification, and to continue to meet those criteria for all years up through the final annual monitoring report and the issuance of a letter of final project certification.

3.1 Wetland Monitoring

The goal of the wetland-monitoring program is to evaluate the establishment and development of emergent and submerged vegetation in and around the wetland areas of the project site. The anticipated timeframe for establishment is one (1) to three (3) years after the construction and planting phase.

Characteristics to be monitored include:

- Vegetative cover as specified in Section 2.1 (qualitative)
- Growth of invasive undesirable vegetation (qualitative)
- Constructed structures integrity (qualitative)
- Pond integrity (qualitative)
- Wildlife utilization (qualitative)
- Size of the constructed habitat (quantitative based on aerial photographs)

3.2 Riparian Enhancement Monitoring

The goal of the riparian woodlands area-monitoring program is to determine the survival rate of planted materials, determine the stalk density of the area, and the relative health of the ecosystem. The riparian / woodland habitat will be monitored once per year, at the end of the growing season.

Characteristics to be monitored include:

- Tree and shrub survival as specified in Section 2.2 (quantitative)
- Wildlife utilization (qualitative)
- During planting and grow out of the riparian habitat, invasive ground cover species shall be held to <20% of the total ground cover. Invasive species to be controlled are specified in Section 2.3 b.
- Size of the constructed habitat (quantitative based on aerial photographs)

3.3 Prairie Restoration Monitoring

The goal of the grassland-monitoring program is to evaluate the establishment and development of desired species introduced as part of the restoration project. The anticipated timeframe for establishment is three (3) to seven (7) full growing seasons after seeding. Several growing seasons may be necessary before all the species in the seed mix are established and foliar cover requirements are met. Many plant species will not germinate until certain climatic conditions are met and some seeds can remain dormant for many years. Grassland establishment and development will be observed annually beginning in the later part of the first full growing season following seeding. The prairie habitat will be monitored once per year, at the end of the growing season.

Characteristics to be monitored include:

- Vegetative cover as specified in Section 2.3 (qualitative)
- Control of invasive undesirable vegetation (qualitative)
- Wildlife utilization (qualitative)
- Size of the constructed habitat (quantitative based on aerial photographs)

4 Monitoring Techniques

Monitoring of the habitat construction projects will involve a cooperative effort between OXY USA and the Trustees. OXY USA will be responsible for implementing the monitoring and reporting plan and proposing any required corrective actions, and the Trustees will oversee monitoring efforts and approve results and approve corrective actions. OXY USA will utilize qualitative methods to monitor the site. However, in the

event that the parties cannot agree upon the results of a qualitative survey relative to the meeting of success criteria, a quantitative survey will be designed and conducted as provided in Section 4.2.

4.1 Qualitative Monitoring Methods

Qualitative techniques will be used to monitor the growth and establishment of plants during the monitoring phase of the project. Qualitative field surveys will be performed within the wetland, riparian and grassland habitat restoration project areas to determine general site conditions, vegetative cover, wildlife utilization, the control of invasive species, damage caused by vandalism, erosion, etc. as provided in Section 3. Observations made during the inspections will be recorded on field data sheets. Any deficient areas will be noted and mapped. Field data and observations will be compared to success criteria (Section 2) to determine if the project has met the success criteria for a given habitat. OXY USA in conjunction with the Trustees will use field surveys, photographic logs, and aerial photographs as presented in annual monitoring or corrective action reports to determine if success criteria are being met for the project areas and assist in identifying areas that may require corrective actions.

Consistent, representative viewing locations will be identified by the Trustees and OXY USA for each restoration area to provide a visual basis for determining vegetative growth, cover and survival. Annual field surveys will include observations at the same viewing locations making it easier to interpret data and formulate conclusions. Photographs of each project area will be taken from the identified monitoring locations to provide visual documentation of development over time during each annual field surveys and project development. Geographic location (projected to the Universal Transverse Mercator [UTM] Zone 14, National American Datum [NAD] 1983 spatial projection), date, time, weather conditions, and photographic equipment used will be noted for each photograph taken. When practicable, equipment and time of day that the photographs are taken will remain consistent for annual monitoring events.

Aerial photographs of the entire restoration project site will be taken to document site conditions and serve as baseline for conservation easement purposes. At a minimum, aerial photographs will be taken following completion of construction and planting certification, as well as during and at the end of Phase I and Phase II monitoring. These photographs will be compared to aerial photos of the site taken prior to the project commencement. Aerial photographs will be provided in digital format, Orthorectified, one (1) foot resolution and projected to the UTM Zone 14, NAD 1983 spatial projection.

4.2 Quantitative Monitoring

In the event that quantitative monitoring is required to resolve disagreement of qualitative survey results, OXY USA shall provide notice upon determination of disagreement. OXY USA and the Trustees will attempt to informally resolve disputed

results. However, if resolution cannot be reached within sixty (60) days of receipt by the Trustees of the notice of disagreement, OXY USA will prepare for Trustee approval a Quantitative Assessment Monitoring Work Plan, including an implementation schedule. This work plan will be submitted to the Trustees within sixty (60) days after OXY USA and the Trustees agree that the dispute cannot be resolved. The Trustees shall review the Work Plan and provide comment or approval within a reasonable amount of time from their receipt of the document. In the event that OXY USA and the Trustees fail to reach consensus on a quantitative monitoring plan, the Dispute Resolution section and any other remedies available under the Consent Decree between OXY USA and the Trustees may be invoked.

5 Corrective Actions

If any of the monitoring surveys show that the Milestone or success criteria described in Section 2 are not being met, OXY USA will notify the LAT and shall conduct minor or Trustee approved major corrective actions Corrective actions will occur as soon as seasonally and logistically feasible and no later than the beginning of the next planting season. Should corrective measures fail to result in the project meeting required success criteria after three (3) replanting efforts, the Trustees will reevaluate the restoration project and determine the need for further corrective measures or alternative actions. If any major corrective measures are required, a corrective measures report will be prepared after the major corrective measures are implemented and will be submitted to the Trustees within sixty (60) days after implementation (Section 6.2).

Plant survival through the first growing season is an important early Milestone for the potential success of the constructed wetlands and other habitats. OXY USA and the Trustees expect that, on a small scale, there will be varying success rates for survival of plants from the initial planting, with certain areas of the constructed habitat being more successful than others. If an inspection demonstrates that survival of planted vegetation at the end of the first growing season still has not met success criteria, OXY USA will meet with the Trustees to discuss possible causes and whether corrective action, including a major corrective action, is needed.

5.1 Minor Corrective Actions

During Phase I monitoring, normal routine maintenance of the project or habitat areas is expected. Routine maintenance includes activities that may be considered minor corrective actions. OXY USA may conduct any minor corrective actions that it believes are necessary to assist or enhance the growth and development of the project or habitat area. OXY USA may perform such activities without prior approval from the Trustees, however, the Trustees may suggest that a minor corrective action be undertaken. Examples of minor corrective actions include the following:

- Replanting or reseeding portions of the habitat, where individual replanted or reseeded areas are less than 10% of the constructed restoration habitat areas as specified in the Final Construction Report.
- Removal of debris and other obstructions from the restoration site.
- Removal of unacceptable plant species specified in Section 2.1(d) and 2.3(b) of this document.

Minor corrective actions will be reported as part of the annual Phase I and II monitoring reports.

5.2 Major Corrective Actions

After Certification of Completion of Habitat Construction, the LAT, on behalf of the Trustees, may require OXY USA to undertake a corrective action in order to meet the Milestone and or success criteria specified in Section 2 of this document. Prior to performing any major corrective action, OXY USA will obtain approval of the Trustees to proceed with the proposed corrective action. Major corrective actions may include, but are not limited to:

- Replanting, replacing or reseeding portions of the habitat, where individual replanted, replaced or reseeded areas are greater than 10% of the constructed restoration habitat areas as specified in the Final Construction Report.
- Adjustment of the elevation of spill ways and dikes.
- Adjustment of the elevation of the wetland.
- Removal of invasive species over 40% of the constructed habitat area or requiring reconstruction.

If OXY USA and the Trustees agree that major corrective action is appropriate or if the LAT, on behalf of the Trustees, issues a letter requiring major corrective action, OXY USA will be responsible for implementing the major corrective action subject to dispute resolution under the Consent Decree. Any area requiring a major corrective action will be considered to be at Phase I monitoring as provided in Sections 2 and 3. Once the Phase I success criteria are met and the LAT has issued a notice that the constructed habitat is considered to be established, in accordance with Sections 2 and 3, Phase II monitoring will begin. If after two (2) years of Phase II monitoring, the constructed habitat has not achieved the Phase II success criteria, OXY USA and the Trustees will meet to determine why that success criteria has not been met and whether major corrective action is appropriate.

6 Record Keeping and Reporting

OXY USA will be responsible for documenting and demonstrating that the restoration project is meeting the Milestone, success criteria and monitoring requirements specified in Sections 2 and 3. OXY USA will include the results of all field monitoring efforts (i.e. notes, calculations, photographs, aerial photography) and activities to document achievement of success criteria. This documentation will be compiled into the following reports and provided to the LAT for Trustee review:

- Annual Grow-out (Phase I) Monitoring Reports: an annual report documenting progress toward meeting success criteria goals will be submitted following Certification of Project Construction Completion until Phase I success criteria are achieved.

- Annual Maintenance (Phase II) Monitoring Reports: an annual report will be submitted, documenting that each specific habitat has continued to meet the Phase II success criteria for two (2) consecutive years following certification of Phase I.

- Corrective Action Report: If the monitoring surveys (Phase I or II) show that the success criteria described in Section 2 are not being met, OXY USA will notify the LAT and conduct any minor or major corrective actions in accordance with Section 5. The report should include the following information: which success criteria or Milestones were not being met, actions taken to correct problems, start and end dates of corrective actions taken, photographs, and other supporting documentation. Corrective action reports may be included in annual monitoring reports.

- Certification Report: The certification report will include all of the components of the Phase I and II reports for which certification is being requested and may be submitted as a replacement for that year's annual monitoring report.

6.1 Phase I and Phase II Annual Monitoring Reports

When either Phase I or Phase II surveys are conducted, a formal monitoring report will be prepared to document the field survey methods required by Section 4. Results and analyses associated with each monitoring event, including field notes and photographs will be used to document current conditions and progress toward achieving or maintaining the success criteria set forth in Section 2. The report will include at a minimum the following:

- A summary of qualitative and quantitative (if necessary) data collected.

- Monitoring results and analyses, including tables and photographs (when appropriate).

- A copy of the all field notes, logs and data collected.
- Aerial photographs and site maps showing data collection locations and results, as appropriate (Geographically referenced using UTM Zone 14, NAD 1983 spatial projection).
- Summary of any minor corrective actions taken.
- Observations that suggest whether significant problems may exist, an evaluation of possible causes and any recommended major corrective actions.
- Results/outcomes from any previous corrective actions.
- Requests for corrective actions or project certifications.

Additionally the following observations and actions should be made or carried out during each monitoring event:

- Record and generally locate on the site map the presence and approximate numbers and density of any wildlife (including aquatic invertebrates, fish and birds as appropriate) observed during the monitoring.
- Remove trash from the site.

6.2 Corrective Action Reports

In the event of a major corrective action, OXY USA will provide to the LAT a corrective action report as provided in Section 5.2 for major corrective measures. If any corrective action is required during Phase II monitoring, OXY USA will notify the LAT. During Phase II, all corrective actions will be documented in a corrective action report or as part of the annual monitoring report. Corrective action reports should clearly document areas not achieving success criteria and the corrective actions taken. Corrective action reports should focus on those success criteria not being met. Corrective action reports may be submitted as part of the Phase I or II annual monitoring report.

6.3 Certification Reports

Certification reports will include all of the components of the respective annual Phase I or Phase II report (Section 6.1) for the habitat or project area for which certification is being requested along with a formal request for certification. The certification request should clearly document which area or areas have achieved success criteria and what

certification (i.e. Phase I, Phase II or Project Completion) is being requested. A certification report may be submitted as a replacement for that year's annual monitoring report or as a supplemental report as necessary.

