Detailed Project Report/Environmental Assessment

Section 206 Aquatic Ecosystem Restoration Project
Stephenville, Texas

US Army Corps of Engineers
Fort Worth District

December 2005

EXECUTIVE SUMMARY

This Detailed Project Report/Environmental Assessment (DPR/EA) is submitted under the authority of Section 206 of the Water Resources Development Act (WRDA) of 1996, as amended (33 USC 2201). The purpose of this study was to identify potential ecosystem restoration alternatives for City of Stephenville-owned properties within and adjacent to the North Bosque River in Erath County, Texas. The goal of the DPR/EA was to evaluate each proposed alternative and, through coordination with the U.S. Army Corps of Engineers (USACE) and City of Stephenville, develop a recommended restoration plan for each study area.

The City of Stephenville is located in north central Texas in Erath County, approximately 63 miles southwest of Fort Worth, Texas. The proposed aquatic ecosystem restoration is located on the North Bosque River adjacent to the Stephenville Wastewater Treatment Plant (WWTP). The site consists of approximately 56.6 acres of abandoned sludge drying beds that run parallel to the North Bosque River. The proposed restoration would also include approximately 0.5 mile of the North Bosque River located within the Stephenville City Park area between the city's low water weir and the U.S. Highway 67 Bridge.

Human activities have had, and are continuing to have, a significant impact on the plants and animals of the region. The terrestrial habitat in the North Bosque River watershed has undergone extensive agricultural development in and around the riparian corridor. Today, less than 40 percent of the bottomland hardwood ecosystem in Texas remains due, primarily, to European settlement of the region. Trends indicate that forest cover throughout the watershed will continue to decrease in the future. The North Bosque River has been listed by the State as an "Impaired and Threatened Water Body" and placed on the 1998 Clean Water Act Section 303(d) List by the Environmental Protection Agency (EPA). Aquatic resources in the North Bosque River have deteriorated to the point where the fish species present are dominated by those types that are considered to be pollution tolerant. If the environmental conditions of the basin continue to degrade, this domination by the more pollution tolerant species would become even more prevalent.

The proposed Stephenville City Park and WWTP study areas have experienced similar environmental degradations as those identified regionally. The existing riparian corridor within the Stephenville City Park study area is narrow and sparse due to routine mowing, heavy public foot traffic, and stream bank erosion. In-stream aquatic habitat within the park is disturbed and fragmented due primarily to stream bank erosion and subsequent sedimentation. Plant species diversity and adequate wildlife habitat is lacking due to encroachment of landscaped park lands. The Stephenville WWTP contains a floodplain area directly adjacent to the North Bosque River that is currently comprised of poor quality old field/grassland habitat that could be restored to wetland habitat. Creation of wetland habitat would provide a unique habitat type for resident and migratory wildlife species, improve water quality by filtering WWTP effluent prior to entering the North Bosque River, and help remove the North Bosque River from the Section 303(d) List.

The aquatic ecosystem components of the proposed project are composed of the North Bosque River channel and riparian corridor/grassland habitat located directly adjacent to the river channel and serves functions (i.e. buffering of pollutants, cover, channel stability) essential for a healthy aquatic ecosystem. The study area, approximately 56 acres of old fields/grasslands, remnant riparian and bottomland forests, and a 0.5 mile of aquatic habitat was studied and found to be suitable for restoration. The purpose of this project is to restore in-stream aquatic habitats, restore wetland and bottomland communities to benefit the variety of resident and migratory wildlife species utilizing the project area, and improve water quality conditions within the North Bosque River.

The recommended plan as defined in this DPR/EA consists of the reforestation of approximately 18.4 acres of riparian woodlands; enhancement of 5.8 acres of water quality and in-stream aquatic habitats; and creation of 45.1 acres of a wetland complex. The total restoration cost is estimated at $2,378,295.

The City of Stephenville as the non-Federal sponsor would provide the lands required for the recommended plan. The City would also be responsible for all operation, maintenance, replacement, and repair costs. Both the Texas Parks and Wildlife Department (TPWD) and United States Fish and Wildlife Service (USFWS) are supportive of this Section 206 project. This report includes sections that contain information necessary to fulfill National Environmental Policy Act (NEPA) requirements, such as Purpose Of and Need for Action; Preliminary Alternatives; Recommended Restoration Plan (Proposed Action); and Environmental Consequences. A Finding of No Significant Impact (FONSI) will be issued after review of the EA, if appropriate.

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ACRONYMS AND ABBREVIATIONS

AAHU	Average Annual Habitat Unit
AST	aboveground storage tank
ASTM	American Society of Testing Materials
BCC	Birds of Conservation Concern
BMP	Best Management Practices
BRA	Brazos River Authority
CAA	Clean Air Act
CAFO	Confined Animal Feeding Operations
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CICIS	TSCA, Chemicals in Commerce Information System
CLI	Closed Landfill Inventory
CWA	Clean Water Act
dBA	decibels
DO	dissolved oxygen
DOCKET	Consolidated Docket of Civil Enforcement Actions
DOT	Department of Transportation
DPR	Detailed Project Report
EA	Environmental Assessment
EComm	Ecological Communications Corporation
E&D	engineering and design
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Environmental Site Assessment
FATES	FIFRA and TSCA Enforcement System
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, & Rodenticide Act
FINDS	Facility Index System
FONSI	Finding of No Significant Impact
FRDS	Federal Reporting Data System
ft	feet
FTTS	FIFRA / TSCA Tracking System
FURS	Federal Underground Injection Control Reporting System
GIS	geographic information system
GPS	global positioning system
HEP	Habitat Evaluation Procedure
HMRIS	Hazardous Materials Information Tracking System.
HSI	Habitat Suitability Index

ACRONYMS AND ABBREVIATIONS (Continued)

HTRW	hazardous, toxic, and radioactive waste
HU	habitat units
IBI	Index of Biotic Integrity
LERRD	Land, Easements, Rights-of-Way, Relocation and Disposal Areas
LQG	large quantity generator
LUST	leaking underground storage tank
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFRAP	No Further Remedial Action Planned
NOAA	National Oceanic and Atmospheric Administration
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRHP	National Registry of Historic Places
NWI	National Wetlands Inventory
NWP	Nationwide Permit
O&M	Operation and Maintenance
OMRR&R	Operation, Maintenance, Repair, Rehabilitation and Replacement
PADS	Polychlorinated Biphenyls Activity Database System
PCA	Project Cooperation Agreement
PCS	Permit Compliance System
PDA	Planning and Design Analysis
PM	particulate matter
PREWet	Pollutant Removal Estimates for Wetlands
PRP	Preliminary Restoration Plan
RCRA	Resource Conservation and Recovery Act
RCRIS	Resource Conservation and Recovery Information System
SIA	Surface Impoundments database
S&A	supervision and administration
SCS	Soil Conservation Service
SQG	small quantity generator
SWPPP	Storm Water Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TMDL	total maximum daily load
TNRCC	Texas Natural Resource Conservation Commission
TPWD	Texas Parks and Wildlife Department
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
TSHA	Texas State Historical Association

ACRONYMS AND ABBREVIATIONS (Continued)

TtNUS	Tetra Tech NUS, Inc.
TX IHW	Texas industrial and hazardous waste
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
WRDA	Water Resources Development Act
WWTP	wastewater treatment plant

1.0 INTRODUCTION

1.1 Study Area

The City of Stephenville is located in north central Texas in Erath County, approximately 63 miles southwest of Fort Worth, Texas. The proposed aquatic ecosystem restoration study area is located along the North Bosque River at two sites. One site is adjacent to the Stephenville Wastewater Treatment Plant (WWTP). This site is approximately 56.6 acres and includes large, abandoned sludge drying beds. The other site is an approximate 0.5-mile stretch of the North Bosque River and adjacent land located within the Stephenville City Park, totaling 9.44 acres. Figure 1-1 shows the project vicinity and the specific location of the study areas in greater detail and photos of the current restoration sites are located in Appendix A.

1.2 Purpose of and Need for Action

The project is needed to restore the aquatic ecosystem components of the proposed study areas to a condition closer to natural conditions within the constraints of the park and WWTP uses. The aquatic ecosystem components are composed of the North Bosque River channel and riparian corridor/grassland habitat located directly adjacent to the river channel, which serves functions (i.e. buffering of pollutants, cover, channel stability) essential for a healthy aquatic ecosystem. Prior to human encroachment, the floodway along the North Bosque River was comprised of high quality riparian and in-stream habitat. However, the majority of the bottomland plant community within the watershed has become highly disturbed and fragmented due primarily to conversion of land to agricultural and urban uses, extensive grazing, and invasion of mesquite, juniper, and hackberry. Likewise, the quality of in-stream aquatic habitat has degraded along the North Bosque River due to increased nutrient and sediment loads from dairy operation run-off, clearing of vegetated floodways, and alterations to natural water flows and channel morphology. Ecosystem degradation has resulted in a loss of high quality in-stream and riparian habitat for terrestrial and aquatic wildlife that inhabit the watershed.

The purpose of the proposed action is to implement conservation measures that would remedy some of these habitat degradations by restoring habitats to a condition closer to natural conditions within the constraints of the park and WWTP uses. Specific habitat degradations within the proposed study areas that require restoration include:

- River banks are eroding due to lack of vegetative cover;
- The existing riparian corridor within the Stephenville City Park study area is too narrow to provide good wildlife habitat and protect banks from erosion;
- Emergent wetland habitat adjacent to the North Bosque River, which would provide wildlife habitat and improve water quality, is lacking;
- Plant species diversity has decreased due to human alterations, which has impacted wildlife species diversity;

- Wildlife cover and nesting habitat has been diminished due to encroachment of landscaped park lands in the riparian area; and

- In-stream habitat features are lacking diversity due to sedimentation and human alterations.

1.3 Study Goals and Objectives

The general goal of this report is to complete a feasibility-level study by evaluating alternatives that are technically feasible, supported by the sponsor, and are consistent with the authorized project purposes of restoring the degraded habitat in the study area to a less degraded, more natural condition. The tasks undertaken and included as part of this Detailed Project Report/Environmental Assessment (DPR/EA) are:

- A description of the existing conditions (affected environment) including documentation of environmental degradations;

- Descriptions of project alternatives and levels of restoration efforts including conceptual designs and construction cost estimates. The conceptual design as defined for this plan provides sufficient plan and/or narrative information for review to understand the functional and technical approach a contractor or designer would follow to complete the project. Correspondingly, the construction cost estimate as determined for this plan has been defined as an engineer's estimate with a 30% contingency;

- Assessment of the potential impacts on cultural resources;

- Documentation of any potential contaminants/Hazardous, Toxic, Radioactive Waste (HTRW);

- Field investigations to support the plan;

- Assessment of real estate value and boundaries;

- Development of detailed cost effectiveness and amounts for the various alternatives;

- Completion of an incremental cost analysis of the various alternatives;

- Identification of a recommended restoration plan, conceptual design of recommended plan features, and development of supporting technical data;

- Conceptual design and justification of any associated recreation features included in the recommended plan; and

- Preparation of an integrated EA to comply with the National Environmental Policy Act (NEPA), which includes the purpose of and need for action, description of alternatives, existing conditions, environmental consequences including cumulative impacts, and mitigation measures to minimize environmental impacts.

For this study, the process of evaluating the project alternatives has been streamlined such that the alternatives have been presented and evaluated, but a detailed analysis, including a construction cost estimate, was developed for only the preferred alternative.

1.4 Study Authority

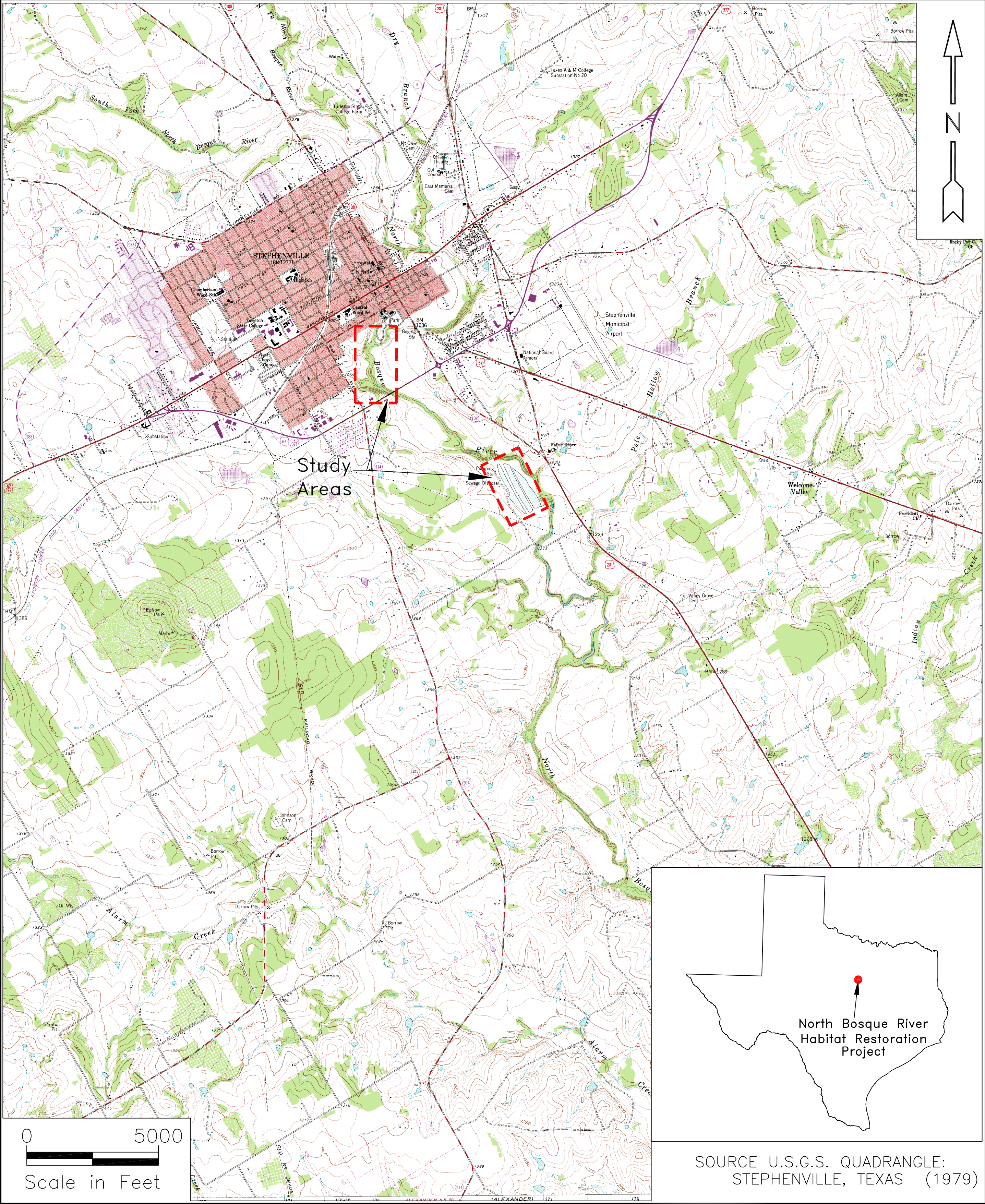
This study is submitted under the authority of Section 206 of the Water Resources Development Act (WRDA) of 1996, Public Law 104-303, which states that,

> *"The Secretary is authorized to carry out an aquatic ecosystem restoration and protection project if the Secretary determines that the project (1) will improve the quality of the environment and is in the public interest, and (2) is cost-effective."*

The United States Army Corps of Engineers (USACE) is the lead agency for this study. The City of Stephenville has expressed their desire to act as a participatory agency in this restoration project. The USACE is also the lead Federal agency for NEPA compliance. The United States Fish and Wildlife Service (USFWS) is a cooperating agency and completed a Fish and Wildlife Coordination Act Report for this project (USFWS 2003) (Appendix B). This report includes an EA to determine the potential impacts that could occur if this project were implemented. The following sections contain information necessary to fulfill NEPA requirements:

- Purpose Of and Need for Action;
- Preliminary Alternatives (fulfills alternatives considered but eliminated from further analysis);
- Recommended Restoration Plan (Proposed Action); and
- Environmental Consequences.

A Finding of No Significant Impact (FONSI) will be issued after review of the EA, if appropriate.



SOURCE U.S.G.S. QUADRANGLE:
STEPHENVILLE, TEXAS (1979)

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 09-28-04	SCALE: 1"=5000'
DWG. NO.: STEPH_SV	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 1-1
PROJECT VICINITY AND STUDY AREA MAP
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 - HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

2.0 EXISTING CONDITIONS

2.1 Climate and Weather

Average annual precipitation in Stephenville is 29.7 inches per year (National Oceanic and Atmospheric Administration [NOAA], 2003). Average monthly precipitation ranges from a low of 1.31 inches in January to a high of 4.4 inches in May. The average annual high temperature is 75.2 degrees Fahrenheit, which ranges from 55.0 degrees in January to 93.6 degrees in July. Average annual low temperature is 51.2 degrees, ranging from 30.0 degrees in January to 70.1 degrees in July.

2.2 Air Quality

Air quality is defined by ambient air concentrations of specific pollutants determined to be of concern with respect to the health and welfare of the general public. Under the Clean Air Act Amendments of 1990, the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS), including six "criteria pollutants:" lead, ozone, sulfur dioxide, oxides of nitrogen, carbon monoxide, and particulate matter less than 10 microns in diameter (PM10). New standards for particulate matter smaller than 2.5 microns in diameter (PM2.5) have been proposed, and policies to implement the standards are in development. Areas that exceed a Federal air quality standard are designated as non-attainment areas.

Although the Stephenville project area is in attainment with the NAAQS (EPA, 2003), Erath County has been assigned a grade level "C" for particulate matter and "D" for ammonia (Airgrades, 2004). The grade levels are assigned based on emission densities in tons per square mile per year, where grade level "A" represents the Best/Cleanest emission density and grade level "F" represents the Worst/Dirtiest. In Erath County, road traffic and construction contribute to 80 percent of the fugitive dust causing the particulate matter levels and livestock and fertilizer causing 99 percent of the ammonia levels.

2.3 Soils and Geology

2.3.1 Soil

The soil association in the bottomlands of the project area is the Maloterre-Purves-Dugout, which is shallow to very shallow, stony and gravelly soils over limestone. It is in the Bunyan Series, which is fine sandy loam that is deep, nearly level, moderately permeable, well drained, and experiences occasional flooding. Erath County elevations range from 900 to 1,750 feet with slopes ranging from 0 to 2 percent. Rapidly flowing floodwaters cause scouring and sediment deposits. Areas with this soil type are cultivated for sorghum, small grain, alfalfa, and cotton (US Department Agriculture Soil Conservation Service [USDA SCS], 1973.)

In February 1995, Alan Plummer Associates, Inc. completed a study that determined the quantity and quality of the solids stored within the City of Stephenville WWTP sludge drying lagoons and evaluated the disposal options for the wastewater solids. Analytical parameters conducted on the solids included total metals, nitrogen series, fecal coliforms, and hazardous waste determination.

Analytical results indicated that the metal levels in the solids were below the regulatory maximums for both land application and co-disposal. Laboratory analysis indicated that the fecal coliform concentrations were well below the Most Probable Number (MPN) per gram of total solids required for Class B pathogen reduction designation. Hazardous waste determination results were negative and nonhazardous for all four parameters (corrosivity, ignitability, reactivity, toxicity). Two conceptual alternatives for use of the lagoon site following removal of the solids were reviewed: 1) demolition of existing lagoon levees and then return the site to original topography contours, and 2) keep existing levees intact and use the lagoons as a wetland treatment system for effluent polishing.

2.3.2 Geology

Erath County, Texas is underlain by Cretaceous sedimentary rocks of the Mesozoic period. The county sits within the Central Texas Cretaceous formation outcropping. The Central Texas Cretaceous outcrop extends to the north from the northeast corner of the state along the Red River Valley and across the East Texas embayment, and then southward towards San Antonio, and westward to the Rio Grande embayment near Uvalde and Eagle Pass (U.S. Geological Survey [USGS], 2003). Lower Cretaceous strata deposited in fluvial, deltaic, strand plain and shallow marine environments and are composed primarily of sand with interbedded clays, limestone, dolomite, gravel and conglomerates. Broad limestone shelves and former barrier reefs surround the deeper parts of the marine sub basins. Rivers flowed to the landward edges of the basins, forming deltas, and coastlines shifted repeatedly as near shore sediments were deposited and then eroded by marine processes. Pennsylvanian strata that are products of these processes are exposed today in North-Central Texas.

Rocks of the Cretaceous age that compose the Trinity aquifer are exposed along the rim of the dissected Edwards Plateau. Formations comprising the Trinity Group are (from youngest to oldest) the Paluxy, Glen Rose, and Twin Mountains-Travis Peak. At the updip, where the Glen Rose thins are missing, the Paluxy and Twin Mountains coalesce to form the Antlers Formation. The Antlers consists of up to 900 feet of sand and gravel, with clay beds in the middle section. Water from the Antlers is mainly used for irrigation in the outcrop area of North and Central Texas.

2.4 <u>Water Resources</u>

2.4.1 Surface Water

The Bosque River is comprised of four main branches: the North, East, Middle, and South Bosque Rivers. The North Bosque River, the longest branch of the river, rises in north central Erath County and cuts through Hamilton County into Bosque County. It is joined in Bosque County by the East Bosque River, which also rises in Erath County. From their confluence the North Bosque continues into central McLennan County, where it is joined by the South and Middle Bosque rivers. The Bosque River traverses an area of rolling hills with dominant vegetation including post oak and cedar and terminates in Lake Waco. The upper branches, in Erath, Hamilton, and Bosque counties, are relatively narrow, free-flowing, and scenic, with clear water and heavily vegetated banks (Texas State Historical Association [TSHA], 2003).

The North Bosque River is a tributary within the Brazos River Watershed which travels below the Caprock escarpment where low escarpments cross the watershed. The basins of the Brazos are deeply trenched and confined in narrow valleys with steeply graded bluffs. These basins have a relatively narrow floodplain. The Brazos basin covers more than 42,000 square miles in Texas with nearly two million Texans living within its borders. The main stem of the Brazos River is formed in eastern Stonewall County, at the confluence of the Salt Fork and the Double Mountain Fork (Brazos River Authority [BRA], 2003). From the confluence, the river winds more than 900 miles to the Gulf combining with other tributary rivers, such as the Clear Fork, the Bosque, the Lampasas, the Leon, the Little, and the Navasota Rivers.

The state of Texas requires water quality in the North Bosque River to be suitable for swimming, wading, fishing, drinking (with treatment), and to support a healthy aquatic ecosystem (Texas Commission on Environmental Quality [TCEQ], 2002). Water quality testing has shown that in the North Bosque high levels of nutrients have contributed to excessive growth of algae and other aquatic plants in the river. This condition can impair the river's aesthetic value, may cause taste and odor problems in drinking water, and under certain circumstances may result in fish kills. In addition, bacteria levels are occasionally elevated, indicating a potential health risk to people who swim or wade in the river. The North Bosque River was included in the 1998 Texas Clean Water Act Section 303(d) List and deemed impaired under narrative water quality standards related to nutrients and aquatic plant growth (Texas Natural Resource Conservation Commission [TNRCC], 2001). Studies have shown that phosphorus is usually the limiting nutrient in the basin and that dairy waste application fields and municipal wastewater treatment plants are the major controllable sources of phosphorus. To address the high level of nutrients, TMDLs for phosphorus have been established for the Upper North Bosque and North Bosque River.

Surface waters within the project area consist of the North Bosque River and the outflow from the WWTP. The Stephenville WWTP currently discharges effluent to the North Bosque River at two different locations. The first discharge point is located east of Graham Street and the Stephenville City Park on the north side of the North Bosque River. The second discharge point is located at the southeast corner of lagoon number three at the Stephenville WWTP. Average Daily Flow (ADF) of effluent from the WWTP is approximately 1.4 million gallons per day with a Maximum Daily Flow (MDF) of approximately 2.2 million gallons per day. Approximately 0.2 to 0.3 million gallons per day is discharged at the Stephenville City Park location. City of Stephenville records from January 1995 through October 2000 identified the following parameters for WWTP effluent: biochemical oxygen demand of 3.9 mg/L, total suspended solids of 10.9 mg/L, dissolved oxygen of 8.0 mg/L, total Kjeldahl nitrogen of 2.1 mg/L, ammonia of 0.7 mg/L, nitrite of 0.2 mg/L, nitrate of 2.8 mg/L, total phosphorous of 2.8 mg/L, chloride of 147.1 mg/L, sulfate of 65.1 mg/L, fecal coliforms of 854.6 colony forming units/100 ml, a PH of 7.7, a conductivity of 1140 micro siemens, and a temperature of 21.2 degrees Celsius. Standing water temporarily collects in portions of the sludge drying ponds after significant rainfall.

2.4.2 Groundwater

Erath County, Texas rests within the Great Plains Physiographic Province and is underlain by the Trinity Aquifer. Groundwater moves from the aquifer's outcrop areas to the downdip areas.

Water levels within the aquifer range from greater than 500 feet below sea level to greater than 1,500 feet above sea level. One large and one small cone of depression and can be found in the Dallas-Fort Worth area and the Waco areas, respectively (USGS, 2003). Recharge to the Trinity Aquifer is generally from precipitation that falls on aquifer outcrop areas and from the seepage of streams and ponds where the head gradient is downward. The aquifer discharges by evapotranspiration at springs or upward leakage into shallower aquifers, through lateral diffusion and withdrawal from wells. Because the materials that compose the aquifer are generally fine grained, clayey, and locally cemented, the transmissive and hydraulic conductivity values are relatively low, however the aquifer is productive for many parts of Erath County.

2.5 Wetlands and Floodplains

2.5.1 Wetlands

The EPA and USACE define wetlands as: "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The North Bosque River running through the project area is an intermittent, seasonally flooded riverine system with a muddy bottom according to the National Wetlands Inventory (NWI) classification system (Cowardin, Carter, and Golet, 1992); (USFWS, 2003). Wetlands in the project area are generally within the banks of the river. Wetlands may extend beyond the banks to the outer limits of the floodplain in areas without steep banks. The cells at the Stephenville WWTP are depicted as excavated, diked, artificially flooded palustrine systems. Currently, these cells do not hold water and may be classified as excavated old fields/grasslands (USFWS, 2003). They may hold water temporarily after rains.

2.5.2 Floodplains

Executive Order 11988 directs Federal agencies to provide leadership and take action on Federal lands to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to:

1) Avoid the direct or indirect support of floodplain development whenever there are practicable alternatives;
2) Evaluate the potential effects of any proposed action on floodplains;
3) Ensure planning programs and budgeting requests reflect consideration of flood hazards and floodplain management; and
4) Prescribe procedures to implement the policies and requirements of the Order.

The project area was identified as within a special flood hazard area, or Zone A, per Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map or the Flood Hazard Boundary Map for Erath County, Texas (FEMA, 1991; Schrickel, Rollins and Associates, Inc.). This area has at least a one percent (1%) chance of a flood equal to or exceeding the base flood elevation (e.g., the elevation predicted during a 100-year flood) in any given year.