7 General Site Management and Invasive Species Control

OXY USA will utilize best management practices in the implementation and management of the restoration property to ensure the presence of non-native and invasive vegetation does not exceed criteria set out in Section 2. To achieve this goal certain activities to manage and control non-native and invasive plant species as identified in Sections 2.1 d and 2.3 b may be required. OXY USA is permitted to control invasive or non-native species using approved herbicides and pesticides in accordance with their EPA labeling and application. This may include an isopropylamine salt of glyphosate base herbicide and a dimethylamine (DMA) salt of dicamba and 2,4-D, Ally, and Amber. Ally and Amber are herbicides with metsulfuron methyl and triasulfuron, respectively, as the primary ingredient. The primary application of DMA, Ally, and Amber will be as a broad leaf weed killer for the grasslands and in the wetlands (limited to the Figure B2 Zone C), and shall be applied only in accordance with approved labeling and as may be warranted in order to meet applicable success criteria. Trustee approval shall be obtained prior to the use of any other chemical treatment intended to control invasive species for the duration of the monitoring period.

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8 Certification and Completion Compensatory Restoration Requirements

This document takes into consideration that at the time of settlement OXY USA, of its own accord, responsibility and liability, has undertaken construction, initial planting and establishment criteria for the restoration project and has documented and demonstrated the completion of construction and some of the other required restoration activities to date. As such the Trustees will consider performance to date for the constructed habitats and at their discretion may approve individual project areas or habitats for satisfying construction, planting, Milestone, Phase I or Phase II success and/or monitoring criteria. Certification may occur in a phased process with some areas receiving certification before others or the restoration project may be certified as a whole. Requests for certification will include all elements of the annual monitoring reports (Phase I, Phase II), corrective action and/or certification reports as specified in Sections 6 and may be submitted as part of these reporting requirements. Phases of the restoration project that require certification include:

- Construction and Planting Certification
- Grow-Out (Phase I) monitoring
- Maintenance(Phase II) monitoring
- Corrective Actions
- Restoration Project Certification

At any time (after entry of the Consent Decree to which this Work Plan is appended) that OXY USA concludes that they have achieved the success criteria (for Phase I or II) as specified in Section 2 for any of the restoration habitat(s), OXY USA will submit a request for certification to the Trustees. The Trustees shall evaluate the request and a site inspection shall be undertaken, within sixty (60) days after receipt of the request for certification. Within thirty (30) days after the date of the inspection, if the Trustees determine that success criteria have been achieved, the Trustees shall issue a written certification of completion for the appropriate restoration habitat(s) as described in Sections 2 and 3. If the Trustees fail to respond to a certification request or any annual report within thirty (30) days after the date of the inspection, the subject report/request will be considered approved by the Trustees.

If the Trustees' determine that success criteria have not been achieved, the Trustees shall provide written notice within thirty (30) days after the date of inspection detailing any and all deficiencies. After OXY USA addresses those deficiencies, a certification request will be resubmitted to the Trustees. This process of requesting certification and identifying deficiencies will continue following the above mentioned procedures until the Trustees have issued certification.

Once all monitored habitats have received Phase I certification and achieved the Phase II monitoring success criteria as specified in Sections 2 and 3, OXY USA will submit a request for final project certification to the Trustees. The Trustees shall evaluate the request and a site inspection shall be undertaken, within sixty (60) days after receipt of the request for certification. Within thirty (30) days after the date of the inspection, if the Trustees determine that all success criteria for all habitats have been achieved, the Trustees shall issue a written certification of completion (the "Final Restoration Project Certification"). If the Trustees fail to respond to a certification request or any annual report within thirty (30) days after the date of the inspection, the subject report/request will be considered approved by the Trustees.

If the Trustees' determine that all success criteria have not been achieved for all habitats, the Trustees shall provide written notice within thirty (30) days after the date of the inspection detailing any and all deficiencies. After OXY USA has addressed these deficiencies, a certification request will be resubmitted to the Trustees. This process of requesting certification and identifying deficiencies will continue following the above mentioned procedures until the Trustees issue the Final Restoration Project Certification.

APPENDIX A: Selected Plant Species

Table A-1: Grasses Planted

Common Name	Genus and species	Seed Mix	
		Area 8	Area 9
Big Blue Stem	*Andropogon gerardii*	20-30%	10-15%
Little Blue Stem	*Schizachyrium sp.*	15-20%	45-55%
Canada Wildrye	*Elymus Canadensis*	0-5%	-
Indian Grass	*Sorghastrum nutans*	20-30%	10-15%
Sideoats Grama	*Bouteloua curtipendula*	5-10%	5-15%
Texas Winter Rye	*Secale cereale*	0-5%	-
Alternative or other acceptable species		0-5%	0-5%
Barnyard Grass	*Echinochloa muncata*		
Texas Millet	*Panicum texanum*		
Black Eyed Susan	*Rudbeckia hirta*		
Purple Coneflower	*Echinacea purpurea*		
Flax	*Linum sp.*		
Coneflower	*Ratibida sp.*		
Partridgepea	*Cassia chamaecrista*		
Indian Blanket	*Gaillardia pulchella*		
Indian Paintbrush	*Castellija coccinea*		
Gayfeather	*Liatris sp.*		

Table A-2: Wetland Plantings Zones

Zone A	
Common Name	**Genus and species**
American Pondweed	*Potamogeton nodosus*
Illinois Pondweed	*Potamogeton illinoiensis*
Perennial Smartweed	*Polygonum hydropiperoides*
Slender naiad	*Najas guadalupensis*
Square Stem spikerush	*Eleocharis quadrangulata*
Flatstem spikerush	*Eleocharis macrostachya*
Softstem bulrush	*Scripus validus*
Arrowhead	*Sagittaria latifolia*
Duck Potato	*Sagittaria graminea*
Bullsedge	*Carex sp.*
Pickerelweed	*Pontederia cordata*
Juncus	*Juncus effuses*
Zone B	
Common Name	**Genus and species**
Slender spikerush	*Eleocharis acicularis*
Flatstem spikerush	*Eleocharis macrostachya*
Softstem bulrush	*Scripus validus*
Bullsedge	*Carex sp.*
American Bulrush	*Scirpus sp.*
Waterwillow	*Justicia americana*
Juncus	*Juncus effuses*

Prairie Cordgrass	*Spartina pectinata*
Yellow Indiangrass	*Sorghastrum nutans*
Switchgrass	*Panicum virgatum*
Eastern Gamagrass	*Tripsacum dactyloides*
Zone C	
Common Name	**Genus and species**
Prairie Cordgrass	*Spartina pectinata*
Switchgrass	*Panicum virgatum*
Indian Blanket	*Gaillardia pulchella*
Buffalo Grass	*Buchloe dactyloides*
Blue Sage	*Salvia azurea*
Purple Coneflower	*Echinacea pallida*
Low Ruellia	*Ruellia humilus*
Oklahoma Blackberry	*Rubus oklahomus*
American Elderberry	*Sambucus Canadensis*
American Beautyberry	*Callicarpa Americana*
Trumpet Honeysuckle	*Lonicera sempervirens*
Indigo Bush (False Indigo)	*Amorpha fruticosa*
Swamp Privet	*Forestiera acuminate*
American Elm	*Ulmus Americana*
American Sycamore	*Platanus occidentalis*
Eastern Redbud	*Cercis Canadensis*
Texas Persimmon	*Diospyros texana*
Common Honey Locust	*Gleditsia triacanthos*

Table A-3: Woodland Plantings

Grasses	
Common Name	**Genus and species**
Big Blue Stem	*Andropogon gerardii*
Little Blue Stem	*Schizachyrium sp.*
Canada Wildrye	*Elymus canadensis*
Indian Grass	*Sorghastrum nutans*
Sideoats Grama	*Bouteloua curtipendula*
Texas Winter Rye	*Secale cereale*
Trees	
Common Name	**Genus and species**
American Elm	*Ulmus americanus*
Winged Elm	*Ulmus alta*
Shumard Oak	*Quercus shumardii*
Post Oak	*Quercus stellata*
Burr Oak	*Quercus macrocarpa*
Eastern Redbud	*Cercis canadensis*
Texas Persimmon	*Diospyros texana*
Black Walnut	*Jugiperus nigra*
Pecan	*Carya illinoinensis*
Green Ash	*Fraxnus pennsylvanica*
American Sycamore	*Plantanus occidentalis*
Rough Leaf Dog Wood	*Cornus drummondii*
Cottonwood	*Populus deltiodes*
Sassafras	*Sassafras albidum*
Black Willow	*Salix nigra*
Shrubs	
Common Name	**Genus and species**
Yaupon Holly	*Ilex vomitoria*
American Beautyberry	*Callicarpa americana*
Swamp Privet	*Forestiera acuminata*
Downy Viburnium	*Viburnium rufidulum*
Coralberry	*Symphoricarpos orbiculatus*

Appendix B: Summary of Habitat Construction Standards and Success Criteria

Table B1: Habitat Construction Standards and Success Criteria

Section 2.1 Constructed Wetland Habitat

Construction Standard*	Success Criteria**		Milestone	Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action****
Original Planting Densities	**Description**	**Requirement**	**Deadline*** **	**Duration**** **		
Wetland Planting Zones (Figures B1 & B2): **Zone A,** Similar in characteristic to the U.S Army Corp of Engineers hydrologic zones I and II, defined as permanently, semi permanently to nearly permanently inundated or saturated, with emergent vegetation. Plants will be selected from Table A-2 (Appendix A) Zone A selection list. Planting densities for emergent, herbaceous vegetation will be on 3 foot centers in areas of water depth of 18 inches or less. **Zone B** Similar in characteristic to the Corp's hydrologic zone III and IV, defined as regularly or seasonally inundated or saturated, with partially submerged or "boggy-like," soils containing vegetation that will thrive under partially saturated conditions. Plants will be selected from Table A-2 (Appendix A) Zone B selection list. Planting densities will be on 10 foot centers. **Zone C** Similar in characteristic to the Corp's hydrologic zone V, defined as irregularly inundated or saturated, for more than 5 percent of the growing season with hydrophytic vegetation present. Plants will be selected from Table A-2 (Appendix A) Zone C selection list. Planting densities will be on 15 foot centers for emergent and woody vegetation.	Percent Survival of Planted Material	50%	1 Years after Planting	1 Year		Replanting and/or re-seeding at original or greater densities.
	Initial Vegetative Cover	30%	2 Years after Planting			Replanting and/or re-seeding at original or greater densities.
	Vegetative Cover within constructed area	60%	-	1 Year	2 Years	Replanting and/or re-seeding at original or greater densities.
	Vegetative Cover Dikes / Spillways (Excluding Hardened Structures)	85%	-	1 Year	2 Years	Replanting and/or re-seeding at original or greater densities.
	Non-native and Invasive Species Control, Wetlands	<10%	-	1 Year	1 Year	Controlled through physical and chemical means as provided in Sections 2.1(d) and 7.
	Non-native and Invasive Species Control, Dikes and Spillways	<20%	-	1 Year	1 Year	Controlled through physical and chemical means as provided in Sections 2.1(d) and 7.
	Maintain dikes and spillways	To Spec	-	1 Year	2 Years	In the event dikes or spillways show signs of significant erosion or collapse, corrective action to stabilize those structures will be undertaken.

Table B1: Habitat Construction Standards and Success Criteria Continued

Section 2.2 Riparian Woodland Habitat

Construction Standard*	Success Criteria**		Milestone	Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action*****
Original Planting Densities	**Description**	**Requirement**	**Deadline*** **	**Duration**** **		
Tress and Shrubs will be selected from Table A-3 (Appendix A) and planted at the rate specified for dense or sparse planting. Dense planting - 15 feet between rows and 15 feet between trees, initial planting density 193 trees per acre. Sparser planting rate 48 trees per acre. Shrubs plant density will be 10 to 15 percent of the planting density of the trees for both sparse and dense areas. Tree and shrub plantings will be done throughout the area in a random pattern, not in a row or rectangular spacing.	Percent Survival of Planted Material	50%		1 Year	2 Years	Replanting at original or greater densities
	Planting Density - Dense	97 tree/shrub per acre		1 Year	2 Years	Replanting at original or greater densities
	Planting Density - Sparse	24 tree/shrub per acre		1 Year	2 Years	Replanting at original or greater densities
	Non-native and Invasive Species Control	< 20%		1 Year		Controlled through physical and chemical means as provided in Sections 2.3(b) and 7.

Section 2.3 Grassland Habitat

Construction Standard*	Success Criteria**		Milestone	Grow-out (Phase I)	Maintenance (Phase II)	Corrective Action*****
Original Planting Densities	**Description**	**Requirement**	**Deadline*** **	**Duration**** **		
Seeds will be selected from Table A-1 (Appendix A) and applied in the percentage listed.	Initial Vegetative Cover	60%	7 Years after Planting			
	Initial Native Species Composition	50%	7 Years after Planting			
	Vegetative Cover	80%		1 Year	2 Years	Replanting and/or re-seeding at original or greater densities
	Native Species Compositions	80%		1 Year	2 Years	Replanting and/or re-seeding at original or greater densities.
	Non-native and Invasive Species Control	< 20%		1 Year	2 Years	Controlled through physical and chemical means as provided in Sections 2.3(b) and 7.