2.6 Vegetation

Erath County is located in the West Cross Timbers and Prairies vegetational areas of Texas (Diggs et al., 1999). Historically, the area was open prairie with a few scattered post oak (*Quercus stellata*) and live oak (*Quercus virginiana*) motts (clusters of trees). Ashe juniper (*Juniperus ashei*) and mesquite (*Prosopis grandulosa*) trees grow in some areas (USDA SCS, 1973). The bottomland woodlands were predominately pecan (*Carya illinoensis*), elms (*Ulmus sp.*), and oaks (*Quercus sp.*). Tree species found in the project area are pecan, American elm (*Ulmus americana*), cedar elm (*Ulmus crassifolia*), black willow (*Salix nigra*), red mulberry (*Morus rubra*), and cottonwood (*Populus deltoides*).

Shrubs found in the wooded areas include bois d-Arc (*Maclura pomifera*), common elderberry (*Sambucus niger var. Canadensis*), privet (*Ligustrum sp.*), cedar elm, rough-leafed dogwood (*Cornus drummondii*), and red mulberry (*Morus rubra*). Vines and forbs include goldenrod (*Solidago canadensis*), poison ivy (*Toxicodendron radicans*), Texas prickly poppy (Argemone *albiflora*), dayflower (*Commelina erecta*), and saw greenbrier (*Smilax bona-nox*).

Within the WWTP lagoon shrubs are limited to sumac (*Rhus sp.*). Vines and forbs include Aster (*Asteraceae sp.*), silver-leaf nightshade (*Solanum elaeagnifolium*), sunflower (*Helianthus sp.*), Buffalo gourd (*Cucurbita foetidissima*), and eyebane (*Chamaesyce nutans*).

Historically, little bluestem (*Schizachyrium scoparium*), silver bluestem (*Bothriochloa laguroides*), side-oats grama (*Bouteloua curtipendula*), tall grama (*Bouteloua pectinata*), and buffalograss (*Buchloe dactyloides*) were predominate grass species in the area (USDA SCS 1973). Most of these grasses have been grazed out long ago. The predominate grasses are now Texas winter wheat (*Nassella leucotricha*), Canada wildrye (*Elymus canadensis*), Bermudagrass (*Cynodon dactylon*), and Johnsongrass (*Sorghun halepense*), with many other less common grasses, such as common sandbur (*Cenchrus spinifex*), crabgrass (*Digitaria sp.*), dallis grass (*Paspalum dilatatum*), Hall's panicum (*Panicum hallii*), purple love grass (*Erogrostis spectabilis*), love grass (*Eragrostis sp.*), old field threeawn (*Aristida oligantha*), panic grass (*Panicum sp.*), silver bluestem (*Bothriochloa laguroides*), stinkgrass (*Eragrostis cilianensis*), Texas panicum (*Panicum texanum*), white tridens (*Tridens albescens*), wild oats (*Chasmanthium latifolium*), windmill grass (*Chioris verticillata*), and wooly rosette grass (*Panicum acuminatum*). A complete listing of plant species observed during the Habitat Evaluation Procedure (HEP), as described in Section 2.10, for this project can be found in Appendix B.

The project area consists of approximately 18.4 acres of riparian woodlands, 45.1 acres of wetland vegetation, and 1.4 acres of in-stream aquatic habitat (USFWS, 2003). An undetermined amount of grassland, shrubland and tree savanna habitats are adjacent to the project area. The riparian corridor contains intermittent sections of deciduous woodlands, grasslands and tree savannas; some of them are maintained as parklands. The wooded sections along each side of the river are narrow, ranging from about 10 to 250 feet wide.

2.7 Fish

Thirteen fish species, representing five families, have been confirmed in the project area by a recent survey (Armstrong, 1998) and are listed in Table 2-1. Minnow (*Cyprinidae*) and sunfish

(*Centrarchidae*) are likely the two most common families with four species of each occurring in the project area. Red shiner (*Cyprinella lutrensis*) was the most common species found in this survey. Other species collected regularly were the sand shiner (*Notropis stramineus*), bullhead minnow (*Pimephales vigilax*), and largemouth bass (*Micropterus salmoides*). Quantification of fish habitat quality is located in Section 2.10.

Table 2-1
Fish Species Likely Occurring in the Project Area
Stephenville, Texas

Family	Scientific Name	Common Name
Lepisosteidae	*Lepisosteus osseus*	Longnose gar
Cyprinidae	*Cyprinella lutrensis* *Notropis stramineus* *Notropis venustis* *Pimephales vigilax*	Red shiner Sand shiner Blacktail shiner Bullhead minnow
Ictaluridae	*Amejurus natalis* *Ictalurus punctatus* *Pylodictus divans*	Yellow bullhead Channel catfish Flathead catfish
Poecillidae	*Gambusia affinis*	Western mosquito fish
Centrarchidae	*Lepomis cyanellus* *Lepomis macrochirus* *Lepomis megalotis* *Micropterus salmoides*	Green sunfish Bluegill Longear sunfish Largemouth bass

Note: Fish species collected from the North Bosque River, County Road 246, just south of the WWTP, Erath County, Texas, June 24, 1998 (Armstrong, 1998).

2.8 Wildlife

The project area is used by both resident and migratory wildlife that are somewhat tolerant of human activity (USFWS, 2003). Migratory waterfowl and shorebirds, and resident wood ducks (*Aix sponsa*), use the river and its tributaries and local emergent wetlands. The woodlands are most likely used by a variety of migratory and resident songbirds, owls, and hawks. Some common resident bird species that likely occur in the project area include various species of sparrows, northern mockingbird (*Mimus polyglottos*), American robin (*Turdus migratorius*), blue jay (*Cyanocitta cristata*), common grackle (*Quiscalus quiscula*), scissor-tailed flycatcher (*Tyrannus forficatus*), common crow (*Corvus brachyrhynchos*), American kestrel (*Falco sparverius*), and red-tailed hawk (*Buteo jamaicensis*).

Common mammals that could occur in the project area include raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), coyote (*Canis latrans*), bobcat (Lynx rufus), cottontail rabbit (*Sylvilagus fioridanus*), fox squirrel *(Sciurus niger*), several species of small rodents such as deer mouse (*Peromyscus sp.*), and bats such as big brown bat (*Eptesicus fuscus*).

Various species of frogs, such as bullfrog (*Rana catesbeiana*), and turtles, such as red-eared slider (*Trachemys scripta elegans*), may be found in the river and wetlands, while lizards and snakes can be found throughout the study area. A list of faunal species that were observed during field investigations in the project area can be found in Appendix B. More detailed descriptions and quantification of existing wildlife habitat types, quality, and quantity are also found in Appendix B and summarized in Section 2.10.

2.9 Special Status Species

2.9.1 Threatened, Endangered, Proposed and Candidate Species

Within Erath County, three species are Federally listed as endangered and one species is listed as threatened (USFWS, 2003) (Table 2-2). The black-tailed prairie dog was removed from the candidate species list in August 2004 (USFWS, 2004). There are no species occurring in the county that are currently proposed for listing.

Table 2-2
Threatened, Endangered, and Candidate Species
Known to Occur in Erath County
Stephenville, Texas

Common Name	Scientific Name	Status
Black-capped vireo	*Vireo atricapillus*	Endangered
Golden-cheeked warbler	*Dendroica chrysoparia*	Endangered
Whooping crane	*Grus americana*	Endangered
Bald eagle	*Haliaeetus leucocephalus*	Threatened
Black-tailed prairie dog	*Cynomys ludovicianus*	Candidate

Source: USFWS, 2003.

No appropriate habitat exists for these species in the project area (USACE, 2001; USFWS, 2003; Tetra Tech, 2003). There is no designated critical habitat for listed species in Erath County (USFWS, 2003).

2.9.2 Birds of Conservation Concern

USFWS published the Birds of Conservation Concern 2002 (BCC) in December 2002, which states, "The overall goal of the BCC is to accurately identify the migratory and non-migratory bird species (beyond those already designated as Federally threatened or endangered) that represent our highest conservation priorities and draw attention to species in need of conservation action" (USFWS, 2002). The seven species listed in Table 2-3 use habitats that occur within the project area (USFWS, 2003).

Table 2-3
Birds of Conservation Concern That Use Habitat Types Present in the Project Area Stephenville, Texas

Common Name	Scientific Name	Habitat Occurrence
Little blue heron	*Egretta caerulea*	Inland marshes and ponds
Northern harrier	*Circus cyaneus*	Marshes, prairies, and savannas
Scissor-tailed flycatcher	*Tyrannus forficatus*	Prairies and savannas
Bell's vireo	*Vireo belli*	Dense thickets
Harris' sparrow	*Zonotrichia querula*	Scrub, undergrowth in open woodlands and savanna, thickets, brushy fields, and hedgerows
Chestnut-collared longspur	*Calcarius ornatus*	Shortgrass prairie, plowed field, overgrazed pasture
Painted bunting	*Passerina ciris*	Riparian and thorn forest, oak woodlands, savanna, brushy pastures, and hedgerows

Source: USFWS, 2002; USFWS, 2003.

2.10 Existing Habitats

To evaluate potential restoration opportunities, it was necessary to quantify baseline habitat conditions within and around the study areas. Wildlife habitats were evaluated using the HEP developed by the USFWS. Fish habitat was evaluated using the TPWD statewide Index of Biotic Integrity (IBI). Water quality improvement based on proposed wetland habitat was evaluated using the USACE Pollutant Removal Estimates for Wetlands (PREWet) program. Figure 2-1 shows the locations of the various habitat types found within and around the proposed project boundaries. A copy of the original USFWS study is attached in Appendix B and contains the complete HEP and IBI evaluations. The following subsections detail the methods and results of each type of habitat evaluation. The following diagram identifies typical stream characteristics.

2.10.1 Habitat Evaluation Procedure

Methods

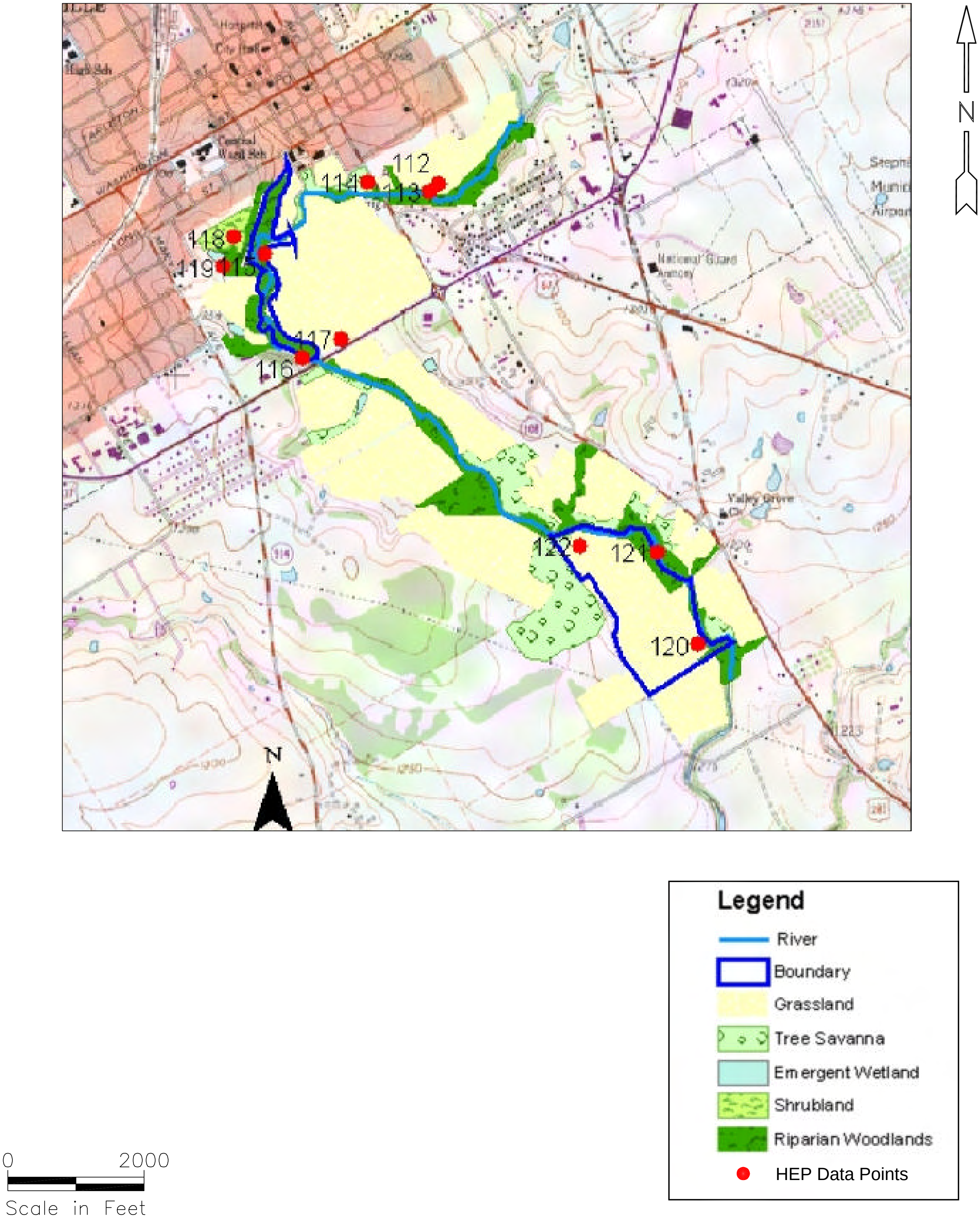
USFWS, with assistance from USACE, conducted field surveys in the project area on July 31, 2002, using USFWS HEP guidance documents (USFWS, 1980) to describe the various existing habitats in the project area (USFWS, 2003). The HEP requires the use of Habitat Suitability Index (HSI) models developed for indicator species that best represent groups of species that use the habitats. Each model contains a group of habitat variables that are measured in the field and used as indicators of habitat value. Utilizing Geographic Information System (GIS) and Global Positioning System (GPS) technology and aerial photos, habitat cover-types were identified in and around the project area. Urban development and bare soil are not considered habitat types; therefore, they are not included in this report. Cover-types found within the project were delineated into riparian woodlands/hardwood forest and grasslands.

The Riparian Woodlands/Hardwood Forest Cover Type consists of mature hard-mast producing trees along the river and its tributaries, or areas that are periodically flooded. This habitat provides food, cover, nesting habitat, and living space to forest dependant species. Large trees are important as nesting habitat for the fox squirrel and red-tailed hawk, and important escape cover for raccoons, wood ducks, and passerine birds. Brush piles and snags provide necessary food, cover, and shelter for the raccoon and passerine birds. Riparian forest habitats provide important wildlife travel corridors and are essential in maintaining biodiversity. This cover type is predominately composed of mature pecan, oaks, and elms within the riparian corridors along the river.

The Grasslands Cover Type is generally located in the flood plain along the river, adjacent to the riparian woodland corridor. The grasslands are comprised of native and introduced grasses and forbs, and scattered trees. Grasslands in the park are routinely groomed and mowed. Grasslands provide open space, a seed source for passerine birds, forage for the eastern cottontail and cover for escape and nesting in brush piles and shrubs. Red-tailed hawks hunt for prey in open grasslands.

Wetlands, shrublands, and tree savannas were three additional cover types analyzed near, but not within, the project area.

Eight wildlife indicator species were selected that best represent the wildlife communities that use the two habitats surveyed. Raccoon, fox squirrel, Carolina chickadee, barred owl, wood duck, and red-tailed hawk were selected to represent those species that use riparian/bottomland hardwoods. Eastern meadowlark, eastern cottontail, and red-tailed hawk were selected to represent the wildlife community in the grasslands. The raccoon, green heron, and wood duck were selected to represent the wildlife community in emergent wetlands. Emergent wetlands were not found in the project area, but they are proposed for construction as described in Section 3.0. This habitat type and indicator species are presented here as a baseline of no habitat.



SITE MANAGER: D. LINDSAY		TETRA TECH NUS, INC. Houston, Texas	FIGURE 2-1 EXISTING HABITAT STUDY MAP
CHECKED BY: L. BOWIE			FORT WORTH DISTRICT CORPS OF ENGINEERS
DRAWN BY: J. FLESCH			SECTION 206 – HABITAT RESTORATION PROJECT
DATE: 09-28-04	SCALE: 1"=2000'		NORTH BOSQUE RIVER
DWG. NO.: STEPH_EH	PROJ. NO.: N7551.347D		STEPHENVILLE, TEXAS

In addition, raccoon and wood duck are used as indicators for more than one cover type. The data were analyzed using the HSI models for the indicator species. Baseline habitat conditions are expressed as a numeric function (HSI value) ranging from 0.0 to 1.0, where 0.0 represents no suitable habitat for an indicator species and 1.0 represents optimum conditions for the species. Habitat units (HU) are calculated by multiplying the HSI by the amount of acres of the habitat type required by each species.

The project area is approximately 81 acres and is divided into two locations along the north Bosque River: (1) the Stephenville City Park area and (2) former sludge drying beds located adjacent to the Stephenville WWTP property. The HEP study area encompassed a much larger area than just the project boundary in order to evaluate existing habitats in the immediate surrounding area. There are only two wildlife habitat types located within the project boundary, 24 acres of riparian woodland and 54 acres of old field grasslands. There are approximately 3 acres of bare ground or urban development. Five data sites are located within the project boundaries. Sites 115, 116, and 121 are located in riparian woodlands and Sites 120 and 122 and located in old field/grassland.

Habitats surrounding the project area were included in the assessment to obtain an understanding of all habitats available to wildlife that could be using the project area. Approximately 567 acres of habitat within and adjacent to the project area are included in the overall assessment. This overall assessment includes 3.26 acres of emergent wetland; 108 acres of riparian woodland, 391 acres of old pasture grassland, 2.5 of shrubland, and 62.5 acres of tree savanna. There are 6 data sites outside the project boundary; two in old pasture/grasslands and one each in riparian woodland, tree savanna, emergent wetland, and shrubland. Results from these analyses can be found in Appendix B.

Results

Table 2-4 displays the HSIs for riparian woodlands and grasslands within the project area per indicator species and as an overall average per habitat type. The overall average HSI value for the riparian woodlands is 0.65 with 15.7 HUs available. This habitat is roughly average valued habitat for the indicator species. The WWTP drying bed cells were assessed as old field/grassland. They are the only grasslands within the project boundary. The overall HSI for these drying beds is 0.28 with only 15.3 HUs available. They are considered fair to poor habitat for grassland species.

The riparian woodland is considered very good habitat for the Carolina chickadee (HSI 0.89) and the barred owl (HSI 0.93), and good habitat (HSI 0.68) for the wood duck. The raccoon and fox squirrel HSI values were both 0.54, average habitat. There were not enough refuge sites (ground burrows, brush piles, windthrow, etc.) for good raccoon habitat. The ground cover was too closed and the understory shrub cover too thick for good fox squirrel habitat next to the river. The lowest HSI (0.33) of all the riparian woodland species was for the red-tailed hawk, which depicts only fair valued habitat. Red-tailed hawks are considered a multi-habitat species using many habitat types with a wide ecological tolerance and geographical distribution. They are found most frequently in or on the edge of open woodlands where there are perching trees and easy viewing and access to prey. Both habitats within the project area are considered red-tailed hawk habitat, with the same HSI value for the species in both habitats, 0.33. This value is related strongly to the habitat values of the red-tailed hawk's prey species.

The WWTP cells have no refuge sites for small mammals and are considered poor habitat (HSI 0.005) for cottontails, therefore, it reduces the red-tailed hawk HSI values in both habitats. Sections of this habitat are dominated by forbs, which are not optimum conditions for the meadowlark that prefers a grass-dominated field. The HSI value for the meadowlark of 0.50 is fair habitat.

HSIs and HUs are provided in Table 2-4 for emergent wetlands as a baseline (no habitat present) for three species that would be used as indicators for estimating habitat gained by the proposed conversion of the WWTP cells from pasture / grassland habitat to emergent wetland.

Table 2-4
Habitat Suitability Index Values for the Habitats Found Within the North Bosque River Aquatic Ecosystem Restoration Project Area Stephenville, Texas

Species	Riparian Woodland HSI (24.18 ac)	HUs	Old Pasture / Grassland HSI (54.53 ac)	HUs	Emergent Wetland HSI (0 ac)	HUs
Carolina chickadee	0.89	21.5				
Barred owl	0.93	22.5				
Raccoon	0.54	13.0			0.0	0.0
Wood duck	0.68	16.4			0.0	0.0
Red-tailed hawk	0.33	6.9	0.33	18.0		
Fox squirrel	0.54	13.0				
Green heron					0.0	0.0
Eastern cottontail			0.005	0.27		
Eastern meadowlark			0.50	28.3		
Average HSI and HUs	0.65	15.7	0.28	15.3	0.0	0.0

Source: USFWS, 2003.

2.10.2 Index of Biotic Integrity

Methods

The statewide IBI, used by TPWD, was selected by USFWS to quantitatively describe the condition of the aquatic resources in the project area within the North Bosque River. The IBI is designed to evaluate the quality or condition of an aquatic resource based on the attributes of the existing fish assemblage. The statewide IBI consists of 12 attributes in three categories: species composition, trophic composition, and health and abundance of fish. The sampled fish assemblage is assigned one, three, or five points for each attribute by comparison to expectations for a pristine stream of similar size and region. Total scores define the stream health in four classes ranging from exceptional (pristine) to limited (degraded). Available in-stream aquatic habitat is comprised of a variety of different physical, chemical, and biological parameters. The existing water quality, available habitat, and stream characteristics generally determine the ecological integrity and attributes associated with biotic communities of the system. Aquatic habitat index values from 0.0 to 1.0 were calculated by dividing the total score from the sampling location by the total points possible from the statewide IBI.

Results

A total of 788 individuals comprising five families and 13 species were identified from the IBI field surveys. The most common families were the minnow (*Cyprinidae*) and sunfish (*Centrarchidae*) families with four species sampled in each. The most common species collected during sampling efforts was the tolerant red shiner. An IBI evaluation score of 42 out of 60 and an aquatic index value of 0.70 indicated that the aquatic life use class of the North Bosque River was intermediate with 4.07 habitat units. The relatively low score was due primarily to the fact that no darter, intolerant, or sucker species were sampled and that 62 percent of the sampled individuals consisted of tolerant species.

2.10.3 Pollutant Removal Estimates for Wetlands

Methods

The PREWet program (USACE, 2000) was utilized to assess the efficiency of proposed wetland designs for removing specific pollutants from surface water runoff and wastewater treatment plant effluent. The PREWet program is designed to take a limited amount of basic information about a wetland (e.g., average depth, length, width, area, volume, flow rate, and temperature) and use simplified quantitative methods to determine wetland detention time and removal rates for a variety of water quality characteristics (e.g., total suspended solids, total phosphorous, total nitrogen, and total coliform bacteria). The inflow concentrations of nitrogen, phosphorous, coliform bacteria, and suspended solids are required to determine the removal rate and efficiency of the wetland.

To assess the water quality of surface runoff and wastewater effluent that would be discharged into the North Bosque River following treatment by one of the proposed emergent wetland scales, the percent removal efficiencies of total suspended solids, total coliform bacteria, total nitrogen, and total phosphorous were calculated. The average removal efficiency for all four water parameters was determined and divided by 100 to calculate the water quality index (WQI) value. To determine future with and without project water quality units, the baseline water quality index values for each restoration measure and scale were calculated through the life of the project based on projected responses of the wetland. The cumulative and average annual water quality units were then calculated for each restoration scale by multiplying the projected WQI value by the number of existing or proposed acres of habitat. The average annual water quality unit gain for each restoration scale was then determined for with versus without project conditions.

Results

The pollutant removal efficiencies and associated WQI values were determined for the three proposed wetland scales at the Stephenville WWTP site (Scale 1 = 16.9 acre wetland and use of all three sludge drying lagoons, Scale 2 = 8.5 acre wetland and use of the eastern two sludge drying lagoons, and Scale 3 = 11.3 acre wetland and use of the southern half of the sludge drying lagoons). Table 2-5 summarizes the pollutant removal efficiencies for each wetland scale.

Table 2-5
Pollutant Removal Efficiency, Average Removal Efficiency, and WQI Value by Water Quality Parameter for Proposed Wetland Scales

Water Quality Parameter	Scale 1 (%)	Scale 2 (%)	Scale 3 (%)
Total Suspended Solids	94.5	82.7	74.7
Total Coliform Bacteria	100	100	100
Total Nitrogen	99.4	95.7	91.4
Total Phosphorous	76.5	58.5	49.7
Average Removal Efficiency:	**92.6**	**84.2**	**79.0**
Water Quality Index Value:	**0.93**	**0.84**	**0.79**

Based on the pollutant removal efficiencies, wetland scale 1 would remove 92.6% of the pollutants with a water quality index value of 0.93; wetland scale 2 would remove 84.2% of the pollutants with a water quality index value of 0.84; and scale 3 would remove 79.0% of the pollutants with a water quality index value of 0.79. With implementation of the emergent wetland complex, the pollutant removal efficiencies and WQI values would increase as the wetland matures and becomes established. Thus, becoming more efficient at removing various pollutants and improving water quality in the North Bosque River downstream of the wetland complex.

2.11 Cultural Resources

An archeological investigation was conducted by Ecological Communications Corporation (EComm) to determine if significant cultural resources were present within the study area, primarily in areas that would be excavated. No evidence of historic or prehistoric occupation was found within the City Park or WWTP project areas. Site 41ER4, located 40 meters east of the City Park project area is the only prehistoric archeological site within 4.4 miles of the project area. Site 41ER4 is described as a prehistoric campsite located in an area that has been agriculturally plowed and currently contains numerous baseball fields (EComm, 2004). It appears that the natural alluvial formation processes along the eastern bank of the Bosque River has prevented cultural resources from accumulating within the City Park project area, whereas, modern cultural processes (construction of the WWTP) have highly disturbed the subsurface stratigraphy within the WWTP project area, thus eliminating the possibility of encountering any intact cultural deposits. The Cultural Resources Report is provided in Appendix C.

2.12 Hazardous Materials

A review of standard environmental record sources in accordance with American Society of Testing Materials (ASTM) Practice E 1527 was conducted by the Environmental Design Branch, Fort Worth District USACE as part of a HTRW Investigation for the project. The area of review was an approximate three-quarter mile reach of the North Bosque River flowing through Stephenville, Texas.

The following recognized environmental conditions were identified within the area of review:

- One Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) site. CERCLIS sites are potentially hazardous sites that are either proposed to or on the National Priorities List (NPL) and sites, which are in the screening and assessment phase for possible inclusion on the NPL.

- One Comprehensive Environmental Response, Compensation and Liability Information System – No Further Remedial Action Planned (CERCLIS-NFRAP) site. After an initial investigation, these sites have been removed from CERCLIS.

- One Resource Conservation and Recovery Information System – Large Quantity Generator (RCRIS-LQG) site.

- Ten Resource Conservation and Recovery Information System – Small Quantity Generator (RCRIS-SQG) sites.

- One Closed Landfill Inventory (CLI) site. Closed and abandoned landfills (permitted as well as unauthorized) across the state of Texas.

- Eight Leaking Underground Storage Tank (LUST) sites.

- Thirty-one Underground Storage Tank (UST) sites.

- One Hazardous Materials Information Tracking System (HMRIS) site. Contains information on hazardous material spills reported to the Department of Transportation (DOT).

- One Federal Insecticide, Fungicide, & Rodenticide Act (FIFRA) / Toxic Substances Control Act (TSCA) Tracking System (FTTS) site. The FTTS tracks administrative cases and pesticide enforcement actions related to FIFRA, TSCA and the Emergency Planning and Community Right-to-Know Act (EPCRA) over the last five years.

- Two Aboveground Storage Tank (AST) sites.

- Eleven Texas Industrial and Hazardous Waste (TX IHW) sites. The TX IHW database contains summary reports by waste handlers, generators and shippers in Texas.

- Fourteen Facility Index System (FINDS) sites. FINDS contains both facility information and "pointers" to other databases. These databases include: RCRIS, Permit Compliance System (PCS), and Aerometric Information Retrieval System, FIFRA and TSCA Enforcement System (FATES), FTTS, CERCLIS, Consolidated Docket of Civil Enforcement Actions (DOCKET), Federal Underground Injection Control Reporting System (FURS), Federal Reporting Data System (FRDS), Surface Impoundments Database (SIA), TSCA Chemicals in Commerce Information System (CICIS), Polychlorinated Biphenyls Activity Database System (PADS), Resource Conservation and Recovery Act (RCRA), medial waste transporter/disposers (RCRA-J), Toxic Chemical Release Inventory System (TRIS) and TSCA.

None of these sites are within the project study areas (EDR, 2003a; EDR, 2003b). Details on these database sites are presented in the government database search report in Appendix D.

2.13 Socioeconomics and Environmental Justice

The population of Stephenville was 14,921 in 2000 increasing from 13,502 in 1990. Erath County had a 2000 population of 30,843. Approximately 85 percent of the population is white (non-Hispanic), 11.6 percent is Hispanic, and the remainder is black or American Indian. Average median age of a resident of Stephenville is 28 years. While unemployment is approximately 2.8 percent, the average household income is less than $30,000 per year, equating to 24 percent of the households in Stephenville. Approximately 3,500 children are enrolled in Stephenville public schools. Agriculture is the leading industry in Stephenville, contributing approximately $200 million to the economy with the dairy industry accounting for approximately $140 million. The manufacturing industry has increased steadily in importance over the past few years. Six major manufacturing firms now employ more than 1,400 people. Stephenville is the retail trade and medical center for the area population within a 30-mile radius, serving approximately 80,000. Gross sales have increased steadily over the past ten years. Tarleton State University also has a strong influence on the economy of the area. The University has a student enrollment of approximately 6,400 and employs a full time facility and staff of 715 (Stephenville, 2004a; Stephenville, 2004b).

2.14 Recreation

The northern portion of the project area is within the Stephenville City Park. This park provides varied recreational activities to residents of the City including walking, running, biking, team sports, picnicking, fishing, and swimming. Facilities include a recreation hall, pavilions, swimming pool, athletic fields, batting cages, tennis courts, horseshoe courts, recreational vehicle hook-ups, playgrounds, picnic areas, paved trails, and a gazebo (Stephenville, Texas Chamber of Commerce 2003). An asphalt walkway parallels the river. The WWTP currently provides few recreational opportunities.

2.15 Visual Resources

The project area includes the Stephenville City Park, which contains athletic fields, tennis courts, picnic areas, roads, and trails as the dominant man-made features of the landscape within the park. The park is bordered on the northeast and southeast by Texas Highways 108 and 67, respectively. The river corridor is human-altered in the northern portion of the park where it flows into a man-made pond and groomed lawns are located adjacent to stream banks with little native vegetation. A cement erosion control bank exists downstream of the man-made pond. Downstream of this area, the river appears more natural with few man-made features within the stream channel or banks. At the downstream end of the project area a sewer line crosses the North Bosque just north of the Highway 67 Bridge. The river corridor contains a narrow riparian area visually characterized by trees, shrubs, vines and grassy understory adjacent to steep banks and slow moving water. Lawns with widely spaced trees, picnic tables, and a paved trail are adjacent to the riparian area.

The WWTP site contains a large former sludge drying bed complex, which now resembles a meadow with vegetated dikes and a few water control structures. The riparian corridor of the North Bosque River dominates the landscape to the north and east of the complex, and the WWTP infrastructure is the obvious feature to the southwest.

2.16 Noise

Noise-sensitive receptors are those locations where activities that could be affected by increased noise levels and include locations such as residences, motels, churches, schools, parks, and libraries. Existing noise levels are determined for the outdoor living area at sensitive receptors. The City Park, which makes up much of the project area, is a sensitive receptor. The dominant noise source in the project area is automobile traffic on Highways 67 and 108, and on roads within the park. At the WWTP no sensitive receptors exist within the project area. However, residences exist to the southeast, within approximately 0.5 mile of the project area. Sources of noise in the area include machinery at the WWTP and automobile traffic on Highways 108 and 281 and on smaller roads adjacent to the WWTP.

3.0 PLAN FORMULATION

3.1 Ecosystem Problems

Existing conditions in the study area and region were described in Section 2.0 and set the baseline condition for each resource to identify ecosystem problems and opportunities for restoration. This baseline condition also represents a point of comparison for prediction of environmental consequences for NEPA compliance as described in Section 8.0.

The North Bosque River flows through the southeast region of the Cross Timbers and Blackland Prairies vegetational areas of north central Texas. The North Bosque River watershed drains approximately 1,236 square miles, which includes six counties. The region historically supported a mixture of highly productive and diverse bottomland forests, floodplain wetlands, and tall grass prairies. Combined with the region's unique geologic and climatic variation, north central Texas accounts for 2,223 flora species, roughly 46 percent of the species known to occur in Texas (Diggs et. al., 1999).

The bottomland hardwood ecosystem in Texas prior to European settlement once extended over 16 million acres. Less than 40 percent of this ecosystem remains. Intact bottomland forests can be some of the most productive ecosystems and are among the list of endangered and threatened ecosystems in the United States (Noss, 1997). One hundred and eighty-nine species of trees and shrubs, 42 species of woody vines, 75 species of grasses, and 802 species of herbaceous plants occur in Texas' bottomland forests. At least 74 threatened and endangered species depend directly on bottomland hardwood ecosystems and over 50 percent of neotropical songbirds not listed as endangered or threatened are associated with these systems. Besides providing critical habitat, bottomland hardwood ecosystems serve as catchment and water retention areas in times of flooding, help control erosion, contribute to the nutrient cycle, and help maintain water quality by collecting sediments, wastes, and pollutants from surface runoff (USACE, 1999).

Human activities have had, and are continuing to have, a significant impact on the plants and animals of the region. The terrestrial habitat in the North Bosque River watershed has undergone extensive agricultural development in and around the riparian corridor. The proliferation of confined animal feeding operations (CAFO), and other forms of agricultural development within the watershed represent some of the major land use changes, which have impacted the riparian corridor. The suppression of fire has facilitated the expansion and invasion of mesquite, juniper, and hackberry species from the floodplains, which has reduced the productivity and diversity of existing bottomland plant communities and tallgrass prairies. Forest cover throughout the North Bosque River watershed has been reduced by approximately 59% since 1980 (USACE, 1999). Trends indicate that forest cover throughout the watershed will continue to decrease in the future.

As described in Section 2.4.1, the North Bosque River has been listed by the State as an "Impaired and Threatened Water Body" and placed on the 1998 Clean Water Act Section 303(d) List by the EPA. Fifty fish species were historically present in the North Bosque River system. Aquatic resources have deteriorated to the point where only six species are now present in the uppermost reaches of this watershed, while 23 species can be found throughout the remainder of the watershed. Thirteen species have been recorded in the project area (See Section 2.7). The fish species present are dominated by those types, which are considered to be pollution tolerant. If the environmental conditions of the basin continue to degrade, this domination by the more pollution tolerant species would become even more prevalent.

The proposed Stephenville City Park and WWTP study areas have experienced similar environmental degradations as those identified regionally within the North Bosque River watershed. Riparian corridor and grassland vegetation within the Stephenville City Park study area is sparse due to routine mowing, heavy public foot traffic, and stream bank erosion. In-stream aquatic habitat within the park is disturbed and fragmented due primarily to stream bank erosion and subsequent sedimentation. Restoration of the park area would help provide aquatic habitat for resident and migratory wildlife species, control erosion and subsequent sedimentation, and help maintain water quality within the North Bosque River by collecting sediments, wastes, and pollutants from surface runoff. Restoration of the Stephenville WWTP study area would provide unique wetland habitat that is sparse within the region and increase water quality conditions by filtering effluent prior to entering the North Bosque River. Implementation of restoration measures that improve water quality and help remove the North Bosque River from the Section 303(d) List are considered a priority for a variety of stakeholders and downstream water resource customers within the watershed.

3.2 Restoration Opportunities

Ample opportunities exist for environmental restoration projects throughout the North Bosque River watershed. Restoration projects for the river could include:

- Development of conservation easements and reforestation of the riparian corridor.
- Management and control of invasive woody species.
- Erosion and sedimentation control through bank stabilization, riparian buffers, and filter strips.
- In-stream habitat creation and enhancement.
- Reduction of point and non-point nutrient loadings via creation of on-channel wetlands, off-channel wetlands, and hydraulic meadows.
- Manure composting and removal.
- Implementation of farm BMPs, such as preventing direct discharge of animal process waste from lagoons and incorporation of animal confinement and maintenance areas into rivers and streams.

The project area consists of two components along the North Bosque River: (1) the Stephenville City Park study area and (2) the Stephenville WWTP study area. Each study area was assessed independently based on existing opportunities and constraints associated with baseline and proposed habitat types.

The Stephenville City Park study area contains three different habitat types: groomed grasslands, riparian woodlands, and in-stream aquatic. The riparian corridor in the park is wooded on both sides of the river and varies in width from non-existent to approximately 150 feet. The majority of the understory vegetation within the riparian corridor and grasslands is sparse due to routine mowing, heavy public foot traffic, and stream bank erosion. In-stream aquatic habitat within the park is disturbed and fragmented due primarily to stream bank erosion and subsequent sedimentation. Riparian corridor and in-stream aquatic habitat values would be improved considerably through development of in-stream restoration measures, rehabilitation of the riparian corridor, and incorporation of bank stabilization measures.

The Stephenville WWTP study area contains three different habitat types: old field/grasslands, riparian woodlands, and in-stream aquatic. Due to the relatively high quality of the existing riparian corridor and in-stream habitat within the WWTP study area, only supplemental plantings would be needed to improve habitat values for the riparian corridor. The WWTP sludge drying lagoons have been abandoned since 1994 and currently function as low quality old field/grassland habitat. The WWTP effluent is currently routed directly from the treatment plant to the North Bosque River, which allows nutrients from the effluent to go directly into the river. The conversion of the sludge drying lagoons into an emergent wetland complex would create valuable off-channel wetland habitat along the North Bosque River for a wide array of aquatic plants, birds, insects, and mammals; provide a catchment and water retention area in times of flooding; help maintain North Bosque River water quality by collecting sediments, wastes, and pollutants from surface runoff and WWTP effluent discharge; and provide educational/recreational opportunities for the general public.

The City Park study area's eastern border has been developed into Century Park and the western border is comprised of a number of privately owned properties. The City of Stephenville has a key interest in the project area as they have proposed a large-scale public recreation complex within the City Park. During preliminary meetings, landowners contested the incorporation of their respective properties into the restoration plan or study area. Therefore, this privately held land is outside the boundaries of this study, and restoration alternatives are limited to city-owned property.

Multiple field studies and inspections were conducted by the USFWS, USACE and Tetra Tech NUS (TtNUS) to identify site conditions, define resources in the vicinity of the study area, identify relevant ecological restoration opportunities and review any existing constraints which may limit the practicality and future success of implementation. The field studies document that existing conditions of both aquatic and terrestrial habitats are degraded due to population growth, urban development, and land use practices along the river.

Baseline habitat conditions of the study area were quantified using HEP, as described in Section 2.10 and detailed in Appendix B.

After the HEP analysis was performed, suggestions were compiled from each agency involved in the field visits. Restoration scenarios were established to restore ecological function of the study area. Key opportunities for several major features along the study reach were identified. These opportunities included:

- A narrow riparian area in the City Park with room to expand into surrounding lawn with scattered large trees.
- Eroding banks reducing habitat values and creating safety and maintenance concerns that can be repaired without major constraints.

- A stream channel with very little structure that can be improved without major constraints.
- The WWTP former sludge drying area provides an existing water supply adjacent to an existing unused large basin with berms to create a large wetland complex.

3.3 Restoration Objectives

General goals and objectives of the study were enumerated in Section 1.3, specific objectives for the proposed restoration include:

- Increase species diversity, cover, and the food base of existing riparian corridor by planting native tree, shrub, and herbaceous species.
- Reduce erosion of riverbanks with a variety of bioengineering stabilization techniques.
- Create an emergent wetland complex to create wetland wildlife habitat and improve water quality.
- Improve in-stream habitat conditions and reduce erosion with placement of native rock veins, weirs and riffle beds.

3.4 Constraints

The project footprint is limited to City of Stephenville property, which prevents optimum restoration impact by defining boundaries by land ownership rather than habitat types or need for restoration. Therefore, only restoration measures and features that could be utilized on city-owned property were considered for evaluation and optimization.

Reforestation and terrestrial habitat design were restricted to certain locations within the study areas based on existing habitat and future recreational needs of the park. In-stream habitat and bank stabilization design would need to consider the existing hydrology and hydraulic parameters of the North Bosque River, impacts on the 100-year floodplain, impacts on existing aquatic habitats, and potential adverse impacts on river stability. Only environmentally friendly biological engineering techniques were considered to control bank erosion, reduce sedimentation, and provide in-stream habitat along and within the North Bosque River.

Wetland design would need to consider the availability of existing WWTP effluent, permeability of soils, impacts on the existing 100-year floodplain, and impacts on existing habitats. Existing utility transmission lines within the study areas are situated such that they would not be impacted by proposed restoration measures.

3.5 Most Probable Future Without the Proposed Project

If no action is taken current habitat degradations would likely continue and gradually worsen. The lack of a well-developed riparian corridor and continuation of existing management practices in the Stephenville City Park study area would likely result in continued loss of existing stream bank vegetation over time. Degradation of existing riparian corridor vegetation over the 50-year project life, would result in the loss of approximately 2.5 average annual habitat units (AAHUs) (Table 6-2). The loss of stream bank vegetation coupled with existing stream bank erosion problems would result in increased erosion within the floodplain and continued sedimentation of in-stream habitat. In-stream aquatic habitat would be reduced from 5.82 AAHUs at base year conditions to 3.20 AAHUs at year 50 (Table 6-3). Due to the fragmented nature of the existing riparian corridor and continued degradation of in-stream habitat, the study area would never achieve the high quality that could be achieved with proposed restoration efforts.

If no action is taken at the WWTP study area, the habitat quality and quantity of the existing riparian corridor would remain similar. However, the in-stream habitat would continue to degrade due to inputs of nutrients from surface runoff and the wastewater treatment plant. The full potential of the abandoned sludge ponds as an emergent wetland would not be achieved and the existing area would likely transition into low-quality shrubland habitat over time, resulting in a loss of approximately 4.0 AAHUs (Table 6-1).

4.0 PRELIMINARY ALTERNATIVES

4.1 Alternative 1 - No Action

Under the No Action Alternative, no restoration measures would be implemented. Predictions of habitat quality degradations if no action were taken were described in Section 3.5. Detailed analysis of environmental consequences from implementing the No Action Alternative, in compliance with NEPA, is described in Section 8.0 for each resource as compared to its existing condition as described in Section 2.0.

4.2 Alternative 2 - Stephenville City Park Study Area

Based on existing environmental degradation, project constraints and opportunities, and input from stakeholders, a variety of restoration alternatives, measures and scales were proposed for evaluation. The primary restoration measures that were proposed for implementation include riparian corridor reforestation, stream bank stabilization, and in-stream habitat enhancement. Table 4-1 (located at the end of this section) shows the range of alternatives, measures, and scales that were evaluated for the Stephenville City Park Study Area. Plant species would be the same for all scales and are described in Section 6.0.

4.2.1 Riparian Corridor Reforestation

Based on the lack of a well-developed riparian corridor the following restoration planting measures and scales were developed for potential implementation:

- **Emergent aquatic vegetation** would consist of emergent aquatic plants that would be planted along the edges of existing and proposed pooled areas of the North Bosque River. Plantings would consist of 2-inch plugs, which were evaluated at three different planting densities (2-, 3-, or 4-foot centers) (Table 4-1).

- **Bank vegetation** would consist of trees and shrubs that can remain permanently saturated in water and would be planted within five feet of the stream bank. Plantings would consist of live stakes or seedlings and were evaluated at three different planting densities (3-, 4-, or 5-foot centers) (Table 4-1).

- **Bottomland hardwood vegetation** would consist of hard and soft mast-producing trees and shrubs that would be planted from the outer edge of the bank vegetation to approximately 150 feet in width. Plantings would consist of three- to five-gallon containerized trees/shrubs and were evaluated at five different planting densities (15-, 20-, 25-, 30-, and 35-foot centers) (Table 4-1). This area currently contains a significant number of mature trees, so that planting would be used to supplement existing trees to increase density and diversity of vegetation. Large existing trees would generally be retained regardless of species.

- **Grassland vegetation** would consist of approximately ten randomly scattered open patches within the boundaries of the bottomland hardwood area. These would be approximately 0.1 acres in size and would be planted with native grasses and other herbaceous species.

4.2.2 Bank Stabilization and In-stream Habitat Creation

To address existing stream bank erosion and subsequent degradation of in-stream habitat due to sedimentation, a variety of bioengineering techniques were evaluated for potential implementation:

- **Bank terracing, geosynthetic liners, gabion/gabion mattress, and/or fiber roll** would be used to stabilize the existing riverbank, reduce erosion, and decrease sedimentation of existing in-stream aquatic habitat.

- **Live fascine, vegetated reinforced soil slopes, brush mattress, and/or bank seeding** would be used to stabilize the existing riverbank, reduce erosion, provide vegetated terrestrial habitat, and create overhead cover.

- **Cross veins and/or rock weirs** would help reduce riverbank erosion, increase grade control, establish a stable width/depth ratio, promote upstream aggravation, shift boundary stress from near-bank regions, and create downstream scour pools.

- **Native rock riffles beds** would help reduce erosion by guiding the thalweg away from the stream banks, dissipate excess energy during high velocity flooding events due to increased streambed roughness, and elevate in-stream oxygen concentrations.

- **Root wads** would be used as a bank stabilization and toe protection measure that also creates fish rearing habitat by creating scour pools and overhead cover.

4.3 Alternative 3 - Stephenville Wastewater Treatment Plant Study Area

Based on existing environmental degradation, project constraints, and input from stakeholders, a variety of restoration alternatives, measures, and scales were proposed for evaluation. The primary restoration alternatives that were proposed for implementation included: riparian corridor reforestation and emergent wetland creation. Table 4-1 shows the range of alternatives, measures, and scales that were evaluated for the Stephenville Wastewater Treatment Plant study area. Plant species would be the same for all scales, with the exception of emergent species where planting plugs and seeding may have somewhat different species compositions based on availability of source materials. The recommended plant species are described in Section 6.0.

4.3.1 Riparian Corridor Reforestation

The following restoration planting areas and zones were developed to supplement the existing riparian corridor, provide habitat transition zones from the proposed emergent wetland complex, and increase diversity of habitat types within the study area:

- **A tree screen zone** would consist of approximately 0.60 acres of hard and soft mast producing trees and shrubs that would be planted between the proposed emergent wetland complex and the wastewater treatment plant. Plantings would consist of three- to five-gallon containerized trees/shrubs and were evaluated at two different planting densities (20- and 25-foot centers) (Table 4-1).

- **The northwest planting zone** would consist of approximately 8.6 acres of native grasses, forbs, and widely dispersed hard and soft mast-producing tree/shrub motts to create a savanna type habitat. Tree and shrub plantings would consist of three- to five-gallon containerized plants and were evaluated at seven different planting densities (5, 15, 25, 50, 100, 200, and 300 trees/shrubs per acre) (Table 4-1).

- **The wetland levee to river zone** would consist of approximately 2.3 acres of native grasses, forbs, and widely dispersed hard and soft mast-producing tree/shrub motts to create transitional habitat from the eastern perimeter of the wetland complex to the existing riparian corridor. Plantings would consist of three- to five-gallon containerized plants and were evaluated at seven different planting densities (5, 15, 25, 50, 100, 200, and 300 trees/shrubs per acre) (Table 4-1).

4.3.2 Emergent Wetland Creation

The following emergent wetland design scales were evaluated for potential implementation to utilize existing wastewater treatment plant effluent, convert low quality old field/grassland habitat into valuable wetland habitat, and further clean the treated effluent from the WWTP:

- **The emergent wetland complex** would utilize the existing wastewater treatment plant sludge drying lagoons by converting them into an emergent wetland complex. Wastewater treatment plant effluent would be used to provide a permanent supply of water to the wetland complex. Three different wetland configurations were evaluated (a 16.9 acre wetland and use of all three sludge drying lagoons, a 8.5 acre wetland and use of the eastern two sludge drying lagoons, and a 11.3 acre wetland and use of the southern half of the sludge drying lagoons) (Table 4-1). The addition of blue bird and wood duck nesting boxes would be included as a restoration measure and would be assumed with each wetland build scale.

- **Emergent aquatic vegetation** would consist of emergent aquatic plants that would be planted within the wetted areas of the emergent wetland complex. The planting acreage is dependent upon each wetland complex scale (16.9, 8.5 or 11.3 acres). Plantings would consist of either 2-inch plugs or seeds and were evaluated at two different planting densities (3- or 4-foot centers and broadcast seeding) (Table 4-1).

- **Wetland bank and island vegetation** would consist of native grasses, other herbaceous species, and hard and soft mast-producing tree/shrub motts along the wetland levees and islands. The number of levees and islands is dependent upon each wetland complex scale (9, 7.5, or 5 acres). Tree and shrub plantings would consist of three- to five-gallon containerized plants and were evaluated at three different planting densities (5, 15, 25 trees/shrubs per acre plus seeding) (Table 4-1).

- **The area surrounding the wetland complex** would consist of native grasses, other herbaceous species, and hard and soft mast-producing tree/shrub motts around the perimeter of the wetland complex. The planting acreage is dependant upon each wetland complex scale (19.2, 27.6, or 24.8 acres). Tree and shrub plantings would consist of three- to five-gallon containerized plants and were evaluated at three different planting densities (5, 15, 25 trees/shrubs per acre plus seeding) (Table 4-1).

Table 4-1
Range of Alternatives Proposed for Restoration
Stephenville, Texas

Study Area	Alternative	Measure	Scale
Stephenville City Park	Riparian Corridor Reforestation	Emergent Aquatic Vegetation	2-inch plugs at 0-, 2-, 3-, or 4-foot centers
		Bank Vegetation	Live stakes or seedlings at 0-, 3-, 4-, or 5-foot centers
		Bottomland Hardwood Vegetation	3-5 gallon containers at 0-, 15-, 20-, 25-, 30-, or 35-foot centers
		Grassland Vegetation	Seeding or no seeding
	Bank Stabilization	Bank Terracing	Removed prior to Incremental Cost Analysis (ICA)
		Geosynthetic Liners	Removed prior to ICA
		Gabion/Gabion Mattress	Removed prior to ICA
		Fiber Roll	Utilize at location A, B, or C
		Live Fascine	Utilize at location A, B, or C
		Vegetated Reinforced Soil Slopes	Utilize at location A, B, or C
		Brush Mattress	Utilize at location A, B, or C
		Bank Seeding	Utilize at location A, B, or C
	In-Stream Habitat Creation	Cross Veins/Rock Weirs	0 or 2 structures
		Native Rock Riffle Beds	0, 5, 6, or 7 riffle structures
		Root Wads	0, 2 or 4 structures
Stephenville Waste Water Treatment Plant	Riparian Corridor Reforestation	Tree Screen Zone	3- to 5-gallon containers at 0-, 20-, or 25-foot centers
		Northwest Zone	3- to 5-gallon containers at 0, 5, 15, 25, 50, 100, 200, or 300 trees/shrubs per acre
		Wetland Levee to River Zone	3-5 gallon containers at 0, 5, 15, 25, 50, 100, 200, and 300 tree/shrub per acre
	Emergent Wetland Creation	Emergent Wetland Complex	0, 16.9, 8.5, or 11.3 acre wetland complex
		Aquatic Vegetation	Seeding, 3- or 4-foot centers on 0, 16.9, 8.5, or 11.3 acres
		Bank and Island Vegetation	0, 9, 7.5, or 5 acres of 3-5 gallon containers at 5, 15, or 25 trees per acre
		Perimeter Wetland Planting	0, 19.2, 27.6, or 24.8 acres of 3- to 5-gallon containers at 5, 15, or 25 trees per acre

5.0 EVALUATION OF RESTORATION ALTERNATIVES

5.1 Incremental Cost Analysis

To determine with and without project habitat units, the baseline HSI, IBI, and WQI values for each restoration measure and scale were calculated through the life of the project. The cumulative and average annual habitat units were then calculated for each restoration scale by multiplying the projected aquatic index value by the number of existing or proposed acres of habitat. The average annual habitat unit gain for each restoration scale was then determined for with versus without project conditions. Details of this analysis can be found in Appendix E. Summaries of the results are found in Section 5.2.

Cost analysis techniques (Robinson et al. 1995) were used to determine the most cost effective restoration plan in terms of incremental cost per habitat unit gained. All of the alternatives, measures, and scales identified in Section 4.0 were evaluated using annualized habitat gains versus annualized cost estimates (including those for operation and maintenance). Annualized habitat unit gains for each alternative, including the no action alternative were computed for a 50-year period. This time period was established, as the project life period based on the period of time it would take for all aspects of the restoration effort to reach a level of maturity necessary to meet the goals of the project.

Typically, the cost analysis technique evaluates a particular restoration measure (e.g. created wetland) that may have a range of different size scenarios, which are referred to as scales. A measure is often evaluated with a range of other restoration measures (e.g. reforestation) of various scales. Measures in the cost analysis procedure usually have relationships of dependency or exclusion with other measures. An example of dependency would be a restoration plan that specifies reforestation if and only if wetland creation is implemented. Therefore, when the model is processed, if a wetland scale other than the “no action” is deemed as cost effective, the model will also evaluate the various reforestation scales. If the “no action” wetland scale is deemed to be cost effective, the “no action” reforestation scale is automatically represented in the model.

It is very important to note that assigning relationships between different scales is not possible in the model. For the proposed emergent wetland complex, the acreage (i.e. scale) of the emergent, perimeter, and island vegetation measures were dependent on the specific acreage, or scale, of the wetland creation measure. Therefore, each potential wetland complex measure was assigned a complimentary or dependent reforestation measure. The model evaluates the multiple combinations of restoration measures and scales to develop plans that are cost effective and incrementally justified (i.e., best buy plans). The WWTP study area provided ample space to evaluate multiple wetland creation measures. The restoration measures represented in the Stephenville City Park study area represent the maximum size that is compatible with the landscape and project boundaries. Based on coordination with the Sponsor, stakeholder, and resource agencies and best professional judgment, the restoration alternatives, measures, and scales as identified in Appendix E were carried forward for incremental cost analysis.