* Summarized from the Natural Resource Damage Restoration Construction Report for the Former Empire Oil Refinery Site Gainesville, Texas. October 31, 2006 Environeering Inc. Houston, TX ** All standards and requirements listed are minimum success criteria, additional monitoring and or grow-out may be required if corrective actions are taken. *** Maximum time allowed to meet criteria **** Minimum duration required for certification of monitoring criteria
***** Should corrective measures fail to result in the required success criteria after three replanting efforts, the Trustees will reevaluate the restoration project and determine the need for further corrective measures or alternative actions.

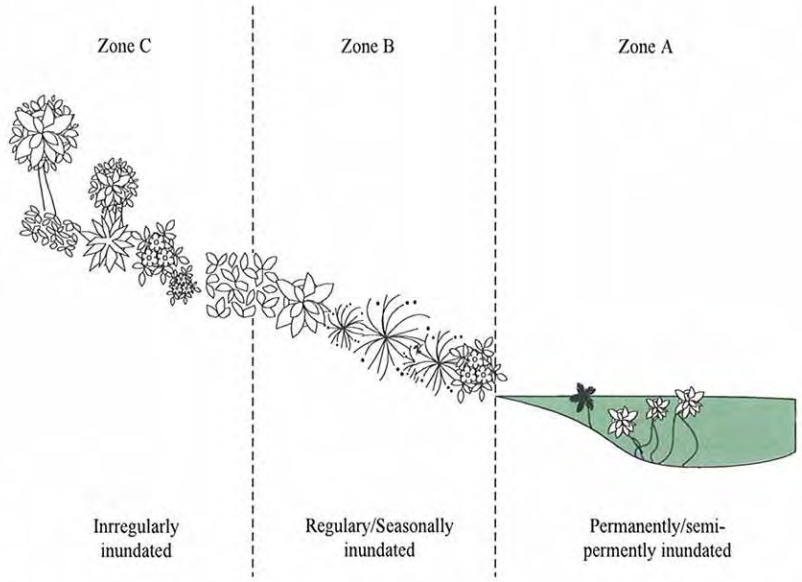

Figure B1: Schematic of Wetland Zones Former Empire Oil Refinery Gainesville, Texas

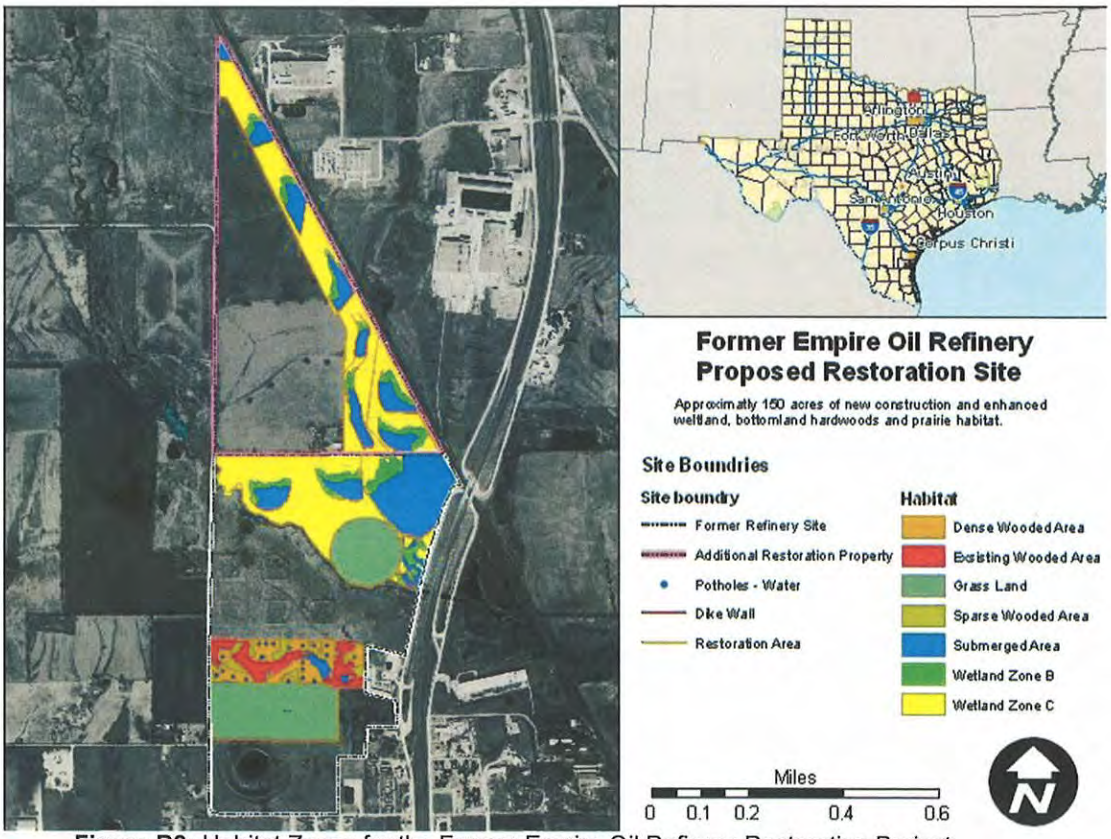

Figure B2: Habitat Zones for the Former Empire Oil Refinery Restoration Project

ATTACHMENT D

NATURAL RESOURCE DAMAGE RESTORATION CONSTRUCTION REPORT

FOR THE

FORMER EMPIRE OIL REFINERY SITE

GAINESVILLE, TEXAS

OCTOBER 31, 2006

Prepared for:

GLENN SPRINGS HOLDINGS, INC.

Prepared by:

ENVIRONEERING, INC.
16350 PARK TEN PLACE, SUITE 140
HOUSTON, TEXAS 77084

ENVIRONEERING, INC.

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1.0 INTRODUCTION

1.1 Background

The former Empire Oil Refinery was owned and operated by Empire Oil Company in Gainesville, Texas. The refinery was built in 1916 and operated until 1935. The property contains two round pits and six former tank pads. The two round pits are referred to as the Northern Pit and the Southern Pit located at the northern and southern ends of the property, respectively. In addition, what appear to be six aboveground tank pads are located southwest of the Northern Pit. It is not known what was stored or contained (other than a petroleum hydrocarbon material) in the Northern or Southern Pits, or how they were operated. This information is based on a January 21, 1942 aerial photograph and a recent survey of the property. A site map showing these features is attached as Figure 1-1.

By September 2000, the record hot summer in 2000 caused the Northern Pit Inner Pond to dry out enough to expose the petroleum hydrocarbon material. Several species of birds and other wildlife were killed because of exposure to the petroleum hydrocarbons. In mid-November, TRRC, Texas Commission on Environmental Quality (TCEQ), United States Environmental Protection Agency (USEPA), US Fish and Wildlife (USFWS), and Texas Parks and Wildlife (TPW) representatives visited the site. It was determined that the USEPA would lead a removal effort to eliminate the petroleum hydrocarbon material from the Northern Pit to protect migratory birds and other wildlife.

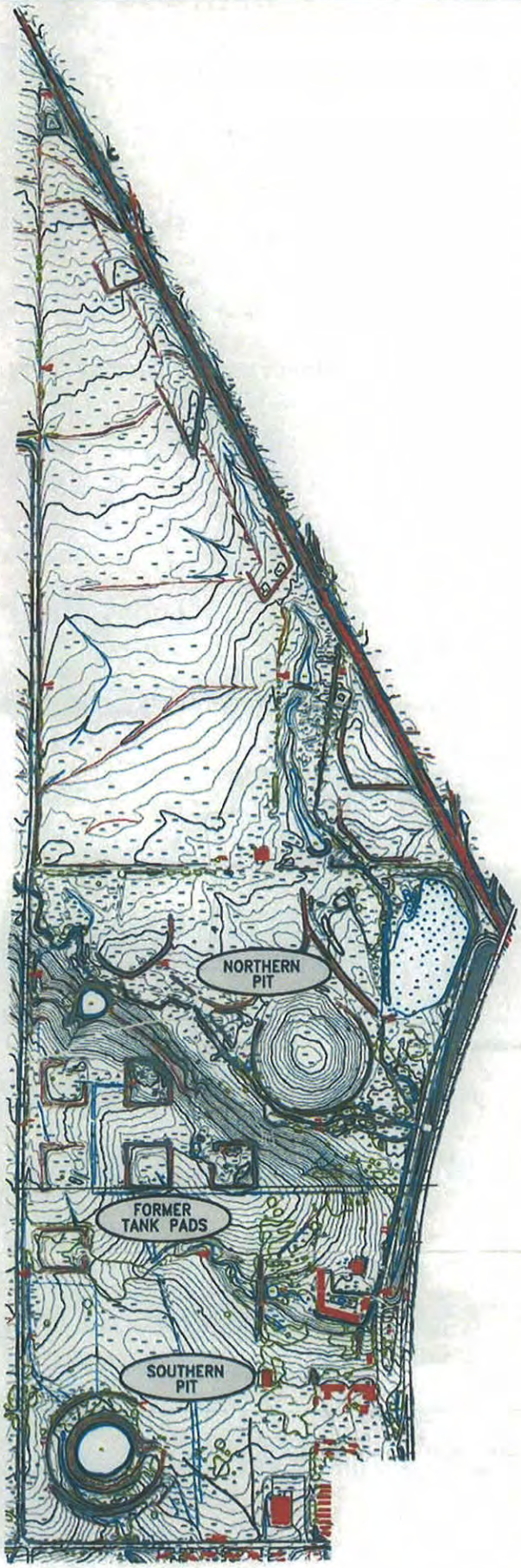
In March 2001, OXY USA agreed to mitigate the immediate threat to wildlife caused by the petroleum hydrocarbons in the Northern Pit. OXY USA applied for and was granted acceptance of the site into the TCEQ's Voluntary Cleanup Program (VCP). An Interim Corrective Measure (ICM) Investigation Work Plan, dated March 1, 2001, was submitted to the VCP. The ICM Investigation was completed by April 2001, and an ICM was selected to remove the petroleum hydrocarbon material from the Northern Pit Inner Pond. The ICM was implemented in June 2001, and was completed in December 2001.

An Affected Property Assessment (APA) Work Plan was submitted in February 2002, and was approved on June 3, 2002. On June 17, 2002, the APA was started, and all field activities were completed in August 2002. The APA Report (APAR) was submitted on November 27, 2002.

Based on the Tier 1 Exclusion Criteria Checklist completed in the APAR, it was determined that a Tier 2 Ecological Risk Assessment (ERA) was required for this site. A site visit and meeting were held February 19, 2003, with the Natural Resource Damage Assessment (NRDA) Trustees, TCEQ VCP Project Manager, TCEQ Ecological Risk Assessor, OXY USA, and Environeering. The NRDA Trustees include the USFWS, TPW, TCEQ, and the Texas General Land Office (GLO). During this meeting, the surrogate species for each feeding guild were discussed and agreed upon. The ERA Report was submitted to the TCEQ and NRDA Trustees on May 4, 2004. Environeering has responded to two sets of comments from the TCEQ and NRDA Trustees, and submitted a revised ERA Report on February 4, 2005. The revised ERA Report was approved by the TCEQ in October 2006.

1.2 Restoration Requirements

In early 2002, OXY USA contacted the Trustees to begin the NRDA settlement. In July 2002, the Trustees determined the type and amount of habitat to be created to compensate the damages to the environment caused by the refinery operations on site. The amount of habitat was based on a reasonable



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SCALE IN FEET

COMPILED FROM AERIAL PHOTOGRAPHY
FLOWN: 3-18-04
METROPOLITAN AERIAL SURVEYS
FORT WORTH, TEXAS
UPDATED: 02-28-06

ENVIRONEERING, INC.

FIGURE 1-1
SITE MAP

FORMER EMPIRE OIL REFINERY
OXY USA
GAINESVILLE, TEXAS

DRAWN BY:	DATE:	PROJ. NO.
	10-31-06	04-47

worst-case scenario for the type and time of the habitat impaired. Based on the assumptions made by the Trustees and the site data that was available, the Trustees determined the type and amount of habitat to be constructed.