5.2 Comparison of Cost Effective Restoration Plans

The incremental cost analysis procedure selected fourteen plan combinations of restoration measures and scales that would be cost effective and incrementally justified. The following is a summary of the restoration measures and scales identified in each of these plans. If a specific restoration measure is not listed, it means that the combination plan chose the "no action" scale for that measure. Appendix E contains the complete incremental cost analysis.

Plan 1. No action/future without project condition; this plan would result in continued stream bank erosion, continued fragmentation of in-stream and terrestrial habitat, and continued input of nutrients into the North Bosque River; due to the continued degradation of existing habitat, average annual habitat units (AAHU) would decrease over the life of the project from 45.36 to 27.44.

Plan 2. Implementation of the 8.5 acre emergent wetland complex at the WWTP study area; this plan would result in increased emergent wetland and in-stream habitat (11.19 AAHU), increased riparian corridor habitat (41.40 AAHU), and increased water quality (4.33 AAHU); the plan would provide an overall gain in AAHU's from 45.36 to 56.92.

Plan 3. Plan 2 with the addition of the tree screen zone (20-foot centers on 0.6 acres), northwest zone (3- to 5- gallon containers at 25 tree/shrubs per acre with seeding on 8.6 acres), and wetland levee to river zone (3- to 5- gallon containers at 25 tree/shrubs per acre with seeding on 2.3 acres) planting measures at the WWTP study area; the plan would provide an additional 4.79 AAHU's of bottomland hardwood habitat versus plan 2.

Plan 4. Plan 3 with the addition of the bank planting (0.3 acres of live stakes at 5-foot centers), bottomland hardwood planting (3- to 5- gallon containers at 36 tree/shrubs per acre on 5.6 acres), and grassland planting (seed up to ten 0.1 acre plots with native grasses and forbs) measures within the riparian corridor of the City Park study area; the plan would provide 64.38 AAHU's.

Plan 5. Plan 4 with the replacement of the bottomland hardwood planting scale (3- to 5- gallon containers at 48 tree/shrubs per acre on 5.6 acres) within the riparian corridor of the City Park study area; the plan would provide 64.59 AAHU's.

Plan 6. Plan 5 with the replacement of the bottomland hardwood planting scale (3- to 5- gallon containers at 70 tree/shrubs per acre on 5.6 acres) within the riparian corridor of the City Park study area; the plan would provide 64.84 AAHU's.

Plan 7. Plan 6 with the replacement of the 8.5 acre emergent wetland scale with the 16.9 acre wetland scale at the WWTP study area; the plan would provide 70.24 AAHU's.

Plan 8. Plan 7 with the addition of bank stabilization alternative and measures (bank seeding at locations A and C; brush mattress, fiber roll, and 20-foot center plantings at location B) and in-stream aquatic habitat alternative and measures (two rock weirs, seven riffles structures, and two rootwad complexes) within the City Park study area; the plan would provide an overall gain in AAHU's from 45.36 to 72.26.

Plan 9. Plan 8 with the replacement of the northwest zone scale (3- to 5-gallon containers at 50 tree/shrubs per acre with seeding on 8.6 acres) and wetland levee to river zone scale (3- to 5-gallon containers at 50 tree/shrubs per acre with seeding on 2.3 acres) at the WWTP study area; the plan would provide 72.47 AAHU's.

Plan 10. Plan 9 with the replacement of the bottomland hardwood planting scale (3- to 5-gallon containers at 109 tree/shrubs per acre on 5.6 acres) within the riparian corridor of the City Park study area; the plan would provide 72.57 AAHU's.

Plan 11. Plan 10 with the replacement of bank stabilization scales (bank seeding at location A; brush mattress at locations B and C; 25 foot center plantings at locations B and C; riffle toe protection) and in-stream aquatic habitat scales (two rock weirs, six riffles structures, and two rootwad complexes) within the City Park study area; the plan would provide 72.73 AAHU's.

Plan 12. Plan 11 with the replacement of the northwest zone scale (3- to 5-gallon containers at 100 tree/shrubs per acre with seeding on 8.6 acres) and wetland levee to river zone scale (3- to 5-gallon containers at 100 tree/shrubs per acre with seeding on 2.3 acres) at the WWTP study area; the plan would provide 72.83 AAHU's.

Plan 13. Plan 12 with the replacement of the bottomland hardwood planting scale (3- to 5-gallon containers at 194 tree/shrubs per acre on 5.6 acres) within the riparian corridor of the City Park study area; the plan would provide 72.87AAHU's.

Plan 14. Plan 13 with the replacement of the northwest zone scale (3- to 5-gallon containers at 300 tree/shrubs per acre with seeding on 8.6 acres) and wetland levee to river zone scale (3- to 5-gallon containers at 300 tree/shrubs per acre with seeding on 2.3 acres) at the WWTP study area; the plan would provide 72.95 AAHU's.

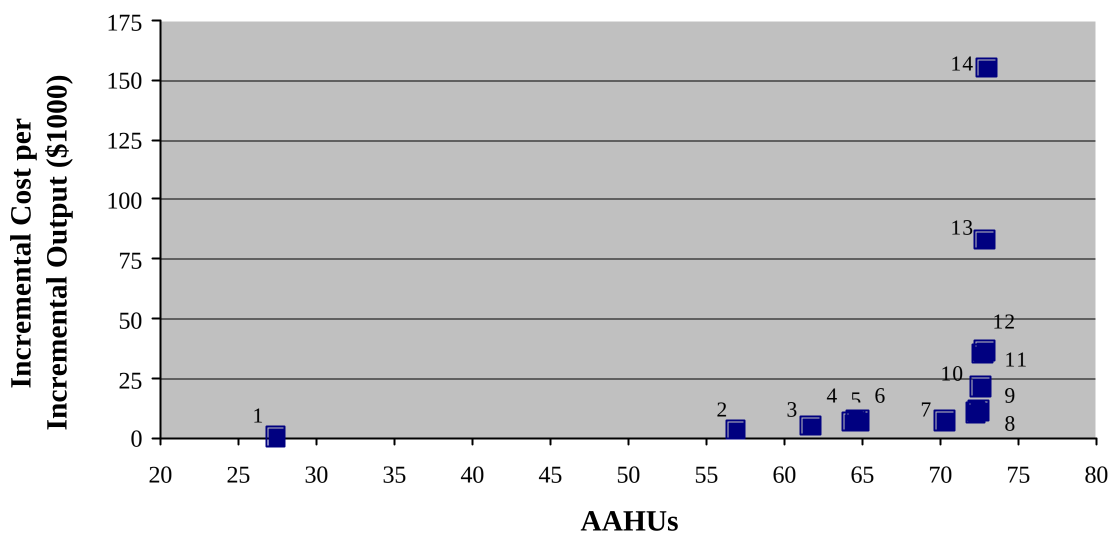
5.3 Recommended Restoration Plan Selection

Table 5-1 identifies AAHU's, incremental AAHU's, annualized costs, incremental annualized costs, average cost per AAHU, and incremental costs per output for each of the fourteen incrementally justified or best buy plans. Figure 5-3 is a graphic representation showing the AAHU's and incremental cost per output for all of the best buy plans.

Table 5-1
Incremental Cost Analysis of Best Buy Plan Combinations
Stephenville, Texas

Plan	AAHUs	Incremental AAHUs	Annualized Costs	Incremental Annualized Costs	Average Cost per AAHU	Incremental Cost per Incremental Output
1	27.44	27.44	$0	$0	$0	$0
2	56.92	29.48	$85,500	$85,503	$1,502	$2,900
3	61.71	4.79	$108,530	$23,030	$1,759	$4,808
4	64.38	2.67	$125,220	$16,687	$1,945	$6,250
5	64.59	0.21	$1126,600	$1,383	$1,960	$6,586
6	64.84	0.25	$128,250	$1,647	$1,978	$6,588
7	70.24	5.40	$164,950	$36,700	$2,348	$6,796
8	72.26	2.02	$185,550	$20,604	$2,568	$10,200
9	72.47	0.21	$187,900	$2,348	$2,593	$11,181
10	72.57	0.10	$190,000	$2,093	$2,618	$20,930
11	72.73	0.16	$195,550	$5,559	$2,689	$34,744
12	72.83	0.10	$199,180	$3,627	$2,735	$36,270
13	72.87	0.04	$202,490	$3,304	$2,779	$82,600
14	72.95	0.08	$214,860	$12,375	$2,945	$154,688

Figure 5-3 - Benefit Cost Ratios of Best Buy Plans
Stephenville, Texas



6.0 RECOMMENDED RESTORATION PLAN

The recommended restoration plan was designed to enhance existing wildlife habitat through a combination of measures and scales directed at both specific habitat types and specific deficiencies within specific vegetative communities. While there is no rule for selecting the most cost effective plan, decisions are generally based on output targets, output thresholds, cost limits, or curve anomalies. The first three criteria for decision-making are not applicable to this project because there is no maximum or minimum required output and the most expensive plan is within budget constraints. Using curve anomalies to guide the decision process focuses the question "Is it worth it?" on plans that incur abrupt or minor changes in the incremental cost curve represented in Figure 5-3.

Beginning with Plan 1, the no action plan, each successive plan requires additional cost over the previous plan. One means of identifying the most cost effective plan is to ask "Is it worth it?" of each plan in relation to the previous plan. When compared to Plan 1, Plan 2 provides an additional 29.48 AAHUs at an incremental cost per incremental output of $2,900 (see Table 5-1). These additional AAHUs would come from gains in wetland habitat provided by the creation of the 8.5-acre emergent wetland complex. This plan provides further benefits by improving water quality in the North Bosque River. Thus, we determine that, "Yes, 29.48 wetland complex AAHUs and improved water quality is worth an incremental cost/output of $2,900."

When comparing Plans 2 and 3, we can see that Plan 3 provides an additional 4.79 AAHUs above Plan 2 at an incremental cost/output of $4,808 (see Table 5-1). These additional AAHUs would come from gains in native bottomland hardwood habitat within the WWTP study area. The addition of bottomland hardwood habitat would increase habitat diversity, complexity, stability, and functionality within the WWTP study area. The additional 4.79 AAHUs and improved habitat stability provided by Plan 3 is worth the additional incremental cost/output of $1,908.

When comparing Plan 3 to Plans 4, 5, and 6, we can see that these plans provide increases in AAHUs (2.67, 2.88, 3.13) at incremental costs/output of $6,250, $6,586, and $6,588, respectively (see Table 5-1). Plans 4, 5, and 6 are different in that each provides a higher density of bottomland hardwood plantings. The additional AAHUs from each plan would come from gains in riparian corridor and grassland habitat within the City Park study area. Additional benefits would include improvements to North Bosque River water quality, increased local aesthetics, and reduced stream bank erosion. The benefits and costs associated with plans 4, 5, and 6 are very similar and the first restoration measures to be incrementally justified at the City Park study area. Therefore, the additional 3.13 AAHUs and additional benefits provided by Plan 6 are worth the additional incremental cost/output of $1,780.

Plan 7 includes all of the features in Plan 6 with the replacement of the 8.5-acre wetland scale with the 16.9-acre wetland scale at the WWTP study area. This plan would provide an additional 5.40 AAHUs of emergent wetland habitat over Plan 6 (see Table 5-1). Plan 7 would provide maximum emergent wetland habitat and water quality benefits by utilizing all of the abandoned sludge drying lagoons at the WWTP study area. Based on the existing water quality problems and a lack of emergent wetland habitat within the North Bosque River Watershed, the additional wetland and water quality benefits are worth the additional incremental cost/output of $208.

Plan 8 includes all of the features in Plan 7 with the addition of the bank stabilization and in-stream aquatic habitat restoration measures within the City Park study area. This plan would provide an additional 2.02 AAHUs for in-stream aquatic habitat over Plan 7 (see Table 5-1). The bank stabilization and in-stream aquatic habitat measures in Plan 8 are critical to the success of the previously justified riparian corridor measures in Plan 6. Without these measures, the ongoing bank erosion and subsequent sedimentation of in-stream habitat would continue to degrade existing habitat and threaten the longevity of adjacent riparian corridor vegetation. Therefore, the additional erosion control and in-stream aquatic habitat benefits are worth the additional incremental cost/output of $3,404.

When comparing Plan 8 to Plans 9 through 14, we can see that these plans provide only minor increases in AAHUs (0.21 to 0.69) with incremental costs/output ranging from $11,181 to $154,688. Plans 9, 10, 12, 13 and 14 are different in that each provides a higher density of bottomland hardwood plantings within both study areas. Plan 11 provides additional bank stabilization and in-stream habitat measures within the City Park study area. Based on the minor increase in AAHUs, increased incremental costs (Table 5-1, Figure 5-3), and the fact that lesser scales of these measures have already been included in Plans 2 through 8, the additional 0.21 to 0.69 AAHUs are not worth the additional incremental costs/output of $11,181 to $154,688.

The study team determined that Plan 8, as identified in Section 5, should be the recommended restoration plan. Plan 8 would maximize incremental costs per output, provide the greatest amount of wetland habitat and water quality benefits, implement required restoration measures for sustainability of the project, and provide the greatest amount habitat diversity. An overview of the City Park and WWTP Recommended Restoration Plans are presented in Figures 6-1 and 6-3, respectively, while the major structural components of the recommended plans are shown in Figures 6-2 and 6-4. All figures are located at the end of this section. Typical design details are included in Appendix F.

The recommended plan (Plan 8, see Section 5.2) elements are described, below.

At the WWTP Study Area:

1. Creation of a 45.1 acre wetland complex consisting of 16.9 acres of emergent aquatic vegetation in the form of seeding; 19.2 acres of 3- to 5- gallon containers for perimeter wetland plantings, and 9 acres of 3- to 5- gallon containers spaced at 15 trees per acre for bank and island vegetation.
2. Reforestation of 11.5 acres of riparian corridor consisting of 3- to 5- gallon containers planted on 20-foot centers in the tree screen zone, and 25-foot centers in the northwest planting and wetland levee to river zones.

At the City Park Study Area:

1. Reforestation of 6.9 acres consisting of live stakes or seedlings on five-foot centers for the bank vegetation; bottomland hardwoods planted at 25-foot centers; and four areas of grassland seeding within the riparian corridor.
2. Implementation of the bank stabilization alternative and measures (bank seeding, brush mattress, fiber roll, and plantings of two-inch plugs planted on four-foot centers) and in-stream aquatic habitat alternative and measures (two rock weirs, seven riffle structures, and two rootwad complexes).

6.1 Recommended Restoration Plan Benefits

The riparian corridor and in-stream aquatic habitat values would be improved considerably through development of pool-riffle-run complexes, rehabilitation of the riparian forest and the use of bank stabilization measures. Additional benefits such as improved water quality, the establishment of recreational opportunities and the improved aesthetic value of Century Park would also result from this plan.

The recommended restoration plan would create high value emergent wetland habitat in an area that currently has none. Approximately 52.4 acres of water quality and wetland complex (consisting of herbaceous emergents, grassland vegetation, berm and island seeding, and a tree screen) benefits would result from the recommended plan. As presented in Table 6-1, within 10 years of project implementation an emergent wetland complex with 29.6 AAHUs would be established and 34.9 AAHUs would be gained within 50 years of project implementation. Incidental benefits associated with the emergent wetland complex include improved water quality, recreational opportunities, educational opportunities, and an improvement in the natural aesthetics of the area surrounding the Stephenville WWTP and along the North Bosque River. Various fish species would eventually be stocked within the wetland to complete the food cycle of the wetland habitat.

Approximately 18.4 acres of riparian forest habitat would result from the recommended restoration plan. With the recommended restoration plan, it is estimated that within 10 years there would be a gain in riparian forest AAHUs of 2.5, and after 50 years the riparian forest habitat would improve by 7.9 AAHUs above future conditions without project implementation (Table 6-2).

The calculated in-stream aquatic habitat value also indicates dramatic results with the project in place. Approximately 5.82 acres of in-stream aquatic habitat and water quality benefits would occur with the recommended plan. Table 6-3 shows an increase of 1.4 aquatic AAHUs in the first 10 years after implementation, and after 50 years, the AAHUs would increase by 2.0 over the conditions without project implementation. Increased riparian corridor development, increased dairy operation run-off, and reduced baseline water flows would decrease habitat values under the no action alternative.

Table 6-1
Creation of Emergent Wetland Habitat
Stephenville, Texas

		Base Year			**Base Year + 10**			**Base Year + 25**			**Base Year + 50**		
	Acres	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain
W/O Project	45.10	0.43	19.39		0.40	18.36		0.35	16.81		0.29	14.98	
With Project	52.40	0.74	38.78	19.39	0.94	47.95	29.59	0.96	49.36	32.55	0.96	49.86	34.88

Table 6-2
Riparian Forest Habitat Restoration
Stephenville, Texas

		Base Year			**Base Year + 10**			**Base Year + 25**			**Base Year + 50**		
	Acres	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain
W/O Project	18.40	0.65	11.96		0.63	11.78		0.51	10.67		0.42	9.26	
With Project	18.40	0.68	12.51	0.55	0.81	14.26	2.48	0.97	16.08	5.41	1.00	17.18	7.92

Table 6-3
In-Stream Aquatic Habitat Restoration
Stephenville, Texas

		Base Year			**Base Year + 10**			**Base Year + 25**			**Base Year + 50**		
	Acres	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain	Avg HSI	HU	HU Gain
W/O Project	5.82	0.70	4.07		0.63	3.77		0.57	3.50		0.50	3.20	
With Project	5.82	0.72	4.19	0.12	0.90	5.16	1.39	0.93	5.31	1.81	0.88	5.22	2.02

6.2 <u>Components and Conceptual Design</u>

6.2.1 Restoration Features

The conceptual design for the recommended plan includes creation of a wetland complex, restoration of the riparian forest and the enhancement of the in-stream aquatic habitat. The habitat values of both the riparian corridor and in-stream aquatic habitat would greatly improve following the development of pool-riffle-run complexes, replanting of the riparian forest and implementing bank stabilization measures. Restoration measures identified for each design feature are detailed in the following sections.

Creation of Emergent Wetland Habitat

The proposed wetland would be created approximately 1 mile south of the City Park within the location of the Stephenville WWTP's sludge drying beds adjacent to the North Bosque River. Existing inflow/outflow conduits would bring water into the wetland from the WWTP. Existing berms associated with the sludge pits would be utilized to retain inflow and direct the water to the surface of the wetland. The sludge beds would be excavated and the interior berms and water control structures removed to allow room for the construction of small islands and levees. The soil resulting from excavation would be utilized to build the terrestrial features. These features would direct water flow in a more natural manner through the wetland and provide dynamic aquatic and terrestrial habitats for wildlife and vegetation. Once the water has traveled through the wetland, the outflow conduits would allow the water to drain into the river. The berm located nearest to the river would need to be reformed to prevent communication with the river except during high water events. During these times, this structure would be utilized as a spillway for excess water accumulated within the wetland. The water level would be monitored and maintained through the use of a flash board riser. Much of the wetland at the WWTP would be managed as a moist-soil impoundment, and planting within the area would be appropriate for this wetland management technique.

Following construction of the wetland, herbaceous emergent plant species would be planted in locations where shallow water up to 1 foot in depth would be located. Water tolerant plants would be planted along the edge of the wetlands while grasses and wildflowers would be planted to establish the surrounding perimeter. These species should extend from the bank of the wetlands to the tree line and roads. Species that are known to form large monocultures, which can cause maintenance problems, were avoided. The wetland planting guideline follows:

- Emergent herbaceous species planted in shallow water (less than one foot deep) within the wetland include:
  - Sedges *(Eleocharis spp., Carex spp., Cyperus spp.)*
  - Rushes *(Juncus spp.)*
  - Bullrush *(Scirpus spp.)*
  - Smartweeds *(Polygonum spp.)*
  - Water pennywort *(Hydrocotyle umbelleta)*

- Native water tolerant plants established along the bank include:
  - Common Buttonbush *(Cephalanthus occidentalis)*
  - Switch grass *(Panicum virgatum)*
  - Smartweeds *(Polygonum spp.)*

- Plant grasses and wildflowers surrounding perimeter of wetland from bank to existing tree lines and roads including:
  - Little bluestem *(Schizachyrium scoparium)*
  - Big bluestem *(Andropogon gerardii)*
  - Indian grass *(Sorghastrum nutans)*
  - Side-oats gramma *(Bouteloua curtipendula)*
  - Switch grass *(Panicum virgatum)*
  - Purpletop *(Tridens flavus)*
  - Vine-mesquite *(Panicum obtusum)*
  - Illinois bundle-flower *(Desmanthus illinoensis)*
  - Maximillian sunflower *(Helianthus maximilian)*

Riparian Forest Reestablishment

All vegetative species planned for reestablishment are native to the county and would be planted parallel with the river. The trees obtained would vary in size to create structural and age diversity in the riparian forest. Riparian restoration is divided into three zones of planting. Zone 1 would consist of emergent aquatic plants introduced in water less than one foot deep along the edges of both the existing and planned pooled areas of the stream. Zone 2 would be planted with species, which can remain permanently saturated in water and spaced approximately five to eight feet apart. Vegetation in Zone 2 should obtain a maximum of 10 to 25 feet in height after 20 years of age. Zone 3 would be planted with large hard mast producing trees approximately eight to 12 feet apart to promote proper spacing and maturation. The hard mast trees would likely grow to heights greater than 25 feet after 20 years of age, and would function as the upper canopy of the forest habitat. Less than 25 percent of the trees planted in Zone 3 would be soft mast producing species which would serve as widely dispersed motts and thickets at approximately five percent canopy cover for grassland areas. Within the scattered open patches, native grasses and other herbaceous species would be planted.

The planting guideline for each zone follows:

- **Zone One:** Emergent aquatic plants to be planted along the edges of existing and proposed pooled areas of the stream include the following:
  - Sedges *(Eleocharis spp., Carex spp., Cyperus spp.)*
  - Rushes *(Juncus spp.)*
  - Bullrushes *(Scirpus spp.)*
  - Smartweeds *(Polygonum spp.)*

- **Zone Two:** Plant species that can remain permanently saturated in water within five feet of the stream bank include the following:
  - Black willow *(Salix nigra)*
  - Cottonwood *(Populus deltoides)*
  - Common buttonbush (*Cephalanthus occidentalis)*
  - Boxelder *(Acer negundo)*

- **Zone Three:** Plant species appropriate for the transitional fringe from five to150 feet of the stream bank. Large hard mast producing trees would include:
  - Pecan *(Carya illinoensis)*
  - Black walnut *(Juglans nigra)*
  - Burr oak *(Quercus macrocarpa)*

  Soft mast producing trees and shrubs (less than 25% of trees) include:
  - Mexican plum *(Prunus mexicana)*
  - Prairie sumac *(Rhus lanceolata)*
  - Hawthorne (*Crataegus spp*.)
  - Coral-berry *(Symphoricarpos orbiculatus)*
  - Thicket plum *(Prunus rivularis)*
  - Sand plum *(Prunus angustifolia)*
  - Red mulberry *(Morus rubra)*

  Native grasses and other herbaceous species to be planted in scattered open patches include:
  - Little bluestem *(Schizachyrium scoparium)*
  - Big bluestem *(Andropogon gerardii)*
  - Indian grass *(Sorghastrum nutans)*
  - Side-oats gramma *(Bouteloua curtipendula)*
  - Switch grass *(Panicum virgatum)*
  - Purpletop *(Tridens flavus)*
  - Vine-mesquite *(Panicum obtusum)*
  - Illinois bundle-flower *(Desmanthus illinoensis)*
  - Maximillian sunflower *(Helianthus maximilian)*
  - Engelmann's daisy *(Engelmannia peristeri)*
  - Coral-berry *(Symphoricarpos orbiculatus)*

In-stream Aquatic Habitat Restoration

Further measures within this plan include the restoration and creation of in-stream aquatic habitat. Effective pool-riffle-run complexes would be created by installing limestone riprap in proposed riffle areas. Seven proposed riffles and two pools (using cross vane rock weirs) would be constructed within the preferred plan. These complexes, which include engineered and existing natural elements, would provide aquatic habitat for diverse biological species, reduce stream flow, and facilitate entry of oxygen into the water column through turbulent mixing. Two rock weirs would be constructed to reduce stream flow rates, which would minimize bank erosion and support backwatering conditions necessary for successful deep water habitats. A copy of the Hydrologic and Hydraulic studies performed for the study area are provided in Appendix G.

Stabilization measures along the stream bank in the northern section of the City Park study area (near Century Park) would include the cutting of the banks to a 2:1 slope. The sloping of these areas would decrease future erosion and allow vegetation growth along the bank. The three cut back locations are shown on Figure 6-2 and are identified as A, B, and C. Additional bank erosion measures include bank seeding at two locations (Figure 6-2, areas A and C), and installation of a brush mattress, fiber roll, and 20 foot center plantings at one location (area B, Figure 6-2) and in-stream aquatic habitat alternative and measures to include two rock cross-vane weirs, seven riffle structures, and two root-wad complexes (Figure 6-2).

6.2.2 Operation and Maintenance Features

Additional benefits of this plan include 4-foot wide, trails consisting of approximately 2,800 feet of asphalt trails constructed along the eastern border of the river at the City Park site and approximately 2,4000 feet crushed stone trail along the western border of the WWTP wetland area. These trails would provide operation and maintenance access to restoration features, provide an avenue for wildlife observation, and could have additional amenities such as benches, trash bins, informational signs, and wildlife viewing stations. Future plans by the City of Stephenville include installation of two walking bridges within the City Park site, which would cross the North Bosque River midway through the project reach (see Figure 6-2).

6.3 <u>Permitting</u>

The recommended construction activities within the Stephenville City Park area of the North Bosque River could result in modifications to existing waters of the United States, as regulated by Section 404 of the Clean Water Act. Modifications could include minimal fill in waters of the United States during construction of cross vanes, installation of rootwad structures, and placement of native stone rip rap. Additional fill could be expected during stream diversion activities to dewater the North Bosque River prior to implementation of proposed construction measures. However, dewatering may not be necessary at all locations if construction occurs during low-flow periods of the year. Generally, these types of restoration measures meet the criteria for Nationwide Permit (NWP) 27 - "Stream and Wetland Restoration Activities," which authorizes activities in waters of the United States associated with the creation and enhancement of wetland and riparian areas. The operation and maintenance components of the project (trail within the riparian corridor and potential bridge crossing over the river) would likely be below the impact threshold criteria for NWP 14 - "Linear Transportation Projects." The Fort Worth District USACE Regulatory Permits personnel have reviewed the project and determined that NWPs 14 and 27 would apply to the proposed project. Since TCEQ has already issued a Section 401 water quality certificate for all NWPs, no additional Section 401 coordination is necessary, so long as the impact thresholds and conditions in the NWPs are not exceeded.

For the WWTP project area, a nationwide permit would probably not be needed since the restoration footprint is outside the ordinary high water mark of waters of the United States. In addition, there are no wetlands currently present within the project footprint; therefore none would be impacted during construction activities.

6.4 <u>Real Estate Considerations</u>

The Real Estate Plan in Appendix H has been prepared in support of this feasibility study and describes the lands, easements, right-of-way, relocations and disposal areas (LERRDs) required for the aquatic ecosystem restoration of the North Bosque River in Stephenville, Texas. The recommended restoration plan consists of 56.60 acres of land at the Stephenville WWTP and 9.44 acres of land at the Stephenville City Park. The total acreage that the City of Stephenville would receive credit for is 66.04 acres, at a value of $5,271.80 per acre, resulting in an overall LERRD credit of $348,150.

6.5 Operation, Maintenance and Monitoring Considerations

Operation and maintenance (O&M) would include watering of plantings until they are established and possible adjustments to in-stream structures after high water events and within the wetland complex to regulate water levels. The water levels within the WWTP wetland would have to be monitored and water levels carefully controlled via the effluent control structure to maintain the desired vegetative conditions and associated wildlife habitat functions of the moist-soil management complex. Occasional mowing and burning may also be needed or desired to manage the vegetation in a productive condition. The City of Stephenville would be responsible for O&M.

The City of Stephenville has agreed to provide the following work in-kind: light clearing and grubbing within the park and wetland areas, earth work at the WWTP for wetland construction, and installation of O&M features within the wetland area.

The estimated annual cost of operation and maintenance is approximately $40,300. Costs associated with Operation, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) would include operational costs, vegetation maintenance costs, wetland management costs, and O&M trail maintenance costs.

6.6 Recommended Restoration Plan Costs

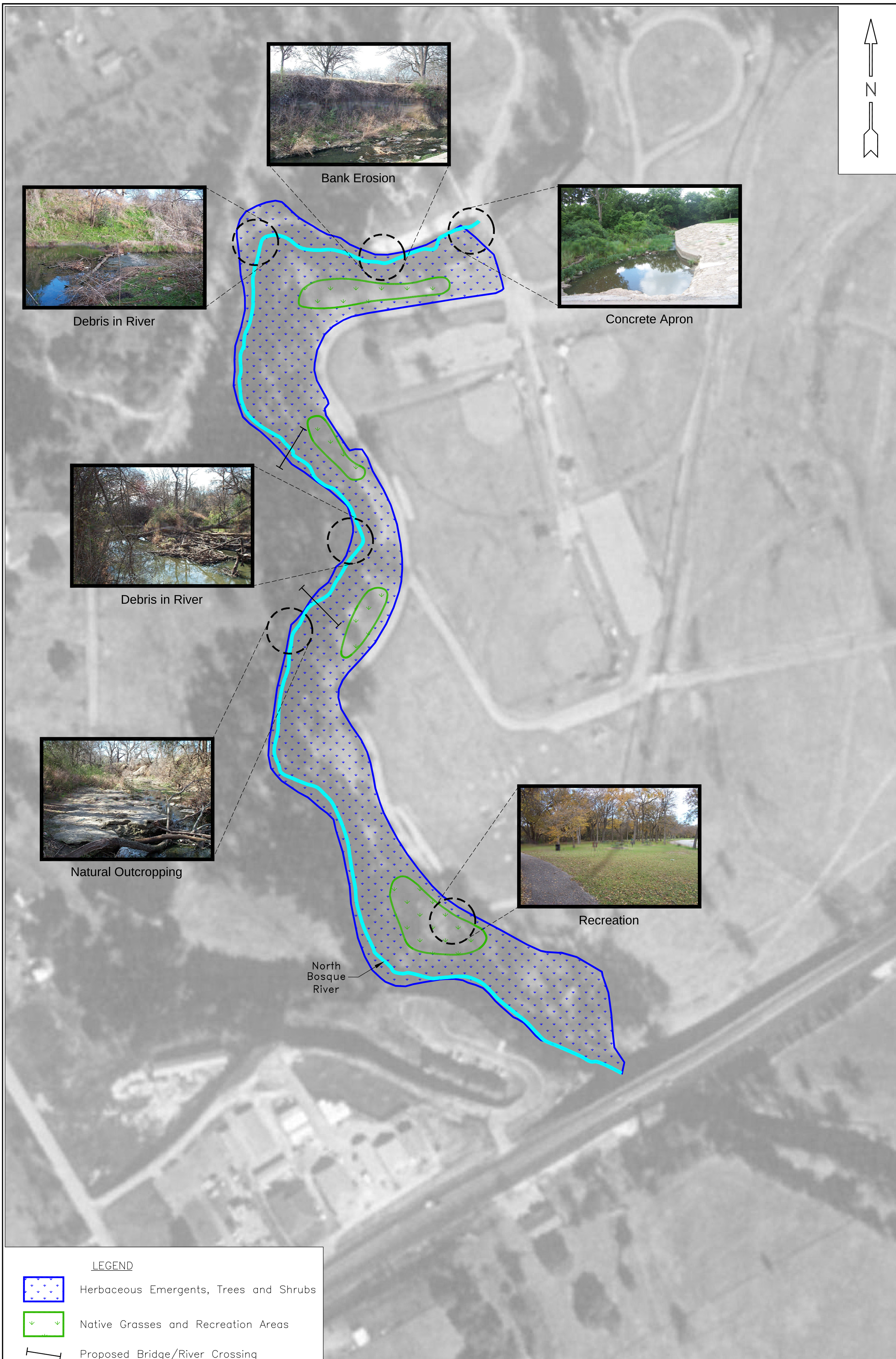
The costs associated with the recommended plan are outlined in Tables 6-4 and 6-5. Also detailed in Table 6-4 are feature types, planting areas, structures, O&M costs and contingencies.

Table 6-4
Recommended Plan Costs by Scale
Stephenville, Texas

WWTP Wetland Complex - Scale A1			Park In-Stream - Scale C2		
Wetland Construction	Entire Footprint	$653,177	In-Stream Construction	General Construction Cost	$30,330
Zone 1	Seed (16.9 Acres)	$28,730	Stream Diversion	Dewatering Costs	$23,640
Zone 2	15 Trees/Acre (19.2 Acre)	$47,616	Weirs; Riffles	2 Ponds; 7 Riffles; 2 Rootwads	$46,234
Berm & Island Seeding	15 Trees-Shrubs/Acre + Seeding (9 Acres)	$22,320	Bank Stabilization	General Construction Cost	$18,710
O&M Trail Costs	2450 Ft Stone Dust Trail	$11,916	Bank Structures	A/C-Seeding; B-Brush Mattress; B-Fiber Roll; B-20ft Centers	$29,238
			Zone 1	4 ft Spacing (0.1 Acres)	$694
	Total Const Cost	**$763,759**		**Total Const Cost**	**$148,846**
Vegetation O&M	Vegetation O&M	$10,400	In-Stream O&M	In-Stream O&M	$3,620
Wetland O&M	Wetland O&M	$6,920	Bank O&M	Bank O&M	$2,280
	Total O&M Cost	**$17,320**		**Total O&M Cost**	**$5,900**
Contingency	% Total Cost	$328,833	Contingency	% Total Cost	$65,153
Land Acquisition	45.1 Acres	$237,758	Land Acquisition	2.54 Acres	$13,390
	Total Plan Cost	**$1,347,670**		**Total Plan Cost**	**$233,289**
WWTP Reforestation - Scale B3			**Park Reforestation - Scale D3**		
Tree Screen Area	20 ft Centers (0.60 Acre)	$2,080	Reforestation Construction	General Construction Cost	$29,907
NW Area	25 Trees-Shrubs/Acre + Seeding (8.6 Acres)	$25,800	Zone 2	5 ft Spacing (0.3 Acres)	$1,045
Levee To River Area	25 Trees-Shrubs/Acre + Seeding (2.3 Acres)	$6,900	Zone 3	70 Trees-Shrubs/Acre (5.6Ac)	$20,384
			Zone 4	Seed 10, 0.1acre Plots (1.0 Ac)	$1,700
			O&M Access	2830 ft X 4 ft X 0.4 ft Asphalt	$18,065
	Total Const Cost	**$34,780**		**Total Const Cost**	**$71,101**
Vegetation O&M	Vegetation O&M	$10,480	Vegetation O&M	Vegetation O&M	$7,660
	Total O&M Cost	**$10,480**		**Total O&M Cost**	**$7,660**
Contingency	% Total Cost	$19,049	Contingency	% Total Cost	$33,163
Land Acquisition	11.5 Acres	$60,626	Land Acquisition	6.9 Acres	$36,376
	Total Plan Cost	**$124,935**		**Total Plan Cost**	**$148,300**

Table 6-5
Recommended Restoration Plan Total Costs
Stephenville, Texas

	WWTP Wetland Complex Scale A1	**WWTP Reforestation Scale B3**	**Park In-Stream Scale C2**	**Park Reforestation Scale D3**
Total Const Cost	$763,759	$34,780	$148,846	$71,101
Total O&M Cost	$17,320	$10,480	$5,900	$7,660
Contingency	$328,833	$19,049	$65,153	$33,163
LEERDs	$237,758	$60,626	$13,390	$36,376
Total Plan Cost by Scale	$1,347,670	$124,935	$233,289	$148,300
TOTAL PLAN COST	**$1,854,194**			



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Scale in Feet

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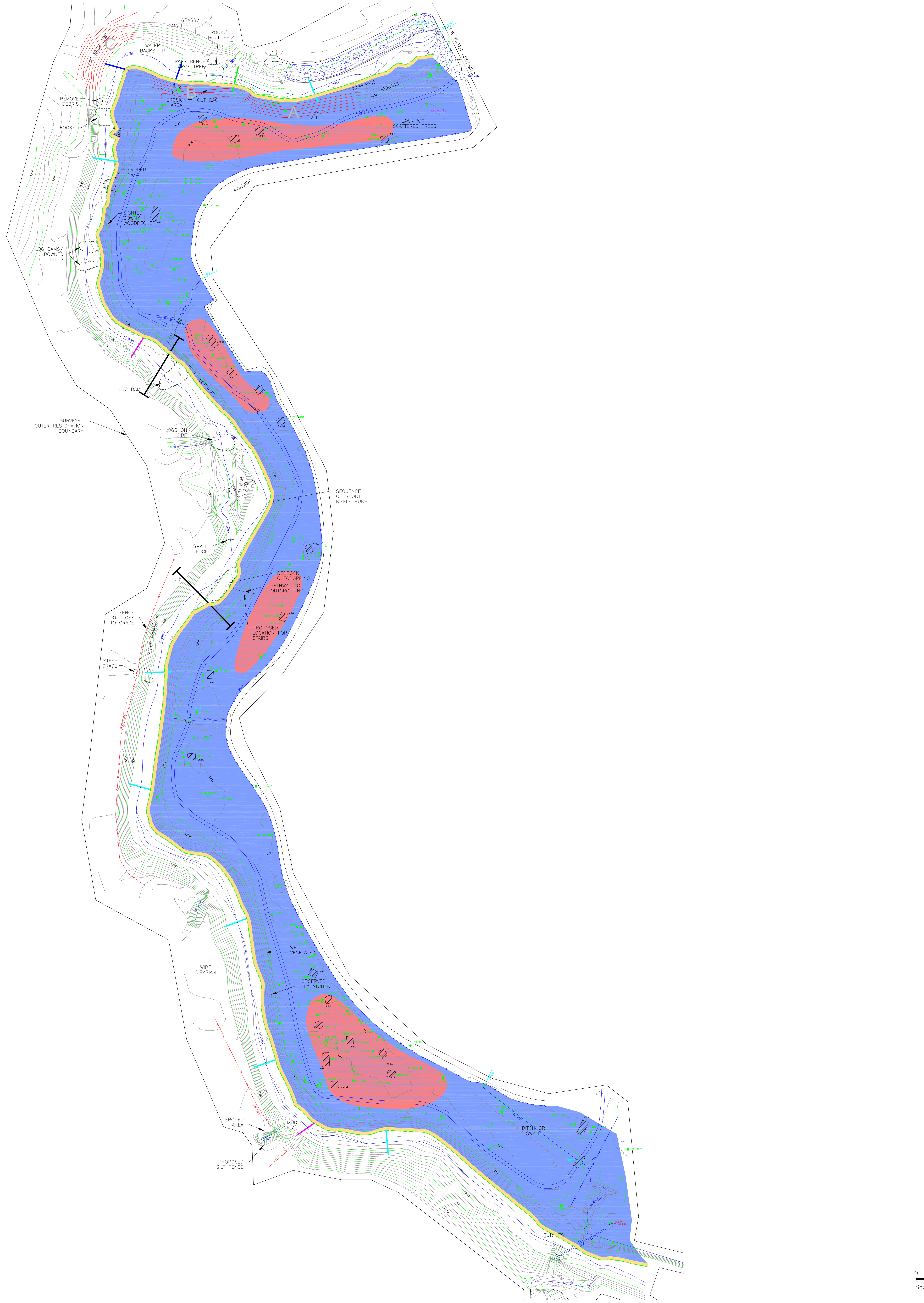
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 10-01-04	SCALE: 1"=200'
DWG. NO.: Park_aerial2	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 6-1
RECOMMENDED RESTORATION PLAN
CITY PARK
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS



LEGEND

A Bank Stabilization Areas

In-stream Structures
- Typical Riffle
- Brush-mattress with Toe Protection
- Root-wad
- Stone Weirs

Planting Legend
- Zone One - Wetland Emergents
- Zone Two - Permanently Saturated Trees and Shrubs
- Zone Three - Mast Producing Plants
- Zone Four - Open Patches of Native Grasses and Forbs

TETRA TECH NUS, INC.

DETAILED RESTORATION PLAN
CITY PARK

FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

FILE	SCALE
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FIGURE NUMBER	REV	DATE
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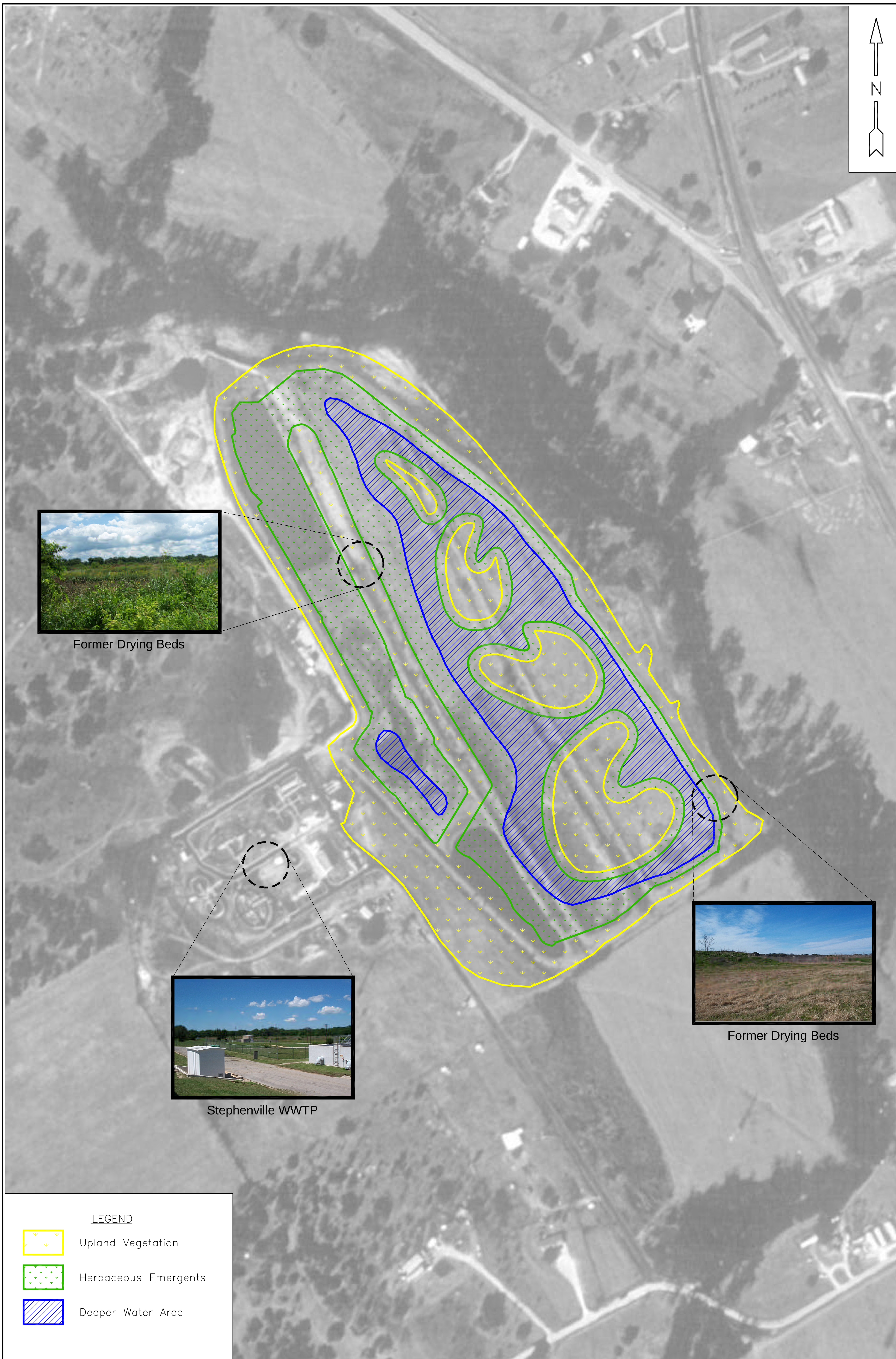

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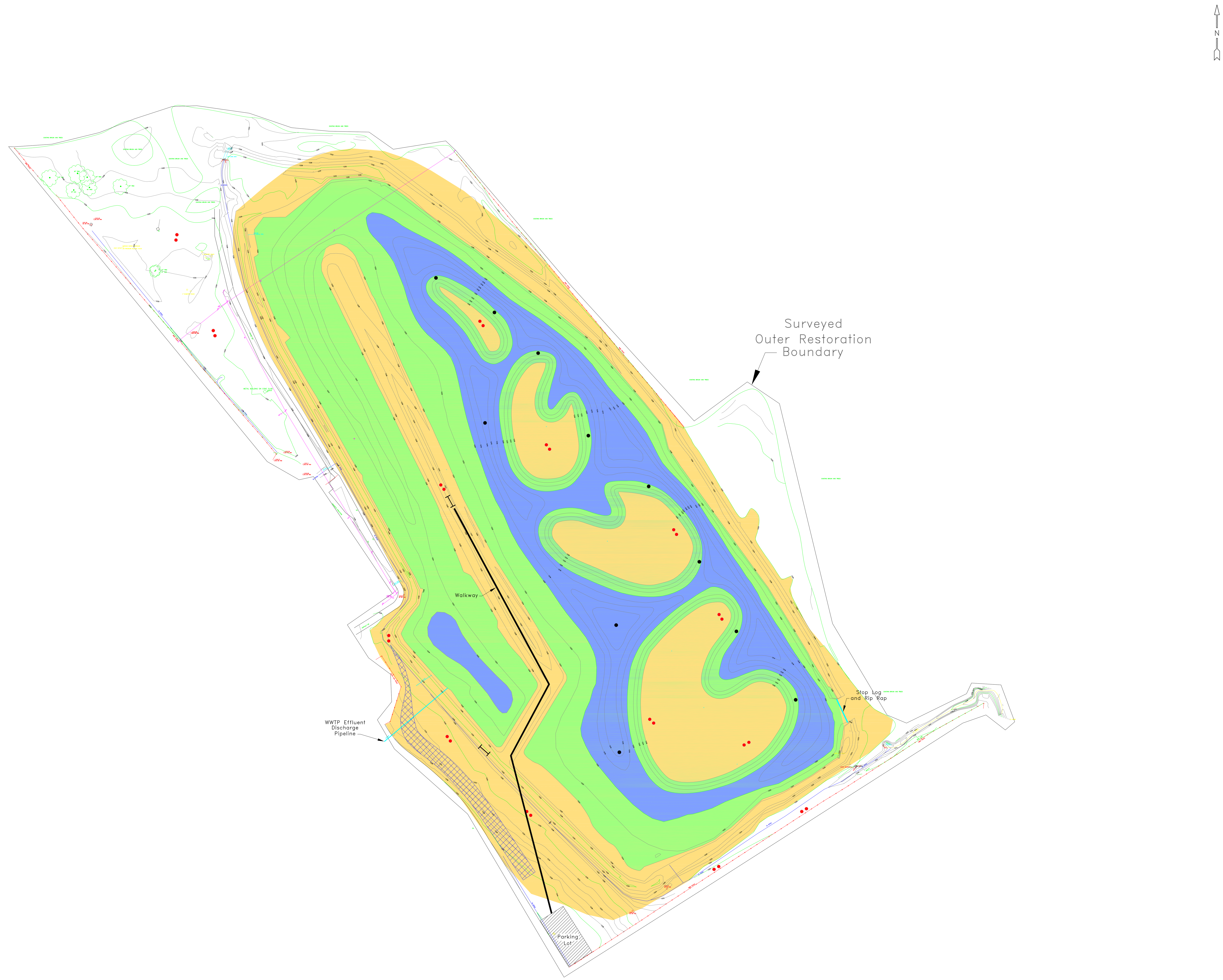
Scale in Feet

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 10-14-04	SCALE: 1"=300'
DWG. NO.: WWTP_aerial2	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 6-3
RECOMMENDED RESTORATION PLAN
WWTP
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS



LEGEND

Planting Legend

- Zone One - Herbaceous Emergents
- Zone Two - Upland Vegetation
- Zone Three - Deeper Water
- Tree Screen
- Wood Duck Box
- Pair of Bluebird Boxes
- Bench
- Stop Log and Rip Rap

TETRA TECH NUS, INC.

DETAILED RESTORATION PLAN
WWTP

FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

FILE	SCALE	
STEPH_WWTP_PRO	1"=100'	
FIGURE NUMBER	REV	DATE
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7.0 PROJECT IMPLEMENTATION

7.1 Project Schedule

A project schedule would be developed to monitor all restoration measures and the overall progress of the project. Achievement of management goals is dependent upon a number of variables, which are subject to unforeseen or unpredictable events. Monitoring of the project progress would prove to be critical in maintaining the relationship between the management of the plan and the ecosystem response. Close inspection would facilitate modifications and adjustments to the restoration as necessary until the ecosystem becomes self sustaining. Proper documentation must be maintained throughout the project's life to establish a basis for evaluating the proposed restorative measures with the ecosystem response. This documentation would prove useful for future restorative projects. All monitoring activities would be funded as a project cost through two years into the project operations.

The final Feasibility Report is scheduled for completion in September 2005. The following design phase will last approximately 6-12 months, construction will last approximately 2 years, and monitoring of implemented project features for approximately 2 years. Following the 2-year monitoring period, the project would be closed-out and the sponsor would then assume all operation and maintenance requirements associated with the project.

7.2 Project Costs

Total estimated project cost for implementation of the recommended plan includes additional items not covered in the recommended plan costs outlined in Section 6.0, such as:

(1) Preparation of Detailed Project Report, as well as engineering plans and specifications, and
(2) Post project monitoring.

A summary of the project associated costs follows:

Detailed Project Report	$244,100
Plans & Specifications	$250,000
LERRD's	$348,150
Construction	$1,059,847
Contingency	$446,198
Post Project Monitoring	$30,000
GRAND TOTAL	**$2,378,295**

7.3 Cost Apportionment

The total estimated project costs would be approximately $2,378,295 that would be cost shared at 65 percent Federal and 35 percent non-Federal. The percentage break out is approximately $1,545,892 and $832,403, respectively. The non-Federal partner 35 percent cost is comprised of credit for the value of all LERRDs, and a credit for the value of any work in-kind services performed, including light clearing and grubbing within the park and wetland areas, earth work at the WWTP for wetland construction, and installation of the O&M trail features associated with the wetland area. The non-Federal partner would provide the non-Federal contribution through property appropriation (valued at approximately $348,150) and work in-kind (valued at approximately $487,253) including operation and maintenance.

In the event the LERRDs and work in-kind services are less than 35 percent of the project cost, the City of Stephenville would contribute the remaining value in cash. Credit for work in-kind can comprise up to 100 percent of the total non-Federal partner contribution and cannot result in reimbursement. Furthermore, the non-Federal partner would comply with applicable Federal and state laws and regulations, including the requirement to secure competitive bids for all work to be performed by contract. Contributions of cash, funds, materials or services from other than the non-Federal partner or their contractor(s) may be accepted; however, such contributions would not be credited to the non-Federal partner share. These contributions would be applied to the entire total project cost and therefore reduce both the Federal and non-Federal share. The following table displays the current estimated cost apportionment:

Table 7-1
Federal and Non-Federal Cost Apportionment
Stephenville, Texas

Project Item	Restoration Costs	Total Project Costs
Total Project Cost	$2,378,295	$2,378,295
Federal Share (65%)	$1,545,892	$1,545,892
Sponsor Share (35%)	$832,403	$832,403
Sponsor Requirements		
LERRD Credit	$348,150	
Work In-Kind Services	$487,253	
Cash Contribution	$0	

7.4 Project Cooperation Agreement

The Project Cooperation Agreement (PCA) is a contract between the Federal Government and the non-Federal partner. The PCA describes the rights and responsibilities of each party during project implementation, including cost sharing. This contract would be executed following the receipt of Federal approval of the project and prior to requests for construction proposals. The PCA would be a model Section 206 agreement without significant deviations requiring USACE Headquarters approval. The PCA is presented in Appendix I.

8.0 ENVIRONMENTAL CONSEQUENCES

8.1 Introduction

This chapter evaluates the potential environmental impacts of the Proposed Action Alternative and the No Action alternative. The Proposed Action Alternative is the selected Plan 8 and is referred to as the Recommended Plan. This analysis includes likely beneficial and adverse effects on the human environment including short-term and long-term effects, direct and indirect effects, and cumulative effects. The analysis of impacts on resources focuses on environmental issues in proportion to their potential effects. Detailed consideration is given to those resources that have a potential for environmental effects. Interpretation of impacts in terms of their duration, intensity, and scale are provided where possible.

8.2 Cumulative Effects

Cumulative effects are the direct and indirect effects of a proposed project alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the action (40 CFR Part 1508.7). Guidance for implementing NEPA (CEQ, 1997) recommends that Federal agencies identify the temporal and geographic boundaries of the potential cumulative effects of a proposed action. For the purposes of this DPR/EA, the temporal boundary of the cumulative effects is from approximately 1999 to 2009. This boundary encompasses a range within which data are reasonably available and forecasts can be reasonably made. The geographic boundaries vary depending on the resource and potential effects. As such, they correspond to the areas described under each resource.

Specific projects that are similar in size or scope or have the potential to cumulatively affect the resources evaluated for the project are identified in Table 8-1 below. These projects are further described in the narrative following the table. Some resources would be affected by several or all of the described activities, while others could be affected very little or not at all.