In October 2002, OXY USA presented new soil, sediment, ground water, and surface water data. Based on these new data, the Trustees revised the reasonable worst-case scenario. OXY USA committed to a site restoration based on this revised reasonable worst-case scenario. The final restoration program agreed to by the Trustees and OXY USA along with the actual area included within each category is as follows:

Habitat To Be Constructed	Area Required (Acres)	Area Constructed (Acres)
Wetlands/Aquatic	99.74	112.97
Woodlands/Riparian	3.55	4.00
Grasslands	29.17	30.54
TOTAL	132.46	147.51

The survey maps for the property are included in Appendix A.

2.0 WETLANDS

2.1 Wetland Areas

OXY USA agreed to construct 99.74 acres of aquatic/wetland areas. During a site visit with the USFWS, they suggested that one of the areas be converted into a woodlands/riparian area. Because of the ecological value for this conversion, the Trustees allowed OXY USA to count the total acreage of this area as part of the aquatic/wetland area requirement. The wetland areas that were constructed are shown in Figure 2-1. The total surface area for the constructed wetland was 112.97 acres, and was broken down by the areas as:

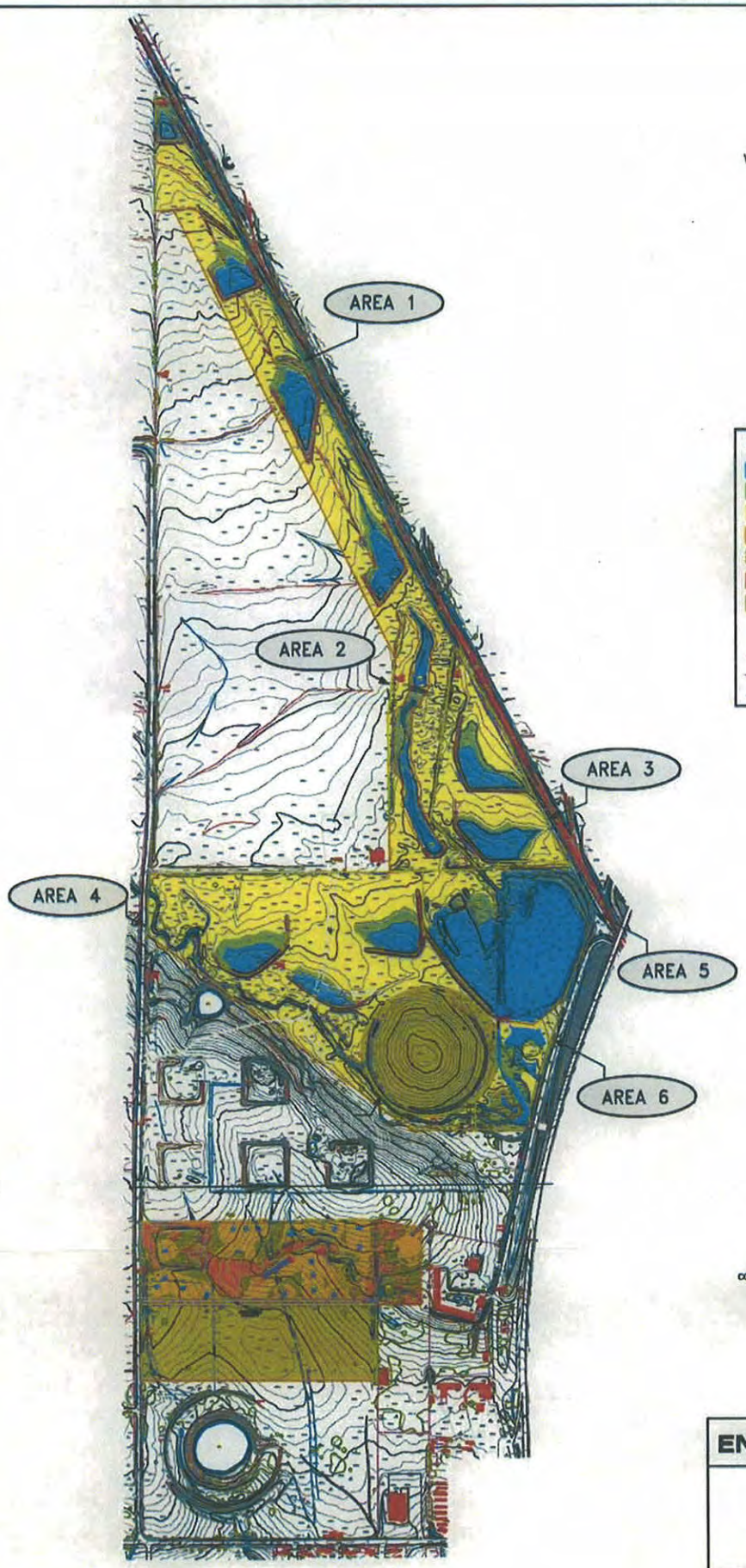
Area No.	Surface Area (acres)
1	20.64
2	13.10
3	12.35
4	29.98
5	16.93
6	4.78
7	15.19
TOTAL	**112.97**

With approval by the Trustees, the woodlands/riparian area (Area 7) could be substituted for an equal area of wetlands. Area 7 contains a total of 19.19 acres. OXY USA elected to use 15.19 acres in Area 7 as wetlands and 4.00 acres as woodlands.

2.2 Site Preparation

In Area 1, 2 and 3 most of this area was fallow consisting mostly of coastal Bermuda grass. In Area 1 a total of 4 dikes were constructed. Each dike was constructed from native soils scraped from the waterside of the impoundment. This served two purposes, first it provided the building material for the dikes, and second it lowered the surface elevation in the area so that water would be held for the creation of the wetlands. Each of the dike areas were designed so that standing water would be present throughout the year.

After scraping the area inside the dike walls and prior to the construction of the dikes, the coastal Bermuda grass and other vegetation in these area was killed using chemical treatment prior to constructing the dikes. Chemical control of undesirable species was done with the use of a non-selective systemic herbicide. For this site, an isopropyl amine salt of glyphosate base herbicide, was used, applied at a rate of 5 to 10 quarts per acre. Spot treating of selected areas was also necessary due to the dense growths of undesirable species. After the vegetation die-back from the chemical control was completed, the Areas 1, 2, and 3 were burned to destroy the biomass.



LEGEND:

- SUBMERGED AREA
- WETLANDS ZONE B
- WETLANDS ZONE C
- DENSE WOODED AREA
- SPARSE WOODED AREA
- EXISTING WOODED AREA
- GRASSLAND AREA
- POTHOLES – WATER
- DIKE WALL
- FENCE – CONSTRUCTED
- FENCE – EXISTING

0 300 600
SCALE IN FEET

COMPILED FROM AERIAL PHOTOGRAPHY
FLOWN: 3-16-04
METROPOLITAN AERIAL SURVEYS
FORT WORTH, TEXAS
UPDATED: 02-28-06

ENVIRONEERING, INC.

FIGURE 2-1
WETLANDS AREAS

FORMER EMPIRE OIL REFINERY
OXY USA
GAINESVILLE, TEXAS

DRAWN BY:	DATE:	PROJ. NO.
	10-31-06	04-47

Upon completion of the dike construction, three distinct zones were established based on ground level contours. The first zone, referred to as Zone A, was the area submerged for the majority of the year, and designed to contain emergent vegetation. This zone is similar in characteristic to the U.S Army Corp of Engineers hydrologic zones I and II, defined as permanently, semipermanently to nearly permanently inundated or saturated.

The second zone, Zone B, was is area that will be partially submerged or "boggy-like," for a portion of the year containing vegetation that will thrive under partially saturated conditions. This zone is similar in characteristic to the Corp's hydrologic zone III and IV, defined as regularly or seasonally inundated or saturated.

The third zone, Zone C, is an area of moist soils containing hydrophytic vegetation. This zone is similar in characteristic to the Corp's Hydrologic Zone V, defined as irregularly inundated or saturated for less than 5 percent of the growing season in most years. The growing season in Cooke County is 226 days as given in The Handbook of Texas Online maintained by the Texas State Historical Association. With a growing season of 226 days, 5 percent of the growing season is 11 days. Zone C needs 11 days or less of saturated soils to qualify as the Corp's Hydrologic Zone V.

In Area 2, a serpentine channel running north to south, was excavated to a depth of approximately 3 feet to facilitate additional Zone A and B-type habitats in this area.

In Area 4 significant excavation and re-grading was conducted to provide additional cover for the landfill in Area 9. Area 4 was lowered approximately 2 feet throughout most of the area. Three dikes were constructed at the southern end of the area to facilitate the development of Zones A and B habitat.

In the area of wetlands that previously existed in Area 5, a chemical control of undesirable species, predominantly cattails (*Typha sp.*) and common reeds (*Phragmites sp)*, was done with the use of a isopropylamine salt of glyphosate base herbicide, applied at a rate of 5 to 10 quarts per acre. Spot treating of selected areas was also necessary due to the dense growths of undesirable species. After the vegetation die-back from the chemical control was completed, the area was burned to destroy the biomass. The area was then excavated to a depth of 1 to 2 feet to remove the cattail/reed root mass. This lowered the eastern part of Area 5 to near the top of the weathered bedrock.

The portion of Area 5 west of the Unnamed Tributary was lowered to near the top of the weathered bedrock, and the Unnamed Tributary inside Area 5 was removed. This created a single pond of approximately 17 acres with an average depth of 8 to 10 feet. The soil removed from the western part of Area 5 and from the Unnamed Tributary was used as cap material for the landfill in Area 9.

In Area 6, a small serpentine channel was constructed running north to south, was excavated to a depth of approximately 2 feet to facilitate additional Zones A and B habitat in this area.

To help facilitate the growth and survival rate of the planted wetland vegetation, a below-grade irrigation system was added throughout Area 1, 2, 3, and 4. The system was designed to provide city-supplied water to the areas in the event of drought. In addition, water supply lines were installed in Areas 1, 2, 3, and 4 to each dike area to assist in the filling of the ponds and facilitate the development and planting of Zone A and B.

Areas 1, 2, 3, 4, 5, 6, and 9 were fenced as one contiguous property. The fence is a 4-strand barbed-wire fence. Areas 7 and 8 were fenced as one contiguous property with a 4-strand barbed-wire fence. These fences are designed to prevent livestock from entry into the wetlands, grasslands, and wooded areas at the site, while allowing wildlife to move in and out of these areas with relative ease.

2.3 Wetland Areas Construction

2.3.1 Area 1

Area 1 is the northern most area as shown in Figure 2-1. Constructed in this area are four dikes using native soil from the water side of the impoundment. The dike walls were built at an elevation to retain a water depth of approximately 4 feet, with an additional foot as freeboard. The dike walls have a 3:1 slope and a top width of three feet. The four impoundments created by the four dikes were numbered 1 through 4 beginning with the northernmost impoundment. The first digit of the pond number is the area number followed by a dash and the sequential pond number. The elevations of the top of the dike and the top of the spillway are as follows:

Pond Number	Top of Dike Elevation (feet, msl)	Top of Spillway (feet, msl)
1-1	828	827
1-2	818	817
1-3	808	807
1-4	798	797

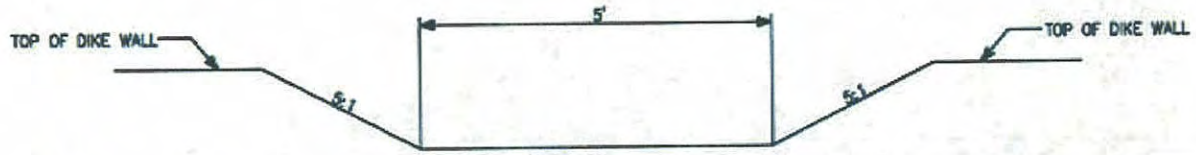
The spillway and dike wall construction is shown in Figure 2-2.

2.3.2 Area 2

A trapezoidal waterway was constructed in Area 2 that followed the natural drainage way. This area was fairly flat and low lying and was inundated or had saturated soils most of the year. The waterway was built by cutting a channel 100 feet wide at the top with a 25-foot flat bottom averaging 3 feet deep. Two dikes were constructed using native soil from the water side of the impoundment. These dikes were added at the center of the waterway and the end of the waterway to retain some additional water within the waterway. The dike walls have a 3:1 slope and a top width of three feet. The tops of dike elevation for the two dikes in Area 2 are 792 and 786 feet mean sea level (msl), starting at the northern dike to the southern dike. The northern dike area is referred to a Pond No. 2-1 and the southern dike area is referred to a Pond No. 2-2. The Area 2 waterway is shown in Figure 2-1.