Table 8-1
Past, Present, and Reasonably Foreseeable Activities
Stephenville, Texas

Cumulative Action	Project Description	Past	Present	Future
Westside Development	Commercial Development	✓		
Tanglewood Northwest Subdivision	Residential Development		✓	
Riverwalk Development	Residential Development	✓		
Municipal Service Center Facility	Municipal Development	✓		
City Park Improvements	Municipal Development	✓		
Bosque River Trail Project	Recreation Trail Construction			✓
Madison Development	Residential Development		✓	✓

Westside Development. Westside Development is a 10-acre development of a mini shopping area that includes two and one-half miles of concrete, curb and gutter street. It is located at U.S. Highway 377 and Wolf Nursery Road and was completed in 1999.

Tanglewood Northwest Subdivision. This project is an 87-acre residential and commercial subdivision that is located on the Northwest Loop (Route 988). The project was started in 1977 and is currently approximately 70% completed.

Riverwalk Development. This development was completed in 2004 and is a 12-acre income-assisted residential facility. It is a 76 unit facility located at Business 377 and U.S. Highway 281.

Municipal Service Center Facility. This facility was completed in 2000 and is a City of Stephenville maintenance facility. It is an 11-acre development located at U.S. Highway 281 and State Highway 67.

City Park Improvements. This project was completed in 2000 and was funded by a TPWD grant. The new facilities consist of:

- Outdoor amphitheater
- Two baseball/softball fields
- Fishing dock and Bosque River bank stabilization
- Multipurpose basketball court area

Bosque River Trail Project. This project includes 7,300 linear feet trail along the Bosque River and is located at Graham Street (City Park) to Tarleton Street. The construction start date is scheduled for 2005.

Madison Development. This residential development is located at Vanderbilt and McIlhaney Street. The project is an apartment complex for student housing at Tarleton State University for which construction began in 2004. There will be 172 units, with 342 beds on 2.6 acres.

8.3 Terminology

Terms referring to impact intensity, context, and duration are used when determining the cumulative effects. Unless otherwise stated, the standard definitions for these terms are as follows:

- *Negligible:* The impact is at the lower level of detection, and there would be no measurable change.

- *Minor:* The impact is slight but detectable, and there would be a small change.

- *Moderate:* The impact is readily apparent, and there would be a measurable change that could result in a small but permanent change.

- *Major:* The impact is severe, and there would be a highly noticeable, permanent, measurable change.

- *Localized Impact:* The impact occurs in a specific site or area. When comparing changes to existing conditions, the impacts are detectable only in the localized area.

- *Short-Term Effect:* The effect occurs only during or immediately after implementation of the alternative.

- *Long-Term Effect:* The effect could occur for an extended period after implementation of the alternative. The effect could last several years or more and could be beneficial or adverse.

8.4 Thresholds of Significance

Significance thresholds are listed in Table 8-2. These thresholds are provided to help the reader and decision-makers understand the magnitude and intensity of impacts. Some thresholds are determined using quantitative data, while others rely on qualitative data.

Table 8-2
Thresholds of Significance
Stephenville, Texas

Resource	Thresholds of Significance
Climate and Weather	Significance threshold would be reached if an alternative were to result in any change in the climate or weather.
Air Quality	Significance threshold would be reached if an alternative were to lead to an exceedance of the NAAQS or the State of Texas Ambient Air Quality Area Standards.
Soils and Geology	Significance threshold would be reached if an alternative were to expose people to an increased level of geologic hazards, such as slope instability, or if it were to result in a change in or loss of a unique geologic resource. Significance threshold would be reached if an alternative were to result in a substantial soil loss because of increased erosion, decreased slope stability, or increased impermeable surfaces, such that there is a measurable decrease in water infiltration into soils. Significance threshold would be reached if an alternative were to convert Federal prime farmland soils or soils of statewide importance to incompatible uses, or if it were to contaminate the soil.
Water Resources	Significance threshold would be reached if an action were to cause substantial flooding or erosion, if it were to substantially impair any significant water body, watershed health, or the functionality of major rivers, wetlands, or floodplains or if it were to decrease surface or groundwater quality or quantity.
Wetlands and Floodplains	Significance threshold would be reached if an action were to dredge, fill or substantially impair the health or the functionality of wetlands or floodplains.

Table 8-2
Thresholds of Significance
Stephenville, Texas

Resource	Thresholds of Significance
Vegetation	Significance threshold would be reached if: • An action introduced or substantially encouraged the spread of noxious weeds or other undesirable invasive species; • There were a substantial loss of riparian, wetland, or marsh habitats; • There were harm or destruction of a species, natural community, or habitat that is specifically recognized as biologically significant in local, state, or Federal policies, statutes, or regulations; or • There was an alteration or destruction of habitat that would prevent the reestablishment of native biological communities that inhabited the area prior to the disturbance.
Fish, Wildlife	Significance threshold would be reached if there were: • A loss of a number of individuals of any native animal species that could affect abundance or diversity of that species beyond normal variability; • A substantial interference with movement of any resident or migratory fish or wildlife species; • An adverse effect on a species, natural community, or habitat that is specifically recognized as biologically significant in local, state, or Federal policies, statutes, or regulations; • Harm, harassment, or destruction of a species, natural community, or habitat that is recognized for scientific, recreational, ecological, or commercial importance; • An alteration or destruction of habitat that would prevent the reestablishment of native biological communities that inhabited the area prior to the disturbance; • An extensive loss of biological communities in high quality habitat for longer than one year; or • A violation of the Migratory Bird Treaty Act.
Special Status Species	Significance threshold would be reached if there were to result in harm, harassment, or destruction of any Federally listed endangered, threatened, or candidate species, its habitat, migration corridors, or breeding areas. Significance threshold would be reached if there were harm, harassment, or destruction of any birds of conservation concern.
Cultural Resources	Significance threshold would be reached if an alternative were to directly or indirectly alter the integrity and characteristics of a resource that would qualify it for inclusion in the National Registry of Historic Places (NRHP) (36 CFR 800.5a). Significance threshold would be reached if it were determined, in consultation with Federally recognized tribes or other tradition-based communities, that an alternative were to inhibit access to or use of culturally important locations or would interfere with cultural or religious practices.

Table 8-2
Thresholds of Significance
Stephenville, Texas

Resource	Thresholds of Significance
Hazardous Materials	Significance threshold would be reached if an alternative were to directly or indirectly create a hazard by exposing the public to hazardous materials at levels exceeding the range of risk generally considered acceptable to the EPA or other Federal or state agencies. Significance threshold would be reached if an alternative were to create a hazard to the public through transport, use, or disposal of hazardous materials or were to increase the likelihood of a hazardous materials release to the environment. Significance threshold would be reached if an alternative were to lead to a major increase in hazardous material used or wastes generated.
Socioeconomic Resources and Environmental Justice	Significance threshold would be reached if a project alternative would create an increase in population growth or the demand for housing, schools, or community facilities that is beyond the capacity of the region to accommodate. Significant effects also would result from the displacement of a large number of people, especially from affordable housing, a decrease in local employment, or a decrease in the accessibility of community facilities. Significant environmental justice effects would occur if a project alternative would disproportionately negatively affect low-income and minority populations.
Recreation	Significance threshold would be reached if an alternative were to result in a substantial decline in the quality or quantity of existing recreational facilities. Impacts on recreational activities would be considered significant if they were to result in a substantial decline in the quality or quantity of opportunities to participate in these recreation activities.
Visual Resources	Significance threshold would be reached if an alternative were to noticeably increase visual contrast and reduce the scenic quality, as seen from any high sensitivity foreground or middle ground viewpoint; if it were to block or disrupt existing views or reduce public opportunities to view scenic resources; or if visual impacts resulting from a project were to conflict with local regulations.
Noise	There are no universally applicable regulatory thresholds for assessing significance of noise impacts, but environmental noise regulations and guidelines are defined by various Federal and state agencies that provide a general context for assessing noise issues. The EPA calls out a maximum annual day/night noise level of 55 decibels (dBA) to protect public health and welfare for outdoor areas where interferes with normal speech or is found to be extremely annoying to those who frequent the area. Significance threshold would be reached if an alternative were to: violate EPA noise standards at the boundaries of the project area over an extended period of time; or create impulse or other short-term event noise levels that are likely to cause significant annoyance to more than 15% of exposed individuals at locations frequented by the general public.

8.5 Climate and Weather

No direct, indirect, or cumulative impacts on climate and weather would occur under any alternative.

8.6 Air Quality

8.6.1 No Action

Direct and Indirect Effects
Under the No Action Alternative, no project-related construction activities would take place and no new construction-related commute trips would occur. Thus, no construction-related emissions would be generated. Therefore no effects on air quality would occur.

Cumulative Effects
The project area and region of influence for cumulative impacts is in an attainment area regarding the NAAQS (EPA, 2003). No cumulative impacts on air quality would occur under this alternative. Therefore, this project would not contribute to other projects affecting air quality because the proposed action would cause no adverse impacts.

8.6.2 Recommended Plan

Direct and Indirect Effects
Construction and O&M activities associated with the Recommended Plan are expected to have only short-term and minor adverse impacts on local air quality. Such impacts would be primarily caused by increased emissions of carbon monoxide, hydrocarbons, and nitrous oxides from vehicles entering and exiting the site along with the operation of necessary equipment. Vehicle travel along unpaved road surfaces and excavation of bare ground surfaces that would create fugitive dust emissions. In addition to fugitive dust, project construction activities would generate tailpipe emissions from mobile heavy equipment and increased vehicular traffic. In a regional context the daily equipment emissions associated with project construction and O&M activities, even during maximum-intensity work periods, would be relatively minor. Impacts on air quality would be less than significant.

Cumulative Effects
In a regional context the daily equipment emissions associated with project construction and O&M activities, even during maximum-intensity work periods, would be relatively minor. Where direct impacts are negligible or minor, it is likely that those direct impacts would be too minimal to incrementally contribute to overall significant cumulative impacts. Therefore, the Recommended Plan would not produce measurable incremental impacts that would contribute to other projects affecting air quality. There would be no long term cumulative impacts.

Mitigation
All construction-related activities on unpaved roadways and bare and dry soil would employ dust-suppression control measures, such as watering, to limit fugitive dust emissions.

8.7 Soils and Geology

8.7.1 No Action

Direct and Indirect Effects

The No Action Alternative would result in the continuation of eroding banks along the North Bosque River within the City Park project area. Areas with steep banks and little vegetation, especially on the outside of bends, would continue to erode away soils, which would wash into the river. This would have a moderate long-term impact. Impacts on soils and geology would be less than significant.

Cumulative Effects

The cumulative effects area would be the area adjacent to and downriver from the project site on the North Bosque River. Cumulative soil conditions under the No Action Alternative would remain the same or possibly worsen if the banks on the North Bosque River in the project area were to continue to erode. While conditions may worsen in the project area, there would be no adverse cumulative impacts due to the minimal amount of direct impacts.

8.7.2 Recommended Plan

Direct and Indirect Effects

Minor, temporary impacts from soil erosion during construction would occur but would be minimized by mitigation measures. Long-term, minor to moderate, beneficial impacts would occur from increased bank stability from additional rooted vegetation.

Cumulative Effects

Minor short-term impacts from the Recommended Plan could combine with the Bosque River Trail project to cumulatively increase soil loss in the project area. But soil erosion from both projects is expected to be minimal and therefore cumulative impacts would not be significant. Other current actions such as the Tanglewood Subdivision and the Madison Development are not geographically related to the project area enough to combine with the Recommended Plan Alternative to cause cumulative impacts. The proposed action would have long-term beneficial impacts and therefore would not combine with other projects to cause any adverse impacts to soils.

Mitigation

Contractors would be required to have erosion control and hazardous spill prevention plans in place. Construction contractors would be required to prepare a Texas Pollutant Discharge Elimination System (TPDES) stormwater plan for general construction activity. The TPDES permit process requires development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) that describes the BMPs that would be employed before, during, and after construction to minimize erosion and runoff from construction activities.

8.8 Water Resources

8.8.1 No Action

Direct and Indirect Effects

The No Action Alternative would result in the continuation of eroding banks along the North Bosque River within the City Park project area. Areas with steep banks and little vegetation, especially on the outside of bends, would continue to erode and soil would continue to wash into the river. This would have a minor long-term impact on water quality by increasing the quantity of suspended solids in the river. No trees would be planted, which would remove the potential benefits on water quality of a healthier riparian corridor. Similarly the wetland at the WWTP would not be constructed, and the potential benefit of additional water cleansing prior to outfall in the river would not be realized. Impacts on water resources would be less than significant.

Cumulative Effects

The cumulative effects area is the North Bosque River area. Water resource conditions under the No Action Alternative would remain the same or possibly worsen if the North Bosque River banks in the project area were to continue to erode. While conditions may worsen in the project area, there would be no adverse cumulative impacts due to the minimal amount of direct impacts.

8.8.2 Recommended Plan

Direct and Indirect Effects

Site preparation and excavation, grading, and construction activities, associated with the Recommended Plan would result in substantial soil disturbance and could result in temporary discharges of soil materials directly into the river. Construction activities also have the potential to discharge hazardous substances into surface water and groundwater, such as fuel, oil, greases, and other petroleum products that may be used during construction. Soil discharged into the river can increase turbidity, stimulate the growth of nuisance algae and aquatic plants and increase sedimentation of habitat used by aquatic organisms. These impacts would be temporary and be reduced to minor and less than significant with the mitigation measures described below.

Cumulative Effects

Minor short-term impacts from the Recommended Plan could combine with the Bosque River Trail project to cumulatively increase soil loss, which could affect water quality downstream of the project area. But soil erosion from both projects is expected to be minimal and therefore cumulative impacts would not be significant. Other current actions such as the Tanglewood Subdivision and the Madison Development are not geographically related enough to the Recommended Plan area to cause cumulative impacts. The proposed action would have long-term beneficial impacts and therefore would not combine with other projects to cause any long-term adverse impacts to soils.

Mitigation

Contractors would be required to have erosion control and hazardous spill prevention plans in place. Construction contractors would be required to prepare a TPDES stormwater plan for general construction activity. The TPDES permit process requires development and implementation of a SWPPP that describes the BMPs, such as use of silt fences, which would be employed before, during, and after construction to minimize erosion and runoff from construction activities.

8.9 Wetlands and Floodplains

8.9.1 No Action

Direct and Indirect Effects

No wetlands would be directly affected by the No Action Alternative. Indirectly, continued erosion of riverbanks would lead to a reduction of wetlands along the river. The wetlands at the WWTP would not be constructed, so that their environmental benefits would not be realized. These impacts would be long-term and adverse but minor and less than significant.

Cumulative Effects

The cumulative effects area for this resource area would be the areas adjacent to and downriver from the project site on the North Bosque River. Wetland and floodplain conditions under the No Action Alternative would remain the same or possibly worsen if the banks of the North Bosque River in the project area were to continue to erode. While conditions may worsen in the project area, there would be no adverse cumulative impacts due to the minimal amount of direct impacts.

8.9.2 Recommended Plan

Direct and Indirect Effects

Construction along the river to stabilize banks, plant vegetation, and install features in the river channel would temporarily disturb the jurisdictional Waters of the United States within the floodplain of the North Bosque River. These would be minor, short-term impacts. The wetlands would be improved and be larger, more functional after restoration efforts. Other wetlands along the river segment, which won't be restored, may indirectly be affected by changes in the directional flow of water, increasing or decreasing quantity of water and frequency of flooding. Plantings would provide for a seed source, so that these species may spread to unplanted areas. These changes would generally have a beneficial, minor to moderate, long-term impact on wetlands and floodplains.

The construction of a wetland complex at the WWTP would substantially increase the quantity of wetlands, especially emergent marshes, in the study area and the City of Stephenville. This would also have beneficial impacts in terms of water quality and wetland-dependent wildlife. No adverse impacts on wetlands or floodplains are expected from this project component.

No significant adverse impacts on wetlands or floodplains would occur under this alternative.

Cumulative Effects

Previously, wetland and floodplain areas of the North Bosque River in the project area have been excavated, diked, and artificially flooded. Also, previous development along the river bank and development projects such as the Riverwalk and Westside developments, that included paving over exposed soils have increased potential flood runoff problems. These historical trends are negative trends for wetlands and floodplains. Minor short term impacts from the proposed action could combine with the Bosque River Trail project to cumulatively increase soil loss which could have minor short term effects on wetlands in and near the project area. Impacts on wetlands from both the Bosque River Trail project and the Recommended Plan Alternative are expected to be temporary and minimal and therefore, cumulative impacts would not be significant. Other current actions such as the Tanglewood Subdivision and the Madison Development are not geographically related to the Recommended Plan area enough to combine to cause cumulative impacts. The Recommended Plan would have long-term beneficial impacts on wetlands and floodplains and therefore would counteract a negative historical trend, and therefore, the proposed action would not have any adverse cumulative impacts on wetlands or floodplains.

Mitigation

Mitigation measures described for water resources in Section 8.8.2 would also protect wetlands and floodplains. In addition, contractors would be required to avoid wetlands not scheduled for restoration. A Clean Water Act, Section 404 permit would be issued by the USACE to authorize dredge and fill of Jurisdictional Waters of the United States. All conditions set forth in that permit would be followed.

8.10 Vegetation

8.10.1 No Action

Direct and Indirect Effects

No impacts from construction would occur. However, the restoration measures to improve quantity, diversity, and quality of vegetation in the project area would not be implemented. The quality of the vegetation in the project area would gradually decrease over time as the river erodes the bank on the park side of the river. Steep banks and a lack of an established riparian buffer between the river and the park lawns would gradually decrease the number of trees along this side of the river. The WWTP study area would remain vegetated primarily in grasses and weeds. These would be long-term moderate adverse impacts. No significant adverse impacts on vegetation would occur under this alternative.

Cumulative Effects

The cumulative effects area would be the areas adjacent to and downriver from the project site on the North Bosque River. Vegetation conditions, including tree cover, under the No Action Alternative would remain the same or possibly worsen if the North Bosque River banks were to continue to erode. While conditions may worsen in the project area, there would be no adverse cumulative impacts on vegetation due to the minimal amount of direct impacts.

8.10.2 Recommended Plan

Direct and Indirect Effects

Minor, short-term, localized adverse impacts on vegetation would occur where construction and need for access necessitates removal or disturbance of vegetation. These impacts would be minimized as much as possible with the mitigation measures below, and residual impacts would be less than significant. Implementing this alternative would primarily have moderate, long-term, beneficial impacts on vegetation. Several native species of trees, shrubs, and herbaceous vegetation would be planted in the riparian area of the river. This would increase the quantity and diversity of vegetation in the project area, which would have indirect beneficial effects on many other resources.

At the WWTP existing vegetation, which is primarily comprised of grasses and weeds, would be removed. The herbaceous emergent wetland vegetation that would be planted in the wetland complex would represent a long-term moderate beneficial effect, because such vegetation is currently, a limited resource in the area. Newly planted vegetation would also help improve water quality and provide habitat for wetland-dependent wildlife.

No significant adverse impacts on vegetation would occur under this alternative.

Cumulative Effects

Minor short term impacts from the proposed action could combine with the Bosque River Trail project to cumulatively increase soil loss which could have minor short term effects on vegetation in and near the project area. Impacts on wetlands from both the Bosque River Trail project and the Recommended Plan are expected to be temporary and minimal and therefore, cumulative impacts would not be significant. Other current actions such as the Tanglewood Subdivision and the Madison Development are not geographically related to the Recommended Plan enough to combine to cause cumulative impacts.

Previously, wetland and floodplain areas of the North Bosque River in the project area have been excavated, diked, and artificially flooded. This historical trend is a negative one for vegetation. The proposed action would have long-term beneficial impacts on wetlands and floodplains and therefore would counteract a negative historical trend.

Mitigation

Construction contractors would be required to minimize destruction of vegetation not scheduled for removal by minimizing the number of access points to the river and locating them in areas with the least amount of desirable vegetation to the extent possible.

8.11 Fish

8.11.1 No Action

Direct and Indirect Effects

No construction related impacts on fish would occur under the No Action Alternative. However, beneficial impacts on fish from restoration efforts under the proposed action would also not occur. Temperatures in the river could rise within the project area as erosion gradually removes trees and their shading from the park-side bank. These would be long-term, minor, adverse impacts, which would be less than significant.

Cumulative Effects
The cumulative effects area for fish would be the area adjacent to and downriver from the project site on the North Bosque River. Conditions for fish under the No Action Alternative would remain the same or possibly worsen if the North Bosque River were to continue to erode and water temperature were to rise. While conditions may worsen in the project area under No Action, there would be no adverse cumulative impacts on vegetation due to the minimal amount of direct impact.

8.11.2 Recommended Plan

Direct and Indirect Effects
Construction activities in and adjacent to the river could cause silt to accumulate in the river, which could affect reproduction and the forage base of resident fish. These impacts would be largely reduced by the mitigation measures described below, so that the residual adverse impact would be short-term and negligible to minor.

The results of the proposed restoration measures under this alternative would likely have minor to moderate long-term beneficial effects on fish in the project area. Instream structures such as rock weirs, riffles, cross vanes, and rootwads, would increase habitat diversity for fish, which would likely increase the diversity of fish species present in the project area. Species whose habitat requirements include more structure, moving water, or oxygen would be the most likely to benefit. Improvements to the riparian area including bank stabilization and tree planting would indirectly benefit fish by increasing shading and thus decreasing temperatures in the river. These measures would also decrease erosion and long-term sedimentation problems. Increasing the quantity of woody vegetation along the river would increase the amount of woody debris in the river in the long-term, which is generally beneficial to many species as it provides escape cover.

The wetland located at the WWTP site could be stocked with small native fish to provide a food source for wading birds, such as the great blue heron. This would introduce fish into an area that currently has no water and thus no fish habitat. Because only species native to the North Bosque River would be used, no adverse impacts would be expected.

No significant adverse impacts on fish would occur under this alternative.

Cumulative Effects
Previously, wetland and fish habitat areas of the North Bosque River in the project area have been excavated, diked, and artificially flooded. This historical trend is a negative one for riparian areas and fish habitat. Minor short term impacts from the proposed action could combine with the Bosque River Trail project to cumulatively increase soil loss which could cause silt to accumulate in the areas adjacent to or downstream of the project area. Soil erosion and resulting silt buildup from both projects is expected to be minimal and therefore cumulative impacts would not be significant. Other current actions such as the Tanglewood Subdivision and the Madison Development are not geographically related to the Recommended Plan enough to cause cumulative impacts. The proposed action would have long-term beneficial impacts on riparian areas and fish habitat and therefore would counteract a negative historical trend.

Mitigation
Mitigation measures described for water resources in Section 8.8.2 would also protect fisheries. Construction activities in the river channel would not be conducted during the spawning season of resident fish.

8.12 Wildlife

8.12.1 No Action

Direct and Indirect Effects
If the No Action Alternative were implemented, beneficial impacts on wildlife would not be realized. The quality of wildlife habitat in the project area and the density and diversity of wildlife species would remain similar to existing conditions in the short-term. In the long-term these conditions may gradually deteriorate in the City Park project area as the riparian area is lost to the eroding river and trees do not regenerate due to vertical slopes and mowed lawns adjacent to the river. These would be long-term, minor, adverse impacts.

At the WWTP the former drying beds would not be converted to wetland, so that a substantial increase in a limited, productive habitat type would not be created. Resident and migratory wetland-dependent wildlife would not occur there. If the drying beds were left completely unmanaged, they would gradually change through succession with more shrubs and trees becoming established. The wildlife community using the area would gradually change, and it would become more suitable for some species and less for others. Overall, it would likely improve slightly. Implementing the No Action Alternative would not have any adverse impacts on wildlife at the WWTP. However, overall value of the site for wildlife would likely be substantially less than under the Recommended Action Alternative.

No significant adverse impacts on wildlife would occur under this alternative.

Cumulative Effects
The cumulative effects area for wildlife would be the project site itself and areas adjacent to and downriver from the project site on the North Bosque River. Conditions for wildlife under the No Action Alternative would remain the same or possibly worsen if the long-term conditions continued to deteriorate as the riparian area is lost to the eroding river and trees do not regenerate. Conditions for wildlife in the WWTP project area may improve slightly. Overall value of the site for wildlife would likely be less than under the Recommended Action Alternative. Because no significant adverse impacts on wildlife would occur under this alternative, there would be no adverse cumulative impacts.

8.12.2 Recommended Plan

Direct and Indirect Effects
Implementing the Recommended Plan would have several long-term, beneficial impacts on wildlife. These impacts would range from negligible to moderate, depending on species. Proposed plantings in the riparian area at City Park would increase the size of the riparian area. This increase would provide more habitat to species adapted to riparian and forested habitats.

Planting trees that produce mast (fruit) and native grasses and shrubs would provide an abundant food source. Improved fish habitat could result in improved foraging opportunities for pisciverous (fish-eating) birds such as great blue heron and belted kingfisher. HSI values would likely increase for most species used in the HEP analysis from the baseline conditions as defined and described in Section 2.10, and AAHUs would increase from 45.36 to an estimated 72.26 as defined and described in Section 5.3.

Adverse impacts would be limited to minor, localized, temporary impacts from construction activities, which could disturb and displace wildlife from noise, human presence, and physical disturbance of habitat. These impacts would be more than offset by mitigation and long-term beneficial effects. No significant adverse impacts would occur.

Cumulative Effects

Previously, fish habitat areas of the North Bosque River in the project area have been excavated, diked, and artificially flooded. Construction and grading for municipal and residential development has disturbed upland habitat and contributed to runoff, which has led to silt build up in the North Bosque River. Examples of such past projects that have reduced upland habitat in the Stephenville area include the Westside and Riverwalk developments. This historical trend is a negative one for upland and some wildlife habitat. Implementing the Recommended Plan would have several long-term, direct beneficial impacts on wildlife that would counteract these negative trends. The Recommended Plan would have long-term beneficial impacts on riparian areas and fish habitat and therefore would counteract a negative historical trend, thereby having a beneficial cumulative impact on fisheries resources. Short term adverse impacts from construction would be offset by mitigation measures and long term beneficial impacts and thus would not incrementally contribute to overall negative cumulative effects.

Mitigation

As described in Section 8.10.2, destruction of existing trees would be minimized. This would reduce temporary habitat loss for wildlife. Tree removal would be restricted to outside of the breeding season of most bird species (spring through mid-summer).

8.13 Special Status Species

8.13.1 No Action

Direct and Indirect Effects

Implementing the No Action Alternative is unlikely to have any impacts on threatened, endangered, proposed, or candidate species as appropriate habitats are not present (USFWS, 2002). Appropriate habitat within the project area for BCC species that frequent riparian areas, such as Bell's vireo and painted bunting may decrease gradually in the long-term due to the deterioration of the riparian corridor in the City Park project area. Improvements to riparian and marsh habitats that could benefit riparian and marsh species under the Recommended Plan would not occur. In general negligible, long-term, adverse impacts on BCC species would occur under the No Action Alternative.

Cumulative Effects

The cumulative effects area for special status species would be the project site itself and areas adjacent to and on the North Bosque River. Conditions for special status species under the No Action Alternative would remain the same or possibly worsen if the long-term conditions continued to deteriorate as the riparian area is lost to the eroding river and trees do not regenerate. Overall value of the site for special status species, including BCC species would likely be lower than under the Recommended Plan Alternative. Because only negligible impacts on special status species would occur under this alternative, there would be no adverse cumulative impacts.