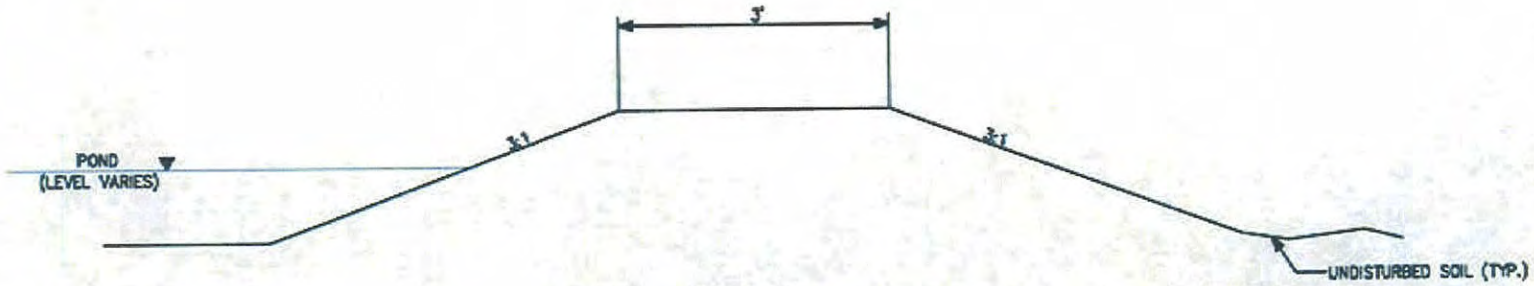
2.3.3 Area 3

Constructed in this area are two dikes using native soil from the water side of the impoundment. The dike walls were built at an elevation to retain a water depth of approximately 4 feet, with an additional foot as freeboard. The dike walls have a 3:1 slope and a top width of three feet. The two impoundments created by the two dikes were numbered 1 and 2 beginning with the northernmost impoundment. The first digit of



TYPICAL SPILLWAY SECTION

NOT TO SCALE



TYPICAL DIKE WALL SECTION

NOT TO SCALE

ENVIRONEERING, INC.

FIGURE 2-2

SPILLWAY & DIKE WALL CONSTRUCTION

FORMER EMPIRE OIL REFINERY
GAINESVILLE, TEXAS

DRAWN BY:	DATE:	PROJ. NO.
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the pond number is the area number followed by a dash and the sequential pond number. The elevations of the top of the dike and the top of the spillway are as follows:

Pond Number	Top of Dike Elevation (feet, msl)	Top of Spillway (feet, msl)
3-1	793	792
3-2	787	786

The spillway and dike wall construction is shown in Figure 2-2.

2.3.4 Area 4

Constructed in this area are three dikes using native soil from the water side of the impoundment. The dike walls were built at an elevation to retain a water depth of approximately 4 feet, with an additional foot as freeboard. The dike walls have a 3:1 slope and a top width of three feet. The three impoundments created by the three dikes were numbered 1 through 4 beginning with the northernmost impoundment. The first digit of the pond number is the area number followed by a dash and the sequential pond number. The elevations of the top of the dike and the top of the spillway are as follows:

Pond Number	Top of Dike Elevation (feet, msl)	Top of Spillway (feet, msl)
4-1	786	785
4-2	788	787
4-3	783	783

The spillway and dike wall construction for Ponds 4-1 and 4-2 are shown in Figure 2-2. Pond 4-3 was built like the other ponds except it did not have a spillway. This pond is approximately 3 feet deep. This pond was added at the request of the Trustee to retain a shallow pool and to help the middle of Area 4 remain saturated for longer periods.

2.3.5 Area 5

Area 5 is the existing wetland plus the area immediately west of the Unnamed Tributary, as shown in Figure 2-1. Constructed in this area is a ten-foot tall dike that extends from the eastern edge of the existing wetland across the Unnamed Tributary and onto the adjacent field. The dike was constructed using native soil from the water side of the impoundment with most of the dike material from the western half of the pond. The dike wall is built at an elevation to retain a water depth of at least 12 feet, with an additional two feet as freeboard. The walls have a 3:1 slope and a top width of ten feet. The top of dike elevation in Area 5 is 784 feet msl with a spillway elevation of 782 feet msl.

Because of this pond, a design for the spillway was required. The design storm event selected was a 25-year, 24-hour precipitation. Based on the hydrograph for this storm through this pond, a concrete spillway that is 40 feet wide on top of the dike wall and narrowing to 20 feet at the toe of the dike wall was selected to handle the volume of water from the design storm event. The spillway extends from about 20 feet down

the upstream side of the dike, across the top of the dike, and down the downstream side to about 10 feet beyond the dike toe. At this point, rip rap was placed another 90 feet downstream in the former channel of the Unnamed Tributary. This former channel was improved by making a 20-foot wide bottom with 2:1 side slopes and is at least 3 feet deep. In addition, the channel of the Unnamed Tributary was improved another 400 feet downstream making the channel 20 feet wide at the bottom with 2:1 side slopes and a minimum 3-foot depth. The design drawings for the spillway and channel system are given in the Appendix B.

2.3.6 Area 6

Area 6 is the area south of the pre-existing wetland and east of the Area 9, as shown in Figure 2-1. Constructed in this area is a waterway approximately 50 feet wide at the top. The waterway is at approximately 2 feet deep with a 10-foot wide flat bottom.

2.4 Wetland Plantings

2.4.1 Grasses

In November and early December 2005, upon completion of site preparation activities, all of Areas 1, 2 and 3 were seeded with a native grass mix to establish an erosion control cover of the worked areas. The seed mix used in these areas consisted of the following:

Common Name	Genus and species
Big Blue Stem	*Andropogon gerardii*
Little Blue Stem	*Schizachyrium sp.*
Canada Wildrye	*Elymus canadensis*
Indian Grass	*Sorghastrum nutans*
Sideoats Grama	*Bouteloua curtipendula*
Texas Winter Rye	*Secale cereale*

Seed mixtures were planted using a no-till drill. The area of the dike walls were sprayed with a hydro-mulch seed mix that consisted of the same mix as described above. Due to the time of year the seed mix was planted, Canada Wildrye (*Elymus canadensis*) and Texas Winter Rye *(Secale cereale)* were the dominant emergent grasses. The thick rye grass cover remained until the warmer temperature of the summer months caused the grass to die back.

In July 2006, upon completion of construction activities, Area 4 and the western portion of Area 5 were seeded with the same mix described above, plus two additional summer seeds annuals were added to promote a vegetative cover over the entire area during remainder of the summer and fall. The summer seeds added to the mix were:

Common Name	Genus and species
Barnyard Grass	*Echinochloa numcata*
Texas Millet	*Panicum texanum*

The dike walls were sprayed with a hydro-mulch seed mix that consisted of the same mix as described above.

2.4.2 Zone A

Prior to planting, each pond was filled to a level approximately 3 feet below the spillway elevation. This level is expected to be maintained in these ponds 6 to 8 months each year.

After the ponds were filled with water, Zone A plants were placed in each pond. Within Zone A, planting densities for emergent, herbaceous vegetation were planted on 3-foot centers in areas of water depth of 18 inches or less. Twelve different species of emergent vegetation were planted in the Zone A. The plants selected for Zone A of were:

Common Name	Genus and species
American Pondweed	*Potamogeton nodosus*
Illinois Pondweed	*Potamogeton illinoiensis*
Perennial Smartweed	*Polygonum hydropiperoides*
Slender naiad	*Najas guadalupensis*
Square Stem spikerush	*Eleocharis quadrangulata*
Flatstem spikerush	*Eleocharis macrostachya*
Softstem bulrush	*Scripus validus*
Arrowhead	*Sagittaria latifolia*
Duck Potato	*Sagittaria graminea*
Bullsedge	*Carex sp.*
Pickerelweed	*Pontederia cordata*
Juncus	*Juncus effuses*

The plants were either rooted clumps from selected nursery stock or cuttings taken from existing nursery stock. Table 2-1 provides a summary of the total of each Zone A plant type placed in each pond for Areas 1 through 6.

2.4.3 Zone B

In addition to the grasses seeded throughout Zone B as described in Section 2.4.1, 11 different species of semi-emergent flora were planted in the Zone B. In Zone B of each pond, planting densities were on 10-foot centers. The flora planted in the Zone B were:

Common Name	Genus and species
Slender spikerush	*Eleocharis acicularis*
Flatstem spikerush	*Eleocharis macrostachya*
Softstem bulrush	*Scripus validus*
Bullsedge	*Carex sp.*
American Bulrush	*Scirpus sp.*
Waterwillow	*Justicia americana*
Juncus	*Juncus effuses*
Prairie Cordgrass	*Spartina pectinata*
Yellow Indiangrass	*Sorghastrum nutans*
Switchgrass	*Panicum virgatum*
Eastern Gamagrass	*Tripsacum dactyloides*

ENVIRONEERING, INC.

TABLE 2-1
Zone A Planting Summary
Former Empire Oil Site
Gainesville, Texas

Common Name	Number of Zone A Plants											
	Area 1				Area 2		Area 3		Area 4		Area 6	
	Pond 1-1	Pond 1-2	Pond 1-3	Pond 1-4	Pond 2-1	Pond 2-2	Pond 3-1	Pond 3-2	Pond 4-1	Pond 4-2	Pond 6-1	Total
American Pondweed	217	439	778	605	272	667	441	625	440	439	0	4923
Illinois Pondweed	218	438	779	604	272	667	441	625	439	440	0	4923
Perennial Smartweed	217	439	778	605	272	667	441	625	440	439	0	4923
Slender naiad	218	438	779	604	272	667	441	625	439	440	0	4923
Square Stem Spikerush	217	439	778	605	272	667	441	625	440	439	40	4963
Flatstem spikerush	218	438	779	604	272	667	441	625	439	440	40	4963
Softstem bulrush	217	439	778	605	272	667	441	625	440	439	40	4963
Arrowhead	218	438	779	604	272	667	441	625	439	440	40	4963
Duck Potato	217	439	778	605	272	667	441	625	440	439	40	4963
Bullsedge	218	438	779	604	272	667	441	625	439	440	40	4963
Pickerelweed	217	439	778	605	272	667	441	625	440	439	40	4963
Juncus	218	438	779	604	272	667	441	625	439	440	0	4923
	Subtotal											59,356

The plants came from either containerized stock, rooted clumps from selected nursery stock or cuttings taken from existing nursery stock. Table 2-2 provides a summary of the total of each Zone B plant placed in each pond area for Areas 1 through 6. In addition to the species planted in the Zone B, some native plants were beginning to establish naturally. Specifically, the eastern cottonwood (*Populus deltoides*) and the black willow (*Salix nigra*) have been found around the ponds in Areas 1 and 2.

2.4.4 Zone C

In addition to the grasses seeded throughout Zone C as described above, 18 different species of flora were planted in the Zone C. Zone C planting densities were on 15-foot centers for emergent and woody vegetation.

Common Name	Genus and species
Prairie Cordgrass	*Spartina pectinata*
Switchgrass	*Panicum virgatum*
Indian Blanket	*Gaillardia pulchella*
Buffalo Grass	*Buchloe dactyloides*
Blue Sage	*Salvia azurea*
Purple Coneflower	*Echinacea pallida*
Low Ruellia	*Ruellia humilus*
Oklahoma Blackberry	*Rubus oklahomus*
American Elderberry	*Sambucus Canadensis*
American Beautyberry	*Callicarpa Americana*
Trumpet Honeysuckle	*Lonicera sempervirens*
Indigo Bush (False Indigo)	*Amorpha fruticosa*
Swamp Privet	*Forestiera acuminate*
American Elm	*Ulmus Americana*
American Sycamore	*Platanus occidentalis*
Eastern Redbud	*Cercis Canadensis*
Texas Persimmon	*Diospyros texana*
Common Honey Locust	*Gleditsia triacanthos*

The plants came from either containerized stock, or were transplanted stock. Table 2-3 provides a summary of the total of each Zone C plant type placed in each pond area for Areas 1 through 6. In addition to the species planted in the Zone C, some native species have begun establishing themselves naturally. Specifically, Maximilan sunflower (*Helianthus maximiliani*) and Golden Tickseed (*Coreopsis tinctoria*) were well established throughout most of Zone C in Areas 1, 2, and 3.

ENVIRONEERING, INC.

TABLE 2-2
Zone B Planting Summary
Former Empire Oil Site
Gainesville, Texas

Common Name	Number of Zone B Plants											
	Area 1				Area 2		Area 3		Area 4		Area 6	
	Pond 1-1	Pond 1-2	Pond 1-3	Pond 1-4	Pond 2-1	Pond 2-2	Pond 3-1	Pond 3-2	Pond 4-1	Pond 4-2	Pond 6-1	Total
Slender spikerush	35	41	51	48	41	69	61	79	130	130	0	685
Flatstem spikerush	35	41	51	48	41	69	61	79	130	130	0	685
Softstem bulrush	35	41	51	48	41	69	61	79	130	130	0	685
Bullsedge	35	41	51	48	41	69	61	79	130	130	0	685
American Bulrush	35	41	51	48	41	69	61	79	130	130	0	685
Waterwillow	35	41	51	48	41	69	61	79	130	130	0	685
Juncus	35	41	51	48	41	69	61	79	130	130	0	685
Prairie Cordgrass	35	41	51	48	41	69	61	79	130	130	0	685
Yellow Indiangrass	35	41	51	48	41	69	61	79	130	130	0	685
Switchgrass	35	41	51	48	41	69	61	79	130	130	0	685
Eastern Gamagrass	35	41	51	48	41	69	61	79	130	130	0	685
	Subtotal											7,535

ENVIRONEERING, INC.

TABLE 2-3
Zone C Planting Summary
Former Empire Oil Site
Gainesville, Texas

Common Name	Number of Zone C Plants											
	Area 1				Area 2		Area 3		Area 4		Area 6	
	Pond 1-1	Pond 1-2	Pond 1-3	Pond 1-4	Pond 2-1	Pond 2-2	Pond 3-1	Pond 3-2	Pond 4-1	Pond 4-2	Pond 6-1	Total
Prairie Cordgrass	35	110	88	122	88	117	75	88	221	221	0	1165
Switchgrass	35	110	88	122	88	117	75	88	221	221	63	1228
Indian Blanket	35	110	88	122	88	117	75	88	221	221	4	1169
Buffalo Grass	35	110	88	122	88	117	75	88	221	221	0	1165
Blue Sage	35	110	88	122	88	117	75	88	221	221	5	1170
Purple Coneflower	35	110	88	122	88	117	75	88	221	221	4	1169
Low Ruellia	35	110	88	122	88	117	75	88	221	221	4	1169
Oklahoma Blackberry	21	66	52	72	52	69	45	53	132	132	0	694
American Elderberry	21	66	52	72	52	69	45	53	132	132	0	694
American Beautyberry	21	66	52	72	52	69	45	53	132	132	0	694
Trumpet Honeysuckle	21	66	52	72	52	69	45	53	132	132	0	694
Indigo Bush (False Indigo)	21	66	52	72	52	69	45	53	132	132	6	700
Swamp Privet	21	66	52	72	52	69	45	53	132	132	6	700
American Elm	4	11	9	12	9	11	8	9	22	22	4	121
American Sycamore	5	16	13	18	13	11	11	13	32	32	0	164
Eastern Redbud	5	16	13	18	13	11	11	13	32	32	2	166
Texas Persimmon	5	16	13	18	13	11	11	13	32	32	0	164
Common Honey Locust	4	11	9	12	9	11	8	9	22	22	0	117
	Subtotal											13,143

3.0 WOODLANDS/RIPARIAN

3.1 Woodland/Riparian Area

Area 7 was established as a riparian habitat (a low lying area along a stream courses) to provide further diversification of the overall restoration project. The riparian management and enhancement of this 21.5 acre tract of land was completed to provided important forested habitat and hardwood bottomland for songbirds and a variety of other wildlife species.

Constructed in this area was a dike using native soil from the water side of the impoundment. A single dike wall was built at an elevation to retain a water depth of approximately 4 feet. The dike wall has a 3:1 slope and a top width of three feet. Water will spill around the ends of the dike wall. The elevation of the top of the dike wall was 793 feet, msl.

Prior to the initiation of the planting of trees and shrubs in Area 7, enhancement of the area consisted of the construction of a serpentine channel, running east to west. The channel was excavated to a depth of approximately 3 feet to provide additional bottomland habitat and available water for the newly planted vegetation. In addition, 20 potholes were dug along the side slopes of Area 7. These potholes were designed to collect rainwater run-off from the area and act as a water source to the trees planted nearby. With a spacing of approximately 200 feet between potholes, they will provide a source of water that the trees can readily utilize. Each pothole is approximately 10 feet diameter and 3 feet deep. It is expected that these potholes will retain standing water for 6 to 9 months of the year. The locations of the channel and potholes are shown in Figure 3-1.

Cleared trees and brush taken from other areas of the site were used to construct a windbreak along the southern perimeter of Area 7. The windbreaks were constructed of tree trunks and limbs, and were stacked approximately 10 feet high and 10 feet wide. The windbreaks were constructed in five sections with lengths of approximately 200 to 300 feet long. In addition to providing the newly planted trees much needed relief from the strong prevailing southerly winds, the windbreaks provide food for wildlife as well as protective cover when they forage in adjacent areas. The windbreaks also provide escape cover and refuge for many wildlife species. On a broader scale, they function as stopover points for migrating songbirds heading north for the summer or south for the winter.

3.2 Woodland Plantings

In early Spring 2006, the remediated portion of Tank Pad 6 in Area 7 was seeded with a native grass mix to establish an erosion control cover of the worked areas. Seed mixtures were planted using a no-till drill. The seed mix used in these areas consisted of the following:

Common Name	Genus and species
Big Blue Stem	*Andropogon gerardii*
Little Blue Stem	*Schizachyrium sp.*
Canada Wildrye	*Elymus canadensis*
Indian Grass	*Sorghastrum nutans*
Sideoats Grama	*Bouteloua curtipendula*
Texas Winter Rye	*Secale cereale*

Initial plantings in this area of the site consisted of the transplanting of existing trees from other areas on the property. These trees were thought to be more tolerant of the harsher environmental conditions along the perimeter of the Area 7 (*i.e.*, sloping and windy conditions). A total of 82 trees, 71 Hackberry (*Celtis sp.*) and 11 Cedar (*Juniperus sp.*), were transplanted along the edge of the riparian area. These transplanted trees will provide a fast growing windbreak to assist in the success of the younger trees planted in the area.

The remainder of Area 7 was planted with a variety native species available from nursery stock. The trees arrived at the site in either containers or balled in burlap. The planting densities varied throughout the area. Minimal disturbance to the existing riparian vegetation occurred. Dense clusters of riparian vegetation were planted along the newly constructed water sources and blended into the existed riparian vegetation. This mosaic pattern provided variability throughout this portion of the restoration area. Figure 3-1 illustrates the mosaic pattern that was created by mixing the dense vegetation with areas of sparser vegetation cover and the newly constructed water holding areas. This pattern provides denser vegetative cover along the natural drainage areas and the pothole areas becoming less dense towards the higher elevations. The use of the potholes provided the opportunity to grow a denser vegetative cover in some of these higher areas that would normally be less productive. The total number of trees planted is given in Table 3-1.

For the dense planting areas, trees were spaced 15 feet between rows and 15 feet between trees, giving an initial stocking rate or planting density of 193 trees per acre. This density encourages the canopy to close rapidly, reducing weed problems and improving tree form and branching. Shrubs were added throughout the area to increase the plant density.

For the sparse planting areas, trees were planted at a rate of 48 trees per acre. Shrubs were planted to increase the planting density of the vegetation in this area. This density provided an ideal wildlife habitat and aesthetic conditions allowing access corridors for wildlife to traverse the area. The tree and shrub plantings were done throughout the area in a random pattern, not in rows or a regular spacing.

After the holes for planting the trees were dug and before the trees were planted, photographs from a low altitude flight were taken of Area 7. The density of the tree plantings is evident from these photograph as shown in Figures 3-2, 3-3, and 3-4.

For the planting of the nursery stock trees, holes were dug larger than the diameter of the root ball, but only as deep as the root ball. The soil at the bottom of the excavation was broken up to provide the newly emerging roots room to expand into loose soil to hasten establishment. The majority of the roots on the newly planted tree will develop in the top 12 inches of soil. If the tree is planted too deep, new roots will have difficulty developing due to a lack of oxygen. For this reason, the trees were planted 2-3 inches above the base of the trunk flare, which allowed for some settling.

If the tree was balled in burlap, the string/wire was cut and removed from around the trunk and top 1/3 of the root ball. Care was given not to damage the trunk or roots in the process. The remainder of the hole was filled taking care to firmly pack soil to eliminate air pockets that may cause roots to dry out. To avoid this problem, the soil was added a few inches at a time and settled with water. This process was continued until the hole was filled and the tree was firmly planted. No fertilizer was applied at the time of planting.

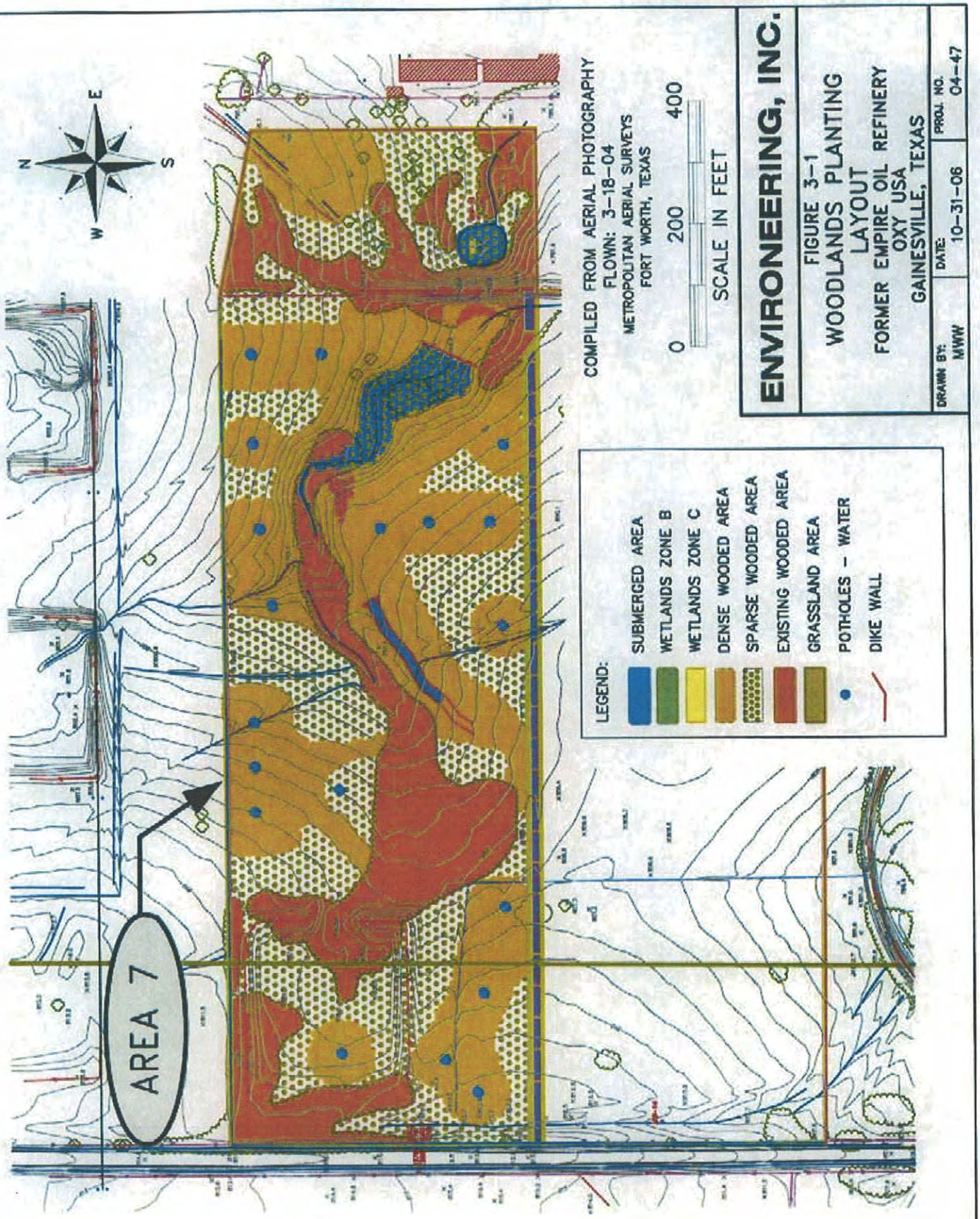

AREA 7
N
E
S
W
COMPILED FROM AERIAL PHOTOGRAPHY
FLOWN: 3-18-04
METROPOLITAN AERIAL SURVEYS
FORT WORTH, TEXAS
0
200
400
SCALE IN FEET
LEGEND:
SUBMERGED AREA
WETLANDS ZONE B
WETLANDS ZONE C
DENSE WOODED AREA
SPARSE WOODED AREA
EXISTING WOODED AREA
GRASSLAND AREA
POTHOLES - WATER
DIKE WALL
ENVIRONEERING, INC.
FIGURE 3-1
WOODLANDS PLANTING
LAYOUT
FORMER EMPIRE OIL REFINERY
OXY USA
GAINESVILLE, TEXAS
DRAWN BY: MWW
DATE: 10-31-06
PROJ. NO. 04-47