8.13.2 Recommended Plan

Direct and Indirect Effects

Negligible to minor beneficial impacts on threatened and endangered species from the proposed conservation measures could occur. No threatened or endangered species currently use the project area. The additional trees, possible improvements in fish populations, and the likely presence of waterfowl in winter at the WWTP wetland site slightly increases the probability of bald eagle use of the area in the long-term because of an increase in suitable food sources and perching and roosting locations. The project area is within the approximate migratory route used by whooping cranes to and from their wintering location on the Texas coast. While it is unlikely that whooping cranes would stop in the completed wetland in the WWTP project area during migration, the construction of this wetland would slightly increase that possibility. Black-capped vireo and golden-cheeked warbler are unlikely to be affected by the Recommended Plan Action. No threatened, endangered, proposed, or candidate species are likely to be adversely affected by the Recommended Plan (USFWS, 2003).

Implementing the Recommended Plan would have beneficial impacts on little blue heron, a species on the USFWS BCC list. Because this species uses inland marshes and the Recommended Plan includes construction of a large marsh at the WWTP, the chances of this species occurring in the project area would increase. Species that use riparian areas would benefit from the Recommended Plan including Bell's vireo and painted bunting. Beneficial impacts on the other BCC species would range from negligible to minor. Implementing the Recommended Plan would have no adverse impacts on BCC species.

Cumulative Effects

Previously, fish habitat areas of the North Bosque River in the project area have been excavated, diked, and artificially flooded. Construction and grading for municipal and residential development has disturbed upland habitat in areas surrounding the project area. This historical trend is a negative one for upland and aquatic wildlife and wildlife habitat. Implementing the Recommended Plan would have minor, direct beneficial impacts on wildlife that would counteract these negative trends. The Recommended Plan would have long-term beneficial impacts on habitat of certain BCC species and therefore would counteract a negative historical trend. Short term adverse impacts from construction would be offset by mitigation measures and long term beneficial impacts and therefore not incrementally contribute to overall negative cumulative effects.

Mitigation
It is unlikely that any mitigation would be necessary for threatened or endangered species. If a threatened or endangered species is encountered during construction, all work would immediately cease and the USFWS in Arlington, Texas would be contacted. In order to avoid adverse impacts to nesting birds including BCC species, construction would take place outside of the breeding season (spring through mid-summer).

8.14 Cultural Resources

8.14.1 No Action

Direct and Indirect Effects
Because no cultural resources were found in the project area, no impacts on cultural resources would occur under the No Action Alternative (EComm, 2004).

Cumulative Effects
Cultural resources under the No Action Alternative would remain the same as current conditions in or adjacent to the project site. There would be no cumulative impacts

8.14.2 Recommended Plan

Direct and Indirect Effects
Because no cultural resources were found in the project area, no impacts on cultural resources would occur under the No Action Alternative (EComm, 2004).

Cumulative Effects
Because no cultural resources are located in the project area, there would be no cumulative impacts.

Mitigation
No mitigation would be necessary for cultural resources.

8.15 Hazardous Materials

8.15.1 No Action

Direct and Indirect Effects
There would be no impacts related to hazard materials under the No Action Alternative.

Cumulative Effects
The cumulative effects area would be the area adjacent to the project. Hazardous waste conditions under the No Action Alternative would remain the same as current conditions on the project site if there was no project. There would be no cumulative impacts.

8.15.2 Recommended Plan

Direct and Indirect Effects

Implementing the Recommended Plan would have no impact on hazardous waste conditions in or near the project area. No HTRW sites were found within or adjacent to the proposed project boundaries (EDR, 2003a; EDR, 2003b).

Cumulative Effects

Hazardous waste conditions under the Recommended Plan Alternative would remain the same as current conditions in or adjacent to the project site. There would be no cumulative impacts.

Mitigation

Excavation would not be carried out deeper than planned for in the Recommended Plan, as described in Section 6.2.1, without further review of the HTRW site survey (Appendix D) to determine if feasible pathways exist between any recognized environmental conditions and places of planned excavation. Additionally, soil and water sampling may be needed.

8.16 Socioeconomics and Environmental Justice

8.16.1 No Action

Direct and Indirect Effects

Implementing the No Action Alternative would have no effect on socioeconomics or environmental justice because the project area is located entirely on City-owned land and not implementing the project would not disproportionately affect any low income or minority populations.

Cumulative Effects

The cumulative effects area for socioeconomics and environmental justice would be the community surrounding the project. Conditions for socioeconomics and environmental justice under the No Action Alternative would remain the same on the project site if there were no project. There would be no cumulative impacts.

8.16.2 Recommended Plan

Direct and Indirect Effects

Implementing the Recommended Plan Alternative would have no effect on socioeconomics or environmental justice because the project would be located entirely on City-owned land and implementing the project would not disproportionately affect any low income or minority populations.

Cumulative Effects

Socioeconomics and environmental justice conditions under the Recommended Plan Alternative would remain the same as current conditions in the community surrounding the project site. There would be no cumulative impacts.

Mitigation
No mitigation would be needed for socioeconomics or environmental justice if the Recommended Plan were implemented.

8.17 Recreation

8.17.1 No Action

Direct and Indirect Effects
Implementing the No Action Alternative would have no adverse impacts on recreation in the project area. The beneficial impacts described in Section 8.17.2 would not occur.

Cumulative Effects
Recreation conditions under the Recommended Plan Alternative would remain the same as current conditions in or adjacent to the project site. There would be no cumulative impacts.

8.17.2 Recommended Plan

Direct and Indirect Effects
Most of the existing recreational facilities within the City Park, such as athletic fields, gazebos, etc., are outside of the project area and would be largely unaffected by the Recommended Plan. A paved trail and several picnic tables near the river would be affected by the project. Picnic tables would likely be retained in the same or similar numbers near the river, but they would likely be regrouped, so that they are located in more open areas of the riparian zone. The existing paved path would likely be retained or portions would be moved to accommodate bank stabilization activities, but would, over time, become redefined rustic as vegetation grows around it. A new trail would be constructed on the outside of the riparian zone alongside the existing fence and road to serve as O & M access and a running and biking trail. These changes could either be adverse or beneficial impacts depending on the recreational preferences of each user. The existing paved path would likely be retained but would, over time, become more rustic as vegetation grows around it. There would be a temporary, moderate, adverse impact on walking, biking, and picnicking near the river during construction due to area safety closures, noise, dust, and decreased quality of aesthetics from machinery and ground excavation. All adverse impacts on recreation would be less than significant. There is likely some current use of this area for bird watching and other wildlife and nature observation, some of which is incidental to other activities. The project would have moderate, long-term, beneficial impacts on this type of activity as the riparian area gradually matures and wildlife becomes more diverse and abundant.

Recreation at the WWTP site is almost nonexistent, so that there would be no adverse impacts if the Recommended Plan were implemented. Moderate, long-term, beneficial impacts on recreation would likely occur from the Recommended Plan. The proposed wetland at the WWTP would provide bird watching as well as environmental education opportunities. This wetland site could be linked to other current and future parks and trails in Stephenville providing a new, potentially important addition to the Stephenville Parks system.

Cumulative Effects

The City Park Improvements program has improved recreational facilities in the Stephenville area in previous years. The Bosque River Trail project is planned for next year and would improve recreation in the Bosque River area. This recreation trend is a positive one. Implementing the Recommended Plan would have direct beneficial impacts on recreation that would contribute to these positive trends. Short term adverse impacts from construction and moving the trail and some tables would probably be neutral. Any impacts to individuals from these short term impacts would be offset by mitigation measures and long term beneficial impacts. Overall cumulative effects to recreation would be beneficial.

Mitigation

Picnic tables near construction areas would be moved prior to construction. Mitigation measures described for air quality in Section 8.6.2, visual resources in Section 8.18.2, and noise in Section 8.19.2 would also decrease adverse impacts on recreation.

8.18 Visual Resources

8.18.1 No Action

Direct and Indirect Effects

Long-term, minor, adverse changes to the appearance of the project area would occur along the riverbanks. Erosion would continue, so that the exact locations of the riverbanks would gradually change. Additional vertical slopes would likely develop over time. The quantity of mature trees along the river would likely decrease as erosion causes them to fall into the river and not be able to regenerate on vertical slopes adjacent to mowed lawns.

Changes to the appearance of the WWTP site associated with the Recommended Plan would also not occur. Specifically the appearance of this site would generally be that of an old field rather than a marsh, and the exact appearance would largely be determined by how the vegetation is maintained within the former sludge drying ponds.

Cumulative Effects

The cumulative effects area for visual resources would be viewpoints from which the project area and adjacent areas are visible from both sides of the North Bosque River. Because the quantity of trees would decrease, vegetation conditions under the No Action Alternative would remain the same or possibly worsen if the North Bosque River banks were to continue to erode. Minor short term changes in views would occur in the area due to construction for the Bosque River Trail project. But these impacts would not combine with the long term changes from the No Action Alternative due to different time periods for both. There would be no cumulative recreation impacts.

8.18.2 Recommended Plan

Direct and Indirect Effects

If the Recommended Plan Alternative were implemented, there would be a minor to moderate, temporary, adverse impact on visual resources along the river within the City Park. This would largely be due to construction activities including the presence of heavy machinery, excavated earth, unvegetated areas, and temporary fencing. In the long-term, impacts of the Recommended Plan would be moderate and beneficial. Vertical slopes would largely be eliminated and additional large trees would be present. The river would contain more riffles and less flat, stagnant water, and would generally have a more diverse appearance.

At the WWTP site the appearance of the former sludge drying beds would be drastically different. This area would be converted from a dry field appearance to a wetland complex with standing water, islands, and waterfowl being the most obvious differing features. The configuration of the interior dikes would also be altered, as would the vegetation present both within the ponds and surrounding. A line of trees between the WWTP facilities and the wetland would over time shield the view of the facility's infrastructure from the wetland complex. These changes would be moderate, long-term impacts and generally beneficial in nature. Adverse impacts would generally be limited to short-term, moderate impacts from construction of the wetland complex. These impacts would affect very few people, primarily employees at the WWTP and one residence located to the south of the future wetlands area. No primary road, trail, or business borders the proposed wetland location. These impacts would be less than significant.

Cumulative Effects
Minor short term impacts from the Recommended Plan could combine with the Bosque River Trail project to cumulatively cause minor cumulative visual impacts in the North Bosque River area. Impacts on visual resources from both projects are expected to be temporary and minimal and therefore, cumulative impacts would not be significant. Other current actions, where similar use of construction machinery is being used, such as the Tanglewood Subdivision and the Madison Development, are not geographically related to the Recommended Plan enough to combine to cause cumulative impacts.

Previously, vegetation near the North Bosque River in the project area has been negatively effected by excavation and diking. This historical trend is a negative one for visual resources. The Recommended Plan would have long-term, direct beneficial impacts on visual resources and therefore would counteract a negative historical trend. The Recommended Plan would have long term beneficial cumulative impact.

Mitigation
Mitigation described for water, as described in Section 8.8.2, and vegetation as described in Section 8.10.2, would minimize impacts on the visual quality of these resources during construction.

8.19 Noise

8.19.1 No Action

Direct and Indirect Effects
No impacts from noise would occur under the No Action Alternative.

Cumulative Effects
Noise conditions under the No Action Alternative would remain the same as current conditions in or adjacent to the project site. There would be no cumulative impacts.

8.19.2 Recommended Plan

Direct and Indirect Effects
Implementing the Recommended Plan would result in temporary, minor to moderate, adverse noise impacts from heavy machinery during construction. These impacts would likely only affect visitors to the park especially near the river. Residences to the west of the river may be close enough to hear construction, but distance would likely be sufficient that these impacts would be negligible. After construction is complete, no changes from existing conditions are anticipated. In fact, a reduction of the noise from the WWTP pumps and equipment may be experienced by the surrounding residences from the tree screen and increased vegetation.

Cumulative Effects
Minor short term impacts from the Recommended Plan could combine with the Bosque River Trail project to cumulatively cause minor cumulative noise impacts in the Bosque River area. Impacts from noise from both projects are expected to be temporary and minor. Construction would rarely occur at the same time and in close enough proximity to create significant cumulative noise impacts. Other current actions, where similar use of construction machinery is being used, such as the Tanglewood Subdivision and the Madison Development, are not geographically related to the Recommended Plan area enough to combine to cause cumulative impacts. Therefore, cumulative impacts would not be significant.

Mitigation
Construction work would not be conducted on weekends when more visitors are present in the park. Construction timing would be coordinated with City of Stephenville Parks Department to minimize impacts on special events.

9.0 PUBLIC INVOLVEMENT AND AGENCY COORDINATION

9.1 Views of Sponsor

The City of Stephenville is identified as the non-Federal partner. The City of Stephenville has been involved in the plan development process and initial restoration parameters, cost sharing and implementation procedures have been agreed upon by the city. In a letter August 1, 2001, the City of Stephenville issued a statement of intent to participate in the restoration project. This letter is provided in Appendix I.

9.2 Agency Coordination

The USFWS and BRA have been involved during the development of the project alternative plans. The USFWS participated in the initial field inspection of the project area and authored the Planning Aid Letter including the HEP analysis. Recommendations made from the collaboration of the USFWS, BRA and City of Stephenville helped formulate the restoration measures proposed in this document. Letters of support, from the USFWS and the BRA are included in Appendix J.

9.3 Other Project Requirements

This document was prepared in accordance with the WRDA of 1986, as amended by Section 206 of WRDA 1996; cost sharing for ecosystem restoration features would be 65 percent Federal and 35 percent non-Federal. The costs for all operations and maintenance for the recommended plan would be the responsibility of the non-Federal sponsor.

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) were considered during the development of the proposed project. Due to the nature of the project area and the intent of restorative action, no practical alternatives were identified in conducting the project outside the floodplain. However, no proposed action would significantly alter or impact the existing boundary of the 100-year floodplain. Furthermore, no negative impacts or loss of wetlands should occur as a result of project implementation. Coordination with the sponsor indicated that the proposed project would not violate any existing City of Stephenville and FEMA regulations/policies regarding floodplain development.

USFWS completed a planning aid letter for the USACE pursuant to the Fish and Wildlife Coordination Act, which also contained the HEP analysis and informal Section 7 Environmental Site Assessment (ESA) documentation. USFWS stated that the project "is not likely to adversely affect these Federally listed, proposed listed, or candidate species."

10.0 CONCLUSIONS

This DPR/EA documents the results of a study conducted under the authority of Section 206 of the WRDA of 1996, as amended (33 USC 2201). The purpose of the study was to develop a recommended plan for restoring the aquatic and riparian habitats of the Stephenville City Park and the Stephenville WWTP area along the North Bosque River.

The recommended plan (Plan 8) would increase the habitat value of the study area over the life of the project by creating approximately 45.1 acres of emergent wetlands complex and reforesting approximately 18.4 acres of riparian corridor habitat. In addition, bank stabilization and in-stream aquatic measures would be installed throughout a 0.5-mile reach of the North Bosque River in the vicinity of the Stephenville City Park. Water quality and in-stream aquatic habitat benefits would occur for approximately 5.8 acres of the North Bosque River. The restoration of these distinct habitats would improve biodiversity and the habitat capacity for migratory and resident wildlife. Various fish species would eventually be stocked within the wetland to complete the food cycle of the wetland habitat.

Total project costs for the recommended plan were determined through a series of evaluations based on average AAHUs and incremental costs. The total project costs associated with the recommended plan are estimated to be $2,378,295 including engineering plans and specifications, LERRDs, and post project monitoring. The City of Stephenville has been identified as the non-Federal sponsor of the recommended plan, and has been presented with the findings of this report. The total estimated project costs would be shared at 65 percent Federal and 35 percent non-Federal. The City of Stephenville has offered their support for the recommended plan, including the cost-sharing plan, and has agreed to assume responsibilities for all operation, maintenance, replacement, and repair costs.

An EA was integrated into this DPR to assess the possible impacts of the recommended plan. A public notice will be released prior to initiation of construction disclosing the availability of the EA. If appropriate, a FONSI would be issued after reviewing comments of the EA.

11.0 RECOMMENDATIONS

I propose that the recommended plan described in this Detailed Project Report be authorized for implementation under the authority of Section 206 of the Water Resources Development Act of 1996, Public Law 104-303, as a Federal project, with such modifications as in the discretion of the Chief of Engineers may be advisable. The initial cost of this project is estimated to be $2,378,295.

Prior to the commencement of construction, local interests must agree to meet the requirements for non-Federal responsibilities as outlined in this report and future legal documents. The City of Stephenville has demonstrated that they have the authority and the financial capability to provide all non-Federal requirements for the implementation, operation, and maintenance of the project. The recommendations contained herein reflect the information available at this time and current Department of the Army policies governing formulation of individual projects. They do not reflect the program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch.

John R. Minahan
Colonel, U.S. Army Corps of Engineers
District Engineer

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13.0 REFERENCES

Airgrades. 2004. US Air Quality Gradebook, "Bosque County". Internet website: http://airgrades.net/airquality/sources/index.htm. Accessed on September 16, 2004.

Armstrong, M.P. 1998. A Fishery Survey of the Middle Brazos River Basin in North-Central Texas. Unpublished Report. U.S. Fish and Wildlife Service, Arlington, TX. 72pp.

BRA (Brazos River Authority). 2003. Brazos River Authority, "Basin History". Internet web site: http://www.brazos.org/ORGANIZATION/history.htm. Accessed on January 7, 2004.

Cowardin, Lewis M., V. Carter, and F.C. Golet. 1992. Classification of Deepwater Habitats of the United States. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79-3 1. 131 pp.

Diggs, G.M., Jr., B.L. Lipscomb, and R. J. O'Kennon. 1999. Shinners & Mahler's Illustrated Flora of North Central Texas. Botanical Research Institute of Texas and Austin College. 1626 pp.

EComm. 2004. Archeological Survey on Two Property Locations within the City of Stephenville, Erath County, Texas. Ecological Communications Corporation. October 2004.

EDR. 2003a. The EDR Radius Map with GeoCheck® for Waste Water Treatment Plant, Stephenville, Texas 76401. Environmental Data Resources, Inc. October 9, 2003.

EDR. 2003b. The EDR Radius Map with GeoCheck® for North Bosque River, Stephenville, Texas 75401. Environmental Data Resources, Inc. October 9, 2003.

EPA (US Environmental Protection Agency). 2003. The Green Book: USA Air Quality Non-attainment Areas, Summary Population Exposure Report. Internet Web site: http://www.epa.gov/airs/nonattn.html. Accessed on June 18, 2003.

FEMA (Federal Emergency Management Agency). 1991. Flood Insurance Rate Map for Stephenville, Texas, Erath County. July 16, 1991.

NOAA (National Oceanic and Atmospheric Administration). 2003. North Central Texas Climatology, Hico, Hamilton County, TX. National Weather Service Forecast Office, Fort Worth Texas. Internet web site: http://www.srh.weather.gov/fwd/CLIMO/coop/hico.html. Accessed on December 1, 2003.

Noss, R.F., E.T. La Rose III, J.M. Scott. 1997. Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation. National Biological Service, Washington, D.C., 1997.

Robinson, R.K., W.J. Hansen, and K.D. Orth. 1995 Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses. U.S. Army Corps of Engineers Institute for Water Resources. Alexandria, Virginia.

Schrickel, Rollins and Associates, Inc. Stephenville Park Drawing for Century Park Master Plan. No date.

Stephenville, Texas, Chamber of Commerce. 2003. Entertainment & Leisure, Parks. Internet Web site: http://www.stephenvilletexas.org/community/Parks.cfm. Accessed on June 20, 2003.

Stephenville, City of. 2004a. Community Profile. Internet website: http://www.ci.stephenville.tx.us/. Accessed on September 22, 2004.

Stephenville, Texas. 2004b. Stephenville, Texas Detailed Profile. Internet website: http://www.city-data.com/city/Stephenville-Texas.html. Accessed on October 20, 2004.

TCEQ (Texas Commission on Environmental Quality, Total Maximum Daily Load Program). 2002. Improving Water Quality in the North Bosque River, Two Total Maximum Daily Loads (TMDLs) for Phosphorous.

Tetra Tech. 2003. Unpublished Biological Field Survey. February 10, 2003.

TNRCC (Texas Natural Resource Conservation Commission). 2001. Two Total Maximum Daily Loads for Phosphorus in the North Bosque River. Internet Web site: http://www.tnrcc.state.tx.us/water/quality/tmdl/bosque_tmdl.pdf. Accessed on January 7, 2004.

TSHA (The Texas State Historical Association). 2003. The Handbook of Texas Online, "Bosque River". Internet web site: http://www.tsha.utexas.edu/handbook/online/articles/view/BB/rnb5.html. Accessed on January 7, 2004.

USACE. 1999. Draft Programmatic Environmental Impact Statement, Upper Trinity River Basin, Trinity River, Texas.

USACE. 2001. Section 206 Preliminary Restoration Plan. U.S. Army Corps of Engineers, Southwestern Division, Fort Worth District, Fort Worth, TX.

USDA SCS (US Department of Agriculture Soil Conservation Service). 1973. Soil Survey of Erath County, Texas. January, 1973.

USFWS (US Department of Interior, Fish and Wildlife Service). 1980. The Habitat Evaluation Procedures. USDI Fish and Wildlife Service, Ecological Services Manual, 102. 124pp.

USFWS. 2002. Birds of Conservation Concern 2002. Division of Migratory Bird Management, Arlington, Virginia. 99 pp.

USFWS. 2003. Existing Conditions and Recommendations for the North Bosque River Aquatic Ecosystem Restoration Project Located in Stephenville, Texas. US Fish and Wildlife Service, Region 2, Albuquerque, New Mexico. March 4, 2003.

USFWS. 2004. News Release – Black-Tailed Prairie Dog Removed from Candidate Species List. August 12, 2004. Internet website: http://mountain-prairie.fws.gov/pressrel/04-57.htm. Accessed on August 31, 2004.

USGS (United States Geological Survey). 2003. Ground Water Atlas of the United States. Internet web site: http://capp.water.usgs.gov/gwa/ch_e/E-text8.html. Accessed June 20, 2003.

Wells, D. 2004. Community Services Director, City of Stephenville. Personal Communication with Craig Miller of Tetra Tech, Inc. August 27, 2004.

APPENDIX A

SITE PHOTOS

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	East	D. Lindsay	Recreation overlook located north of project area

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	East	D. Lindsay	Ducks within North Bosque River located upstream of project area

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	East	D. Lindsay	Existing water weir located upstream of project area

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	Southeast	D. Lindsay	Road and culvert located at the upstream boundary of project area

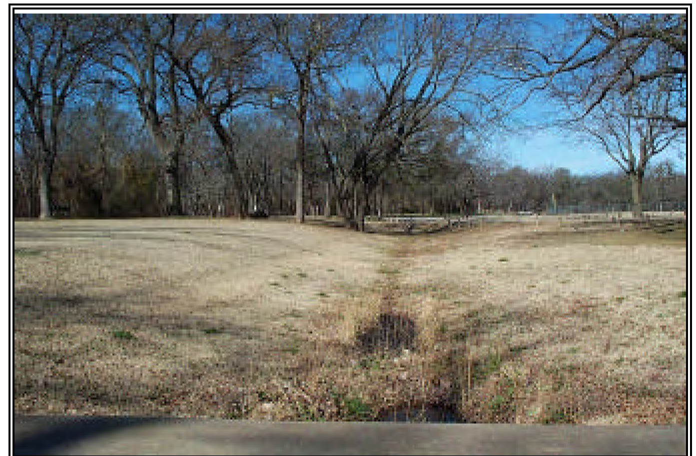
DETAILED PROJECT REPORT/ENVIRONMENTAL ASSESSMENT
Stephenville, Texas

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:	DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	West	D. Lindsay	Bank erosion at northern portion of stream reach.	Feb 03	West	D. Lindsay	Northern portion of stream reach near stormwater channel

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:	DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	South	D. Lindsay	Typical conditions within project area.	May 02	Northwest	D. Lindsay	North Bosque River within City Park project area

DETAILED PROJECT REPORT/ENVIRONMENTAL ASSESSMENT
Stephenville, Texas

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	North	D. Lindsay	Bosque River walking trail within City Park project area



DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	North	D. Lindsay	Typical photo, City Park project area

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	South	D. Lindsay	Wastewater line located downsteam of project area.

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	South	D. Lindsay	Wastewater line support, located downstream of project area.

DETAILED PROJECT REPORT/ENVIRONMENTAL ASSESSMENT
Stephenville, Texas

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Jun 04	Northeast	D. Lindsay	Proposed wetland area showing existing conditions of WWTP drying beds.

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Jun 04	Southeast	D. Lindsay	Proposed wetland area showing existing conditions of WWTP drying beds

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	Southeast	D. Lindsay	Existing conditions of WWTP looking towards earthen spillway

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Feb 03	East	D. Lindsay	Earthen spillway constructed in berm of former WWTP drying beds

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:	DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
May 02	Northwest	D. Lindsay	Old outlet structure at WWTP drying beds	May 02	Northeast	D. Lindsay	WWTP located west of wetland site

DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:	DATE:	DIRECTION:	TAKEN BY:	DESCRIPTION:
Jun 04	South	D. Lindsay	North Bosque River near WWTP.	May 02	South	D. Lindsay	WWTP located west of wetland site

APPENDIX B

USFWS FISH AND WILDLIFE COORDINATION ACT REPORT AND PLANNING AID LETTER CONTAINING HEP AND IBI EVALUATIONS

HEP Site #112 East view.

HEP Site #112 North view.

HEP Site #112 South view.

HEP Site #112 West view.

HEP Site #113 East view.

HEP Site #113 North view.

HEP Site #113 South view.

HEP Site #113 West view.

HEP Site #114 East view.

HEP Site #114 North view.

HEP Site #114 South view.

HEP Site #114 West view.

HEP Site #115 East view.

HEP Site #115 North view.

HEP Site #115 South view.

HEP Site #115 West view.

HEP Site #116 East view.

HEP Site #116 North view.

HEP Site #116 South view.

HEP Site #116 West view.

HEP Site #117 East view.

HEP Site #117 North view.

HEP Site #117 South view.

HEP Site #117 West view.

HEP Site #118 East view.

HEP Site #118 North view.

HEP Site #118 South view.

HEP Site #118 West view.

HEP Site #119 South end of pond.

HEP Site #119 Middle view of pond.

HEP Site #119 North view of pond.

HEP Site #120 East view.

HEP Site #120 North view.

HEP Site #120 South view.

HEP Site #120 West view.

HEP Site #121 East view.

HEP Site #121 North view.

HEP Site #121 South view.

HEP Site #121 West view.

HEP Site #122 East view.

HEP Site #122 North view.

HEP Site #122 South view.

HEP Site #122 West view.

The North Bosque River (Texas Brazos River Segment 1226) at CR 246 in Erath County, Texas, 1998.

The North Bosque River (Texas Brazos River Segment 1226) at CR 246 in Erath County, Texas, 1998.