Table 3-1
Area 7 Planting Summary
Former Empire Oil Site
Gainesville, Texas

Plant Type	Plant Size			
	Bare Root, 2 Year Old Seedlings (3 to 6 feet in Height)	Root Ball Bagged in Burlap (1.5 to 2-inch Trunk Diameter)	Quart Containers	Totals
Trees	**Number of Plants**			
American Elm - *Ulmus americanus*	100	50	0	150
Winged Elm - *Ulmus alta*	100	100	0	200
Shumard Oak - *Quercus shumardii*	200	250	0	450
Post Oak - *Quercus stellata*	100	111	0	211
Burr Oak - *Quercus macrocarpa*	100	67	0	167
Eastern Redbud	100	100	0	200
Texas Persimmon - *Diospyros texana*	25	25	0	50
Black Walnut - *Jugiperus nigra*	12	12	0	24
Pecan - *Carya illinoinensis*	12	12	0	24
Green Ash - *Fraxnus pennsylvanica*	40	62	0	102
American Sycamore - *Plantanus occidentalis*	25	25	0	50
Rough Leaf Dog Wood - *Cornus drummondii*	24	24	0	48
Cottonwood - *Populus deltiodes*	25	25	0	50
Sassafras - *Sassafras albidum*	25	25	0	50
Black Willow - *Salix nigra*	25	25	0	50
			Subtotal	**1,826**
Shrubs	**Number of Plants**			
Yaupon Holly - *Ilex vomitoria*	0	0	57	57
American Beautyberry - *Callicarpa americana*	0	0	48	48
Swamp Privet - *Forestiera acuminata*	0	0	48	48
Downy Viburnium - *Viburnium rufidulum*	0	0	48	48
Coralberry - *Symphoricarpos orbiculatus*	0	0	48	48
			Subtotal	**249**

Looking from near the southwest corner of Area 7 toward the northeast. Tank Pad 6 is in the extreme lower left corner of this photo. The pock marks are the holes for the tree planting.

FIGURE 3-2

TREE PLANTING DENSITY
AREA 7 PHOTOGRAPH 1

FORMER EMPIRE OIL REFINERY
GAINESVILLE, TEXAS

Looking from near the southeast corner of Area 7 toward the northwest. Tank Pad 6 is in the upper middle portion of this photo. The pock marks are the holes for the tree planting.

FIGURE 3-3

TREE PLANTING DENSITY
AREA 7 PHOTOGRAPH 2

FORMER EMPIRE OIL REFINERY
GAINESVILLE, TEXAS

Looking from almost straight down from near the east side of Area 7. The wind break is along the left side of the photo. The pock marks are the holes for the tree planting.

FIGURE 3-4

TREE PLANTING DENSITY
AREA 7 PHOTOGRAPH 3

FORMER EMPIRE OIL REFINERY
GAINESVILLE, TEXAS

To reduce competition from grass and weeds, a two-inch to four-inch layer of wood chip mulch was added at the base of all the newly planted trees. It was determined at the time of planting that staking was necessary for support of the younger trees. Two stakes used in conjunction with a wide flexible tie material were used to hold the tree upright, provide flexibility, and minimize injury to the trunk. Support staking and ties will be removed after the first year of growth.

4.0 GRASSLANDS

4.1 Grassland Areas

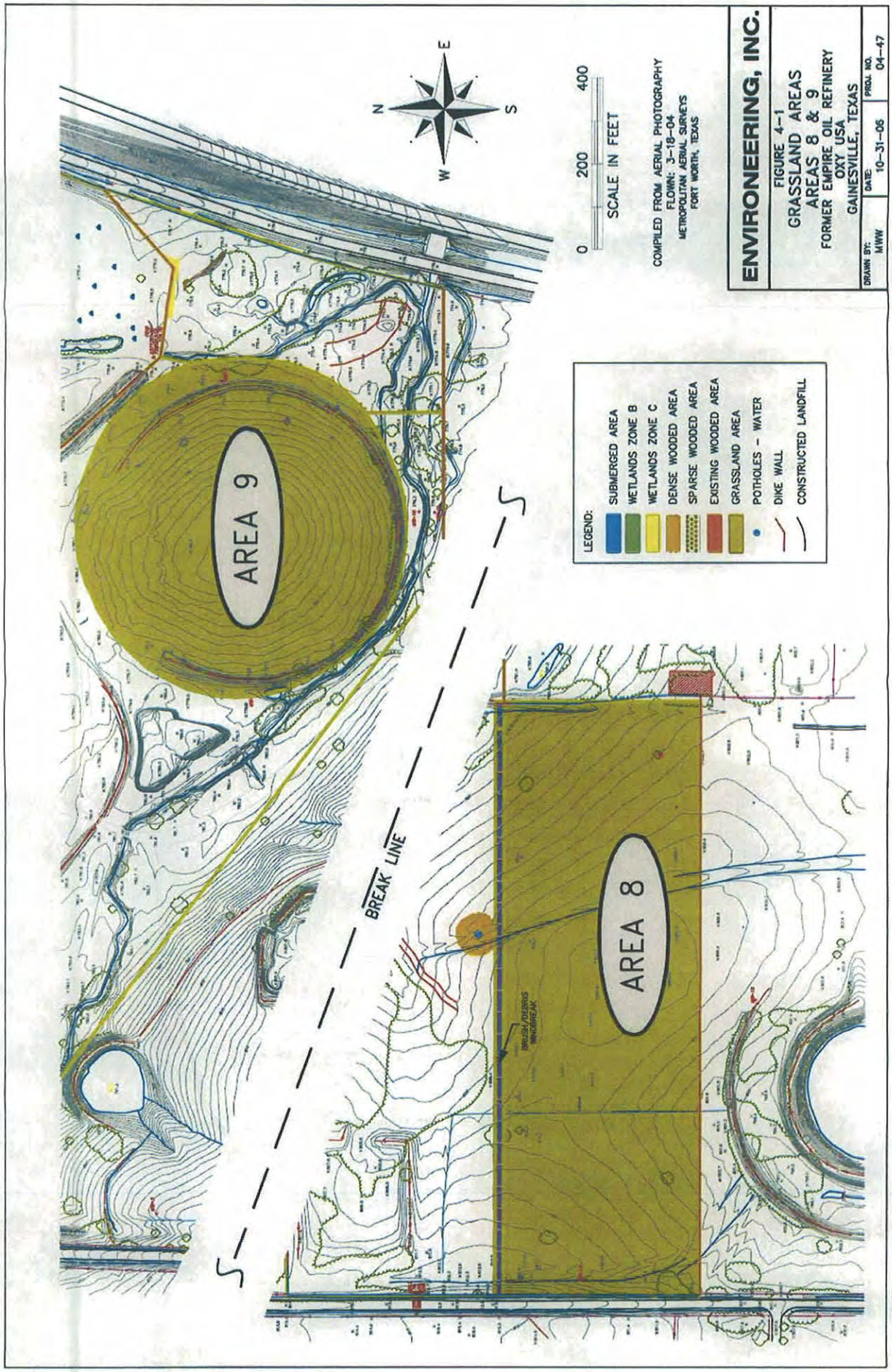
Areas 8 and 9 were designated as grassland areas, as shown in Figure 2-1. Area 8 is between the Southern Pit and the riparian woodland area. Area 8 has an area of 14.66 acres. Area 9 is adjacent to Areas 4, 5, and 6. Area 9 has an area of 15.88 acres giving a total grassland area of 30.54 acres. Areas 8 and 9 are shown in more detail in Figure 4-1.

4.2 Grassland Plantings

Upon completion of the remediation activities at the Southern Pit area, all paths and roads were disked. In July 2006, Area 8 was seeded with a mix of grasses and wild flowers. The climax vegetation consists of Little Bluestem, Indian Grass, Big Bluestem, Canada Wild Rye, Texas Winter Grass and Sideoats Grama. The wild flowers mix typically consisted of the following:

Common Name	Genus and species
Black Eyed Susan	*Rudbeckia hirta*
Purple Coneflower	*Echinacea purpurea*
Flax	*Linum sp.*
Coneflower	*Ratibida sp.*
Partridgepea	*Cassia chamaecrista*
Indian Blanket	*Gaillardia pulchella*
Indian Paintbrush	*Castellija coccinea*
Gayfeather	*Liatris sp.*

In July 2006, Area 9 was seeded with Little Bluestem, Indian Grass, Big Bluestem, Canada Wild Rye, and Sideoats Grama. Two additional summer seeds annuals, Barnyard Grass (*Echinochloa muncata)* and Texas Millet (*Panicum texanum*), were added to promote a vegetative cover over the entire area during this summer months. Seed mixtures were planted using a no-till drill. The dike walls were sprayed with a hydro-mulch seed mix that consisted of the same mix as described above.


AREA 9
AREA 8
BREAK LINE
N
S
E
W
0 200 400
SCALE IN FEET
COMPILED FROM AERIAL PHOTOGRAPHY
FLOWN: 3-18-04
METROPOLITAN AERIAL SURVEYS
FORT WORTH, TEXAS
LEGEND:
SUBMERGED AREA
WETLANDS ZONE B
WETLANDS ZONE C
DENSE WOODED AREA
SPARSE WOODED AREA
EXISTING WOODED AREA
GRASSLAND AREA
POTHOLES - WATER
DIKE WALL
CONSTRUCTED LANDFILL
ENVIRONEERING, INC.
FIGURE 4-1
GRASSLAND AREAS
AREAS 8 & 9
FORMER EMPIRE OIL REFINERY
OXY USA
GAINESVILLE, TEXAS
DRAWN BY: MWW
DATE: 10-31-06
PROJ. NO. 04-47

5.0 WILDLIFE RE-ESTABLISHMENT

As phases of the restoration were completed, wildlife populations have begun re-establishing the area. Evidence of mammalian, avian, reptilian and amphibian species have been noted. Throughout the wetland areas footprints of raccoons (*Procyon lotor*) are numerous. Beaver (*Castor canadensis*) and deer *(Odocoileus virginianus)* trackings have been noted in Areas 3 and 5. Scat from coyotes (*Canis latrans*) has been found in Areas 1 through 7. Red foxes (*Vulpes fulva*) and skunks (*Spilogale putorius*) have been seen in Area 7, using the windbreaks for cover.

In Area 1, frogs (*Rana sp.*) have been noted in some of the ponds. In Area 2, a Red-eared slider (*Trachemys scripta elegans*) was seen in the constructed channel. A water snake (*Nerodia sp.*) has also been witnessed in the same waterway.

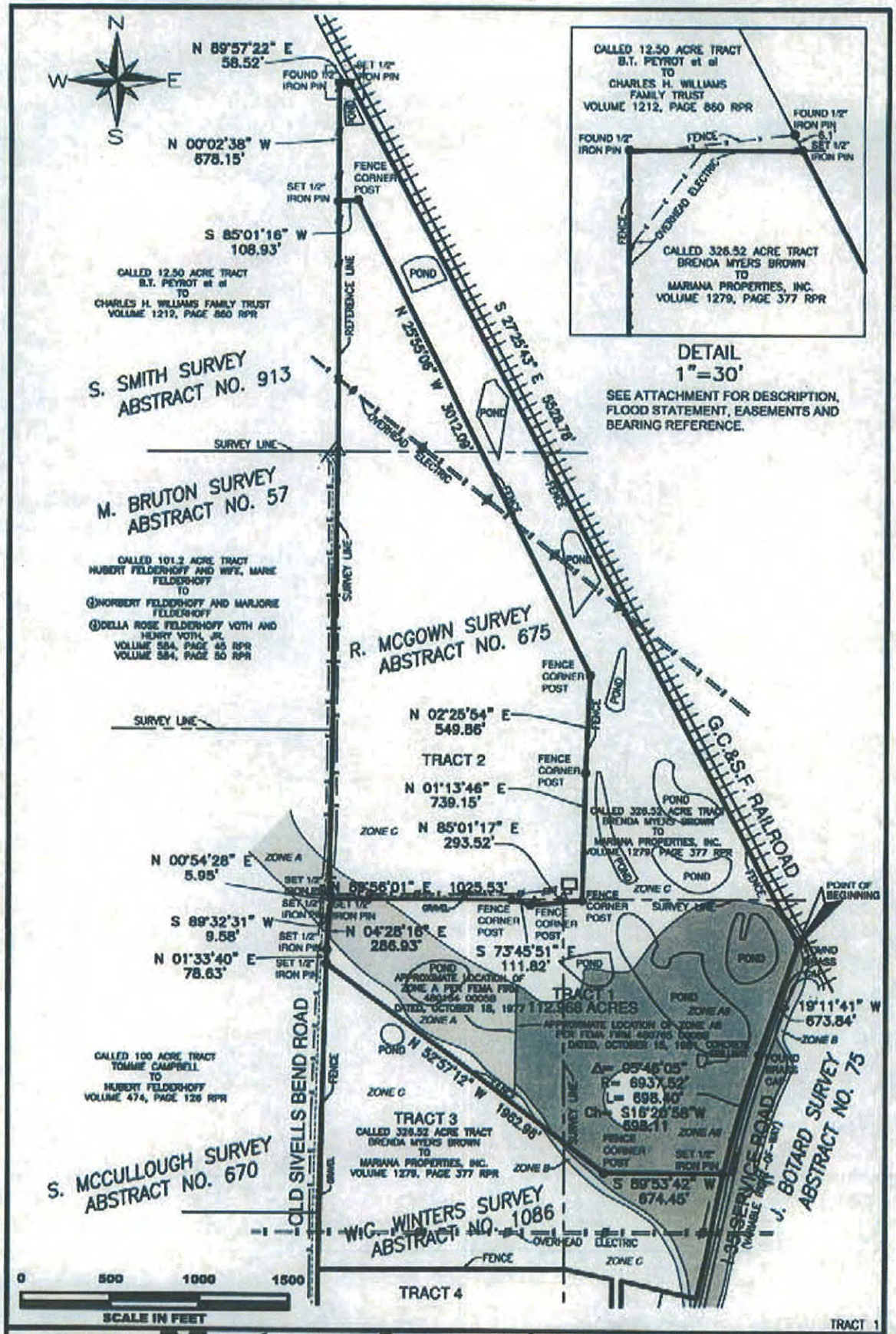
Green-backed herons (*Butorides striatus*) have been seen in the newly established vegetation in Area 2. Mallards (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), blue-winged teal (*Anas discors*), and coots (*Fulica americana*) have all been seen visiting the ponds in Areas 2 and 3.

Larger birds such as the red-tail hawks (*Buteo jamaicensis*), the northern Harrier (*Circus cyaneus*) and the Turkey vulture (*Carthartes aura*) have been noted hunting/scavenging throughout the restoration areas. Mourning doves (Zenaida macroura), meadowlarks (*Sturnella sp.*), mockingbirds (*Mimus polyglottos*), shrikes (*Lanius ludovicianus*), cardinals (*Cardinalis cardinalis*), and numerous sparrow (Emberizids) have become common in many areas around the site.

While a detailed survey of the fauna of the site has not been undertaken, a perfunctory examination of the site reveals that the areas restoration has proven to be well on its way to becoming a success story for the development of wildlife habitat in north central Texas.

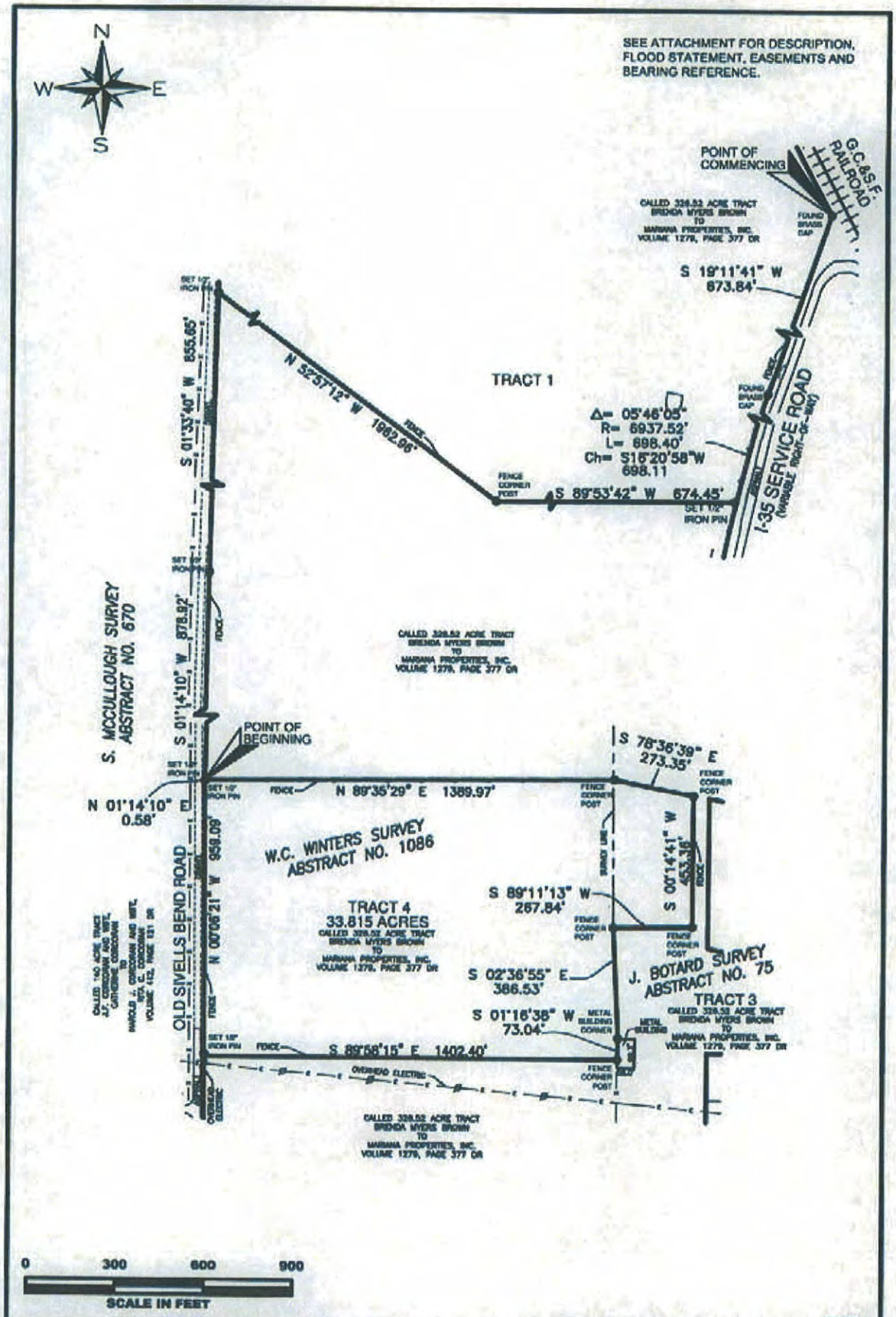
APPENDIX A

PROPERTY SURVEY



MSI Metroplex Surveying, Inc.	DWN. JRH	SCALE 1"=500'	
	CKD. BGS	DATE 09/22/06	
	REV.	JOB NO. 34499	

940-387-0506 223 W. HICKORY, DENTON, TEXAS 76201 info@metroplexsurveying.com



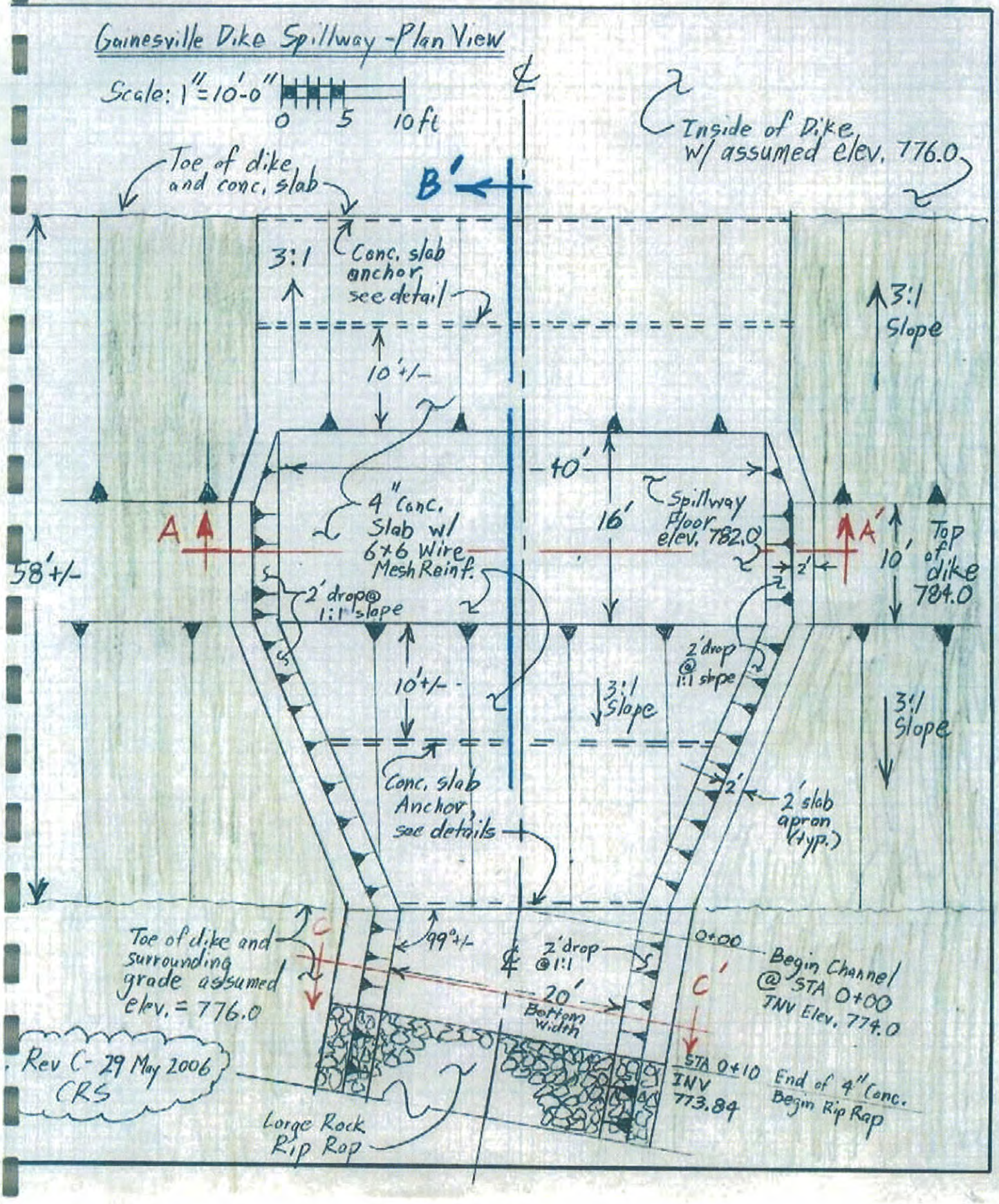
TRACT 4

Metroplex Surveying, Inc.	DWN. JRH	SCALE	1"=300'
	CKD. BGS	DATE	09/22/06
	REV.	JOB NO.	34499

940-387-0506 223 W. HICKORY, DENTON, TEXAS 76201 info@metroplexsurveying.com

APPENDIX B

AS-BUILT DRAWINGS FOR AREA 5 SPILLWAY


Gainesville Dike Spillway - Plan View
Scale: 1" = 10'-0"
0 5 10 ft
Inside of Dike w/ assumed elev. 776.0
Toe of dike and conc. slab
B'
3:1
Conc. slab anchor see detail
3:1 Slope
10'+/-
40'
4" Conc. Slab w/ 6x6 Wire Mesh Reinf.
16'
Spillway Floor elev. 782.0
A
A'
58'+/-
2' drop @ 1:1 slope
2'
10'
Top of dike 784.0
2' drop @ 1:1 slope
10'+/-
3:1 Slope
3:1 Slope
Conc. slab Anchor see details
2'
2' slab apron (typ.)
Toe of dike and surrounding grade assumed elev. = 776.0
C
99°+/-
2' drop @ 1:1
0+00
Begin Channel @ STA 0+00 INV Elev. 774.0
C'
20' Bottom Width
Rev C - 29 May 2006 CRS
STA 0+10 INV 773.84
End of 4" Conc. Begin Rip Rap
Large Rock Rip Rap