Longnose gar (*Lepisosteus osseus*) collected from the North Bosque River at CR 246 in Erath County, Texas during the summer of 1998.

Red shiner (*Cyprinella lutrensis*)

Channel catfish (*Ictalurus punctatus*)

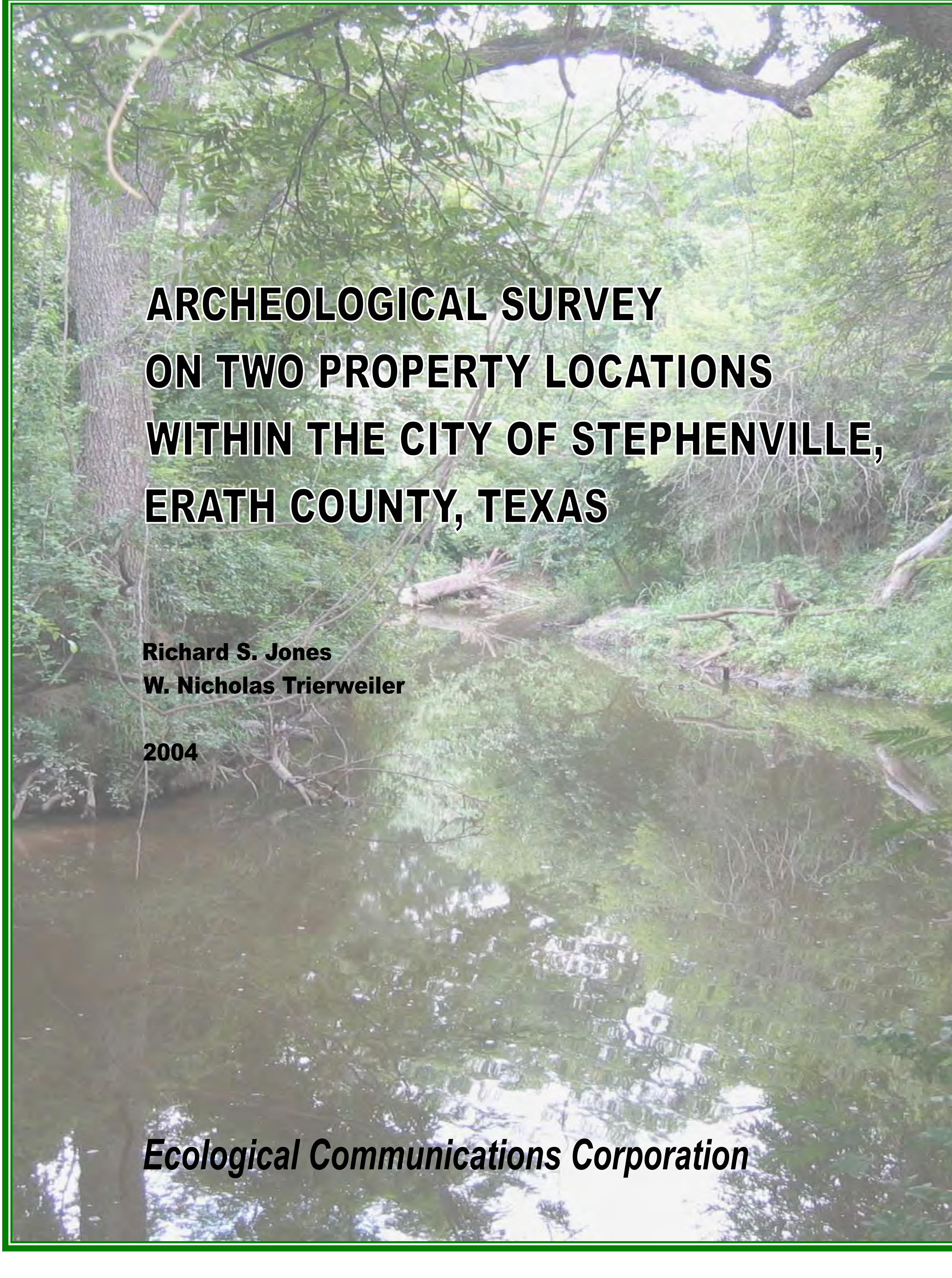
Flathead catfish (*Pylodictus olivaris*)

Longear sunfish (*Lepomis megalotis*)

Largemouth bass (*Micropterus salmoides*)

APPENDIX C

CULTURAL RESOURCE REPORT



ARCHEOLOGICAL SURVEY ON TWO PROPERTY LOCATIONS WITHIN THE CITY OF STEPHENVILLE, ERATH COUNTY, TEXAS

Richard S. Jones
W. Nicholas Trierweiler

2004

Ecological Communications Corporation

ARCHAEOLOGICAL SURVEY ON TWO PROPERTY LOCATIONS WITHIN THE CITY OF STEPHENVILLE, ERATH COUNTY, TEXAS

Richard S. Jones, Project Archeologist
W. Nicholas Trierweiler, Principal Investigator

Prepared by

Ecological Communications Corporation
Austin, Texas

Prepared for
TetraTech NUS, Inc.

For submittal to
U.S. Army Corps of Engineers, Fort Worth District

Texas Antiquities Permit No. 3464

October 2004

ABSTRACT

On June 23-25, 2004, Ecological Communications Corporation (EComm) conducted a Phase I archaeological survey on nine acres of property located within the Stephenville City Park and 126 acres within the Stephenville Waste Water Treatment Plant (WWTP), Erath County, Texas. In order to conduct this survey the Texas Historical Commission (THC) assigned EComm Antiquities Permit No. 3464. Field methods included a pedestrian survey accompanied by manual excavation of 40 shovel tests and five mechanically excavated trenches. The survey resulted in the discovery of no new archaeological sites within the confines of either project area.

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Figure 5. Aerial photograph of WWTP survey area, locations of shovel tests 1-20. 10

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APPENDICES

1.0 INTRODUCTION

On June 23-25, 2004, Ecological Communications Corporation (EComm) conducted a Phase I archaeological survey on nine acres of property located within the Stephenville City Park and 126 acres within the confines of the Stephenville Waste Water Treatment Plant (WWTP), Erath County, Texas (Figure 1). The archaeological survey was conducted under subcontract to Tetra Tech NUS Inc. (TtNUS), who is assisting the U.S. Army Corps of Engineers (USACE) Ft. Worth District with design of an aquatic ecosystem restoration plan for the North Bosque River in Stephenville.

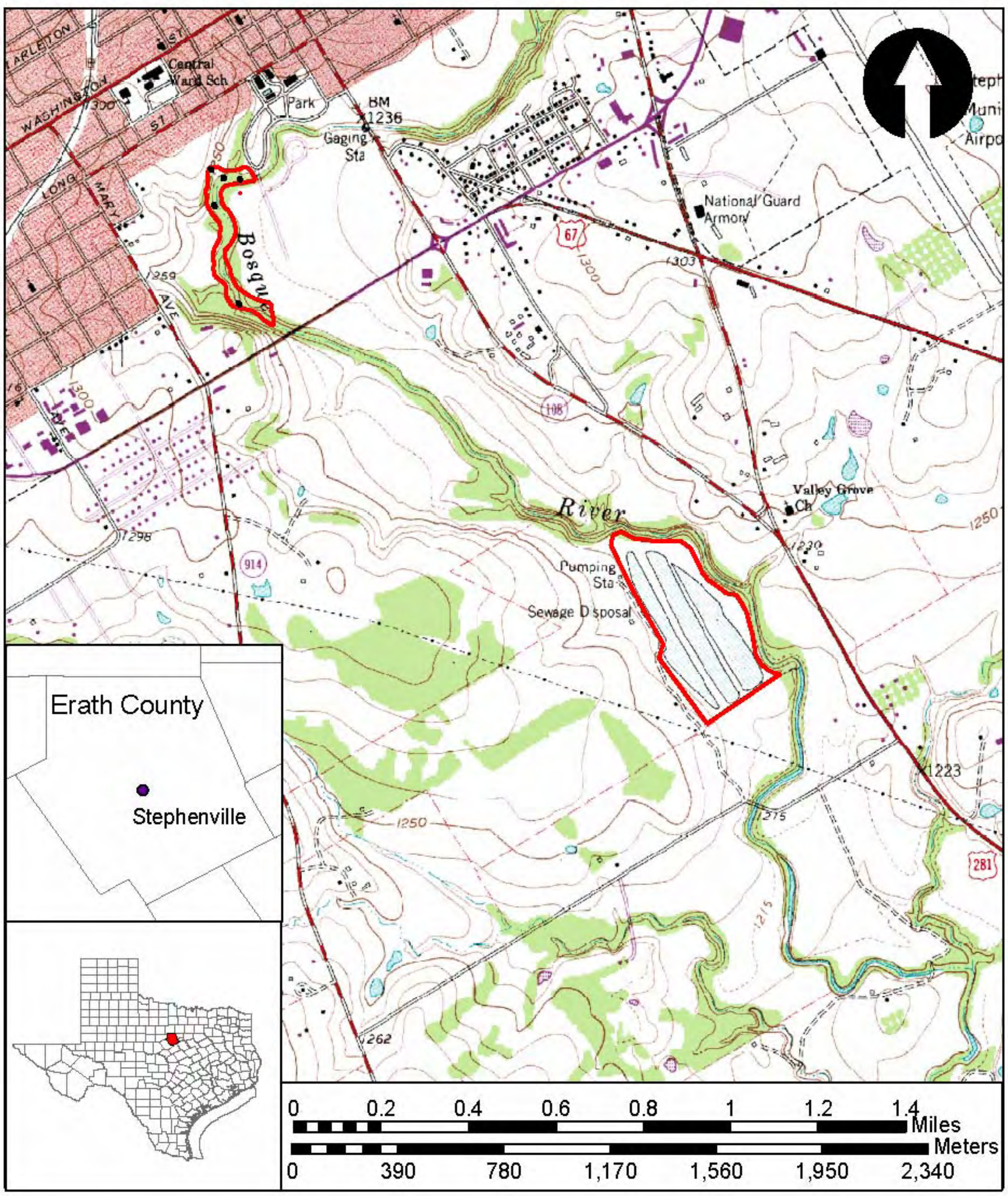


Figure 1. Topographic map of project locations.

The objective of this survey was to identify and document cultural resources within the two project areas that could be impacted by construction activities associated with a proposed aquatic restoration project. In addition, this survey was conducted in order to ensure compliance with the Antiquities Code of Texas and federal regulation 36 CFR Part 800, which pertain to Sections 106 and 110 of the *National Historic Preservation Act* (16 U.S.C. 470 et seq.). In order to conduct this survey the Texas Historical Commission (THC) assigned EComm Antiquities Permit No. 3464.

Subsurface disturbances under the proposed ecosystem restoration plan will be mostly shallow in nature and associated with tree/vegetation planting. However, there are several areas within both project areas where deep subsurface impacts are planned (Table 1).

Table 1. Summary of Proposed Impacts

Survey Area	Soil Impact	Depth of Impact	Integrity
Stephenville WWTP	Sludge Drying Pits Excavated	Shallow to Deep	Disturbed
	Interior Berm of Sludge Pits Removed	Shallow	Disturbed
	Reformation of One Berm	Shallow	Disturbed
	Vegetation Plantings	Shallow	Unknown
Stephenville City Park	Construction of Weirs at 2 Locations	Deep	Unknown
	River Bank Stabilization at 3 Locations	Deep	Unknown
	Walking Trail (1,000 ft)	Shallow	Unknown
	Vegetation Plantings	Shallow	Unknown

1.1 Areas Where Deep Impacts Are Planned

Within the Stephenville City Park, bank stabilization activities are planned to deeply impact the soil at three locations along the Bosque River. In addition, two low-flow stone weirs will be constructed across the Bosque River within the northern and southern portion of the project area. Deep archaeological testing (i.e., trenches) will be necessary at these five locations.

Within the Stephenville WWTP, the ecosystem restoration plan calls for the highly disturbed sludge drying pits to be excavated and interior berms removed to allow room for the construction of small islands and levees. Due to the fact that these activities are located in areas with very low contextual integrity, deep archaeological testing (i.e., trenching) of these locations is not required.

1.2 Areas Where Shallow Impacts Are Planned

In both project areas, shallow impacts are expected to result from extensive tree and vegetation plantings. In the Stephenville City Park location, shallow impacts are also expected from construction of an approximately 1,000 ft. walking trail. In these locations, archeological shovel testing is expected to be adequate to locate and identify any buried cultural resources.

2.0 ENVIRONMENTAL SETTING

Both project areas are located within the sandy "Main Belt" division of the Western Cross Timbers physiographic region as described by Dyksterhuis (1948). This region is predominantly characterized by flat to gently rolling terrain which is moderately dissected by narrow stream valleys with steep gradients. The North Bosque River is located adjacent to both areas surveyed by EComm during this investigation. From Stephenville, the Northern Bosque River flows in a general southeasterly direction before joining the Middle and South Bosque Rivers in McLennan County and draining into Lake Waco (North Bosque River 2004).

2.1 Flora and Fauna

Typical vegetation currently encountered within the Western Cross Timbers region includes blackjack oak (*Quercus marilandic*), post oak (*Quercus stellatta*), pecan (*Carya illinoinensis*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis spp*.), juniper (*Juniperus spp*.), hairy grama (*Bouteloua curtipedula*), side-oats grama (*Bouteloua curtipedula*) and mesquite (*Prosopis juliflora*). The project area is located within the Texan Biotic Province as defined by Blair (1950). Typical mammalian fauna commonly observed within this region include white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis marsupialis*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), armadillo (*Dasypus novemcinctus*), and coyote (*Canis latrans*). Channel catfish (*Ictalurus punctatus*), bluegill sunfish (*Lepomis macrochirus*), spotted gar (*Lepisosteus oculatus* [see Figure 2]), and snapping turtle (*Chelydra serpentine*) are just a few of the many aquatic species found within the North Bosque River.

Figure 2. Photograph of a 4-ft spotted gar within the North Bosque River.

2.2 Climate

Erath County is located within a subhumid climatic zone of convergence where warm moist Gulf air collides with cool and dry northern air masses, triggering atmospheric instability and heavy periods of rainfall. The average yearly precipitation is 29 inches; the average temperature ranges from a low of 34°F during January to 96°F in July (Erath County 2004).

2.3 Geology

Both project areas are situated within the active floodplain of the North Bosque River in areas that contain recent Holocene alluvium (Qal), which fall under the Bunyan fine sandy loam (Bu) soil series. The Texas Commission on Environmental Quality (TCEQ) (2004) defines Qal deposits as "Floodplain deposits, includes low terrace deposits near level of floodplain and bedrock locally in stream channels, gravel, sand, silt, and clay; and organic matter; thickness up to 35 feet". According to Wagner et al. (1973:13), Bu soils form in stratified loamy alluvium along the flood plains of streams and flood an average of once every four to ten years. The elevated countryside immediately surrounding the project area is predominantly comprised of bedrock deposits of the Late Cretaceous aged Glen Rose Formation (Kgr) (TCEQ 2004).

3.0 CULTURAL BACKGROUND

The project area is located within the extreme northern portion of the Central Texas archaeological region. Over the past century, numerous explanations have been put forth by prominent archaeologists regarding Central Texas' prehistoric cultural chronology (see Kelly 1947; Jelks 1962; Weir 1976; Prewitt 1981, 1985; Johnson and Goode 1994; Collins 1995; Black 1989b, 1995). The cultural background presented in this report is predominantly based on the chronological interpretations made by Johnson and Goode (1994), and Collins (1995). All dates are approximate and given as radiocarbon years before present or B.P. (i.e., before the development of radiocarbon dating in 1950). Human presence in Central Texas is divided into Prehistoric and Historic stages.

3.1 Cultural-Historical Framework

Three major intervals or periods are identified in the Prehistoric Stage: 1) Paleoindian, 2) Archaic, and 3) the Late Prehistoric.

3.1.1 Paleoindian

The discovery of several confirmed Clovis points within Erath County suggests the county has been occupied since the onset of the Paleoindian period (see Meltzer 1987; Meltzer and Bever 1995). According to Collins (1995:381-383) the Paleoindian period (which is divided into early and late periods) occurred between 11500-8800 B.P. in Central Texas. The native inhabitants during the Early Paleoindian period are thought to have been nomadic hunter and gatherers that subsisted mainly on big game/megafauna hunting (Willey 1966:37). The Late Paleoindian period was a time period when the native inhabitants shifted the focus of their subsistence strategy away from big game/megafauna hunting to other large herbivores such as deer (Collins 1995:382).

3.1.2 Archaic

According to Collins (1995), the Archaic period in Central Texas occurred between 8800-1200 or 1300 B.P. The Archaic period is divided into three sub periods: Early, Middle, and Late Archaic (Collins 1995).

Early Archaic

The Early Archaic period in Central Texas occurred between 8800-6000 B.P. (Collins 1995). The hunting patterns that formed during the Late Paleoindian continued into the Early Archaic. The hunter-gatherers during this time period modified their existing subsistence strategy, becoming more holistic by exploiting a wider array of food resources such as prickly pear, rodents and rabbits (Story 1985:38-39, Weir 1976). Early Triangular, Martindale, and Andice are some of the projectile points commonly associated with this period (Black 1995).

Middle Archaic

Collins (1995) dates the Middle Archaic in Central Texas between 6000-4000 B.P. During the Middle Archaic period, severe and prolonged altithermal (warm and dry) climatic conditions were predominate. The severe altithermal noted within Texas led to numerous important social and subsistence adaptations for the native inhabitants during this time period. The altithermal caused the numerous bison populations, commonly observed in this region during the early stages of the Early Archaic, to migrate out of Texas into the more mesic climate in the northern Great Plains. With the total loss of bison and severe xeric conditions throughout Texas, native populations migrated into Central Texas where resource-rich environments were fed by natural springs, which rise from the Balconies Escarpment fault zone.

Late Archaic

Collins (1995) dates the Late Archaic in Central Texas between 4000-1200 or 1300 B.P. During the Late Archaic, the severe altithermal observed during the Middle Archaic waned and more mesic conditions prevailed (Collins 1995). The return of mesic conditions in Central Texas also brought about the return of the large bison populations that left Texas during the Early Archaic. The return of large bison herds brought about a substantial change in the population density and subsistence strategies employed by the native inhabitants in Central Texas during this time period. The mobile hunting and gathering subsistence strategy associated with plains bison-focused hunting replaced the sedentary and holistic food processing lifeways adopted during the Middle Archaic.

<u>3.1.3 Late Prehistoric</u>

The Late Prehistoric in Central Texas occurred between 1250-260 B.P. (Collins 1995). The development of the bow and arrow along with the introduction of pottery in Central Texas are technological innovations that mark the shift from the Archaic to the Late Prehistoric (Black 1989c:32, Story 1985:45-47). The Late Prehistoric is divided into two phases: the Austin Phase (ca. 1250 B.P. – 800 B.P.) and the Toyah Phase (ca. 800 B.P. – 260 B.P.).

Austin Phase

The Austin Phase was a time period of population decline (Black 1989c:32). Early expanding stem projectile points (e.g., Scallorn) are common during this time period. Even though small burned rock middens associated with Edwards and Scallorn points have been found (Goode 1991:71; Houk and Lohse 1993:193-248), they are rare.

Toyah Phase

In Central Texas the Toyah Phase is marked by a shift from expanding stem projectile points (e.g., Scallorn) to contracting stem points (e.g., Perdiz [Black 1989a:32; Huebner

1991:346]). In addition, this phase is characterized by the introduction of bladelet technology and the first appearance of bone-tempered pottery in Central Texas.

3.1.4 Historic

The first attempts at Anglo settlement within the area occurred in 1854 when A. H. Dobkins and T. Holland established homesteads near present day Dublin (Erath County 2004). In 1855, John M. Stephens and other pioneers (including a black family) were led into the area by surveyors George B. Erath and Neil McLennan. The Stephens family settled on 4,409 acres of the John Blair survey, while the black family was left near the present site of Stephenville, to establish relations with Caddo and Anadarko Indians, who visited the area from their camp in Young County (Erath County 2004). In 1856, Stephens donated a portion of his land to Texas in order to construct a courthouse and town site, which was subsequently named ‘Stephenville’ in his honor (Stephenville, Texas 2004).

3.2 Previous Investigations

Previous archaeological investigations have not taken place within the nine acres of park property surveyed by EComm. However, one previously recorded archaeological site (i.e., 41ER4) is located approximately 60 meters east of the project area (State of Texas Archaeological Site Data Form on file at the Texas Archeological Research Laboratory, University of Texas at Austin (TASDF-TARL) [Figure 3]). 41ER4 was recorded in 1965 by Tom E. Adams and is described as an archaic campsite approximately six to fifteen-acres in size located within the confines of the park. At 41ER4, Adams recorded ten to fifteen Pedernales points, one metate, and an unknown number of manos (TASDF-TARL).

In 1998, AR Consultants surveyed approximately fourteen acres of park property (located east and adjacent to EComm’s survey area) that included a portion of 41ER4, which AR Consultants failed to mention in their report. During this survey, AR Consultants performed a pedestrian survey, profiled three cut banks along the North Bosque River, and excavated eight auger tests to approximately 1.5 meters below surface (Skinner and Kent 1998). The survey resulted in the discovery of no cultural resources within the entire fifteen acre project area. Following this investigation, Skinner and Kent concluded that the park was “…an unlikely location for prehistoric occupation based on the pattern of regular flooding, the upstream location of the park, and the seasonal fluctuations of the water regime” (1998:i). This conclusion seems to be contradicted by the fact that a previously recorded archaeological site is, in fact, located within the confines of the park and their survey area.

No archaeological survey has been previously conducted within the confines of the Stephenville WWTP.

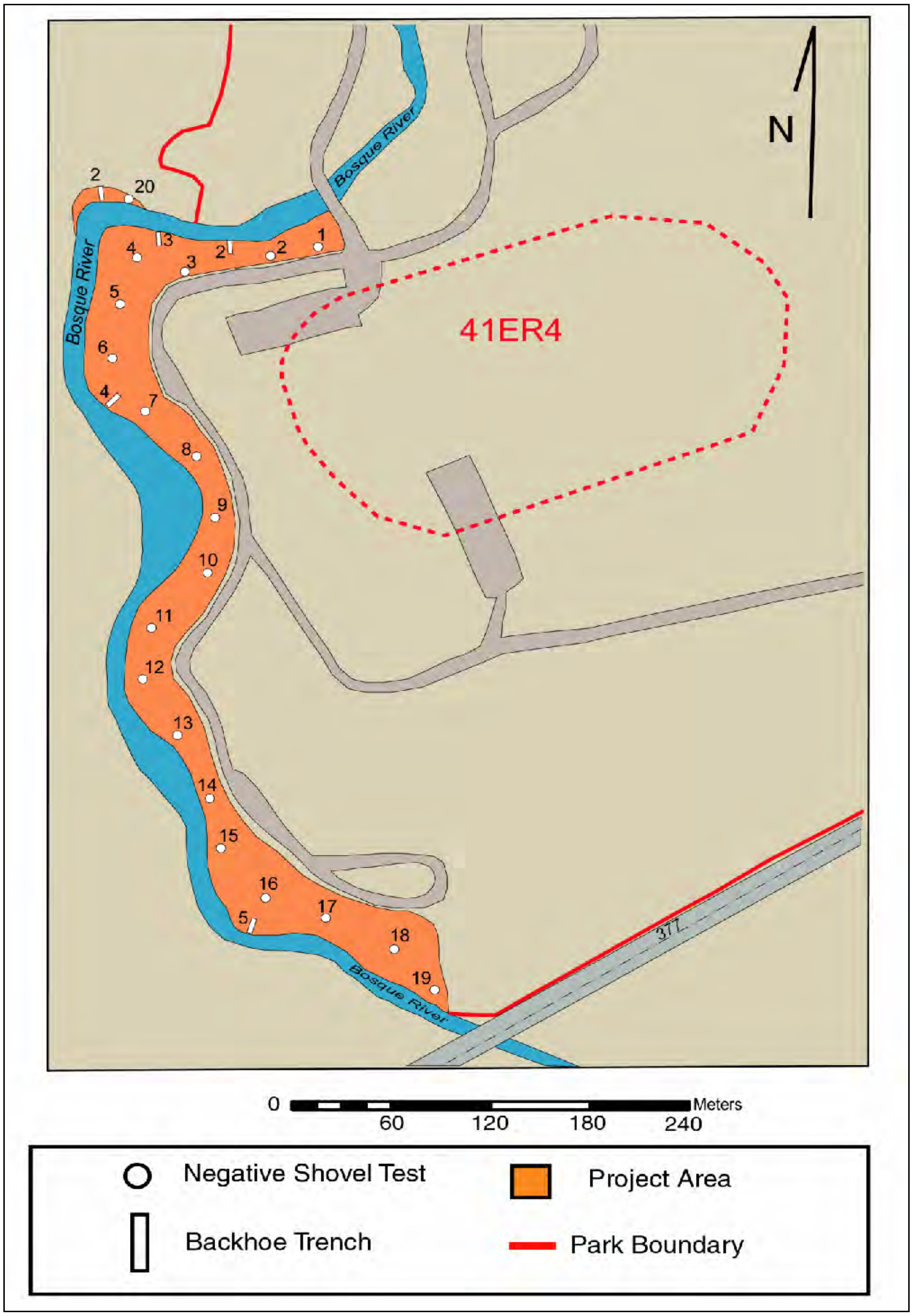


Figure 3. Map of City park survey area showing site 41ER4, Shovel Tests 1-20, and Backhoe Trenches 1-5.

4.0 METHODS

4.1 Stephenville City Park

In order to ascertain the nature of cultural resource deposition within the nine-acre project area, 20 shovel tests were systematically excavated along the eastern alluvial terrace of the Bosque River. The locations of all shovel tests are plotted on Figure 3. Testing density was thus approximately 2.2 tests per acre. Tests were approximately 30 cm in diameter and were excavated to 60 cm below the current ground surface. All excavated sediments were screened through ¼-inch mesh.

In addition, five backhoe trenches (BTs) were excavated within the project area (Figure 3). BTs 1-3 were located where proposed bank sloping and stabilization will result in deep ground disturbance. BTs 4 and 5 were located where construction of low-flow weirs may deeply impact the adjacent banks. The primary goal of the trench excavations was to record the geologic stratigraphy and, if present, ascertain the nature of cultural resource deposition. Trenches were approximately 70 cm wide and ranged in depth from 180 cm to 310 cm below the modern ground surface.

4.2 Wastewater Treatment Plant

Of the 126 acres in the WWTP project area, about 86 acres in the center of the project area were highly disturbed by obvious construction activities related to the sewage settling ponds, septic drain fields, etc. (Figure 4). In consultation with the USACE, these disturbed areas were not inventoried, leaving about 40 acres around the perimeter of the ponds/fields that were inventoried.

Figure 4. Photograph of WWTP survey area showing thick brush and highly disturbed terrain.

Within this 40-acre project area, 20 shovel tests were systematically excavated, for a net testing density of about 0.5 tests per acre (Figure 5). Tests were approximately 30 cm in diameter and were excavated to 60 cm below the current ground surface. Backhoe trenches were not excavated in this area due to the shallow nature of the proposed impacts.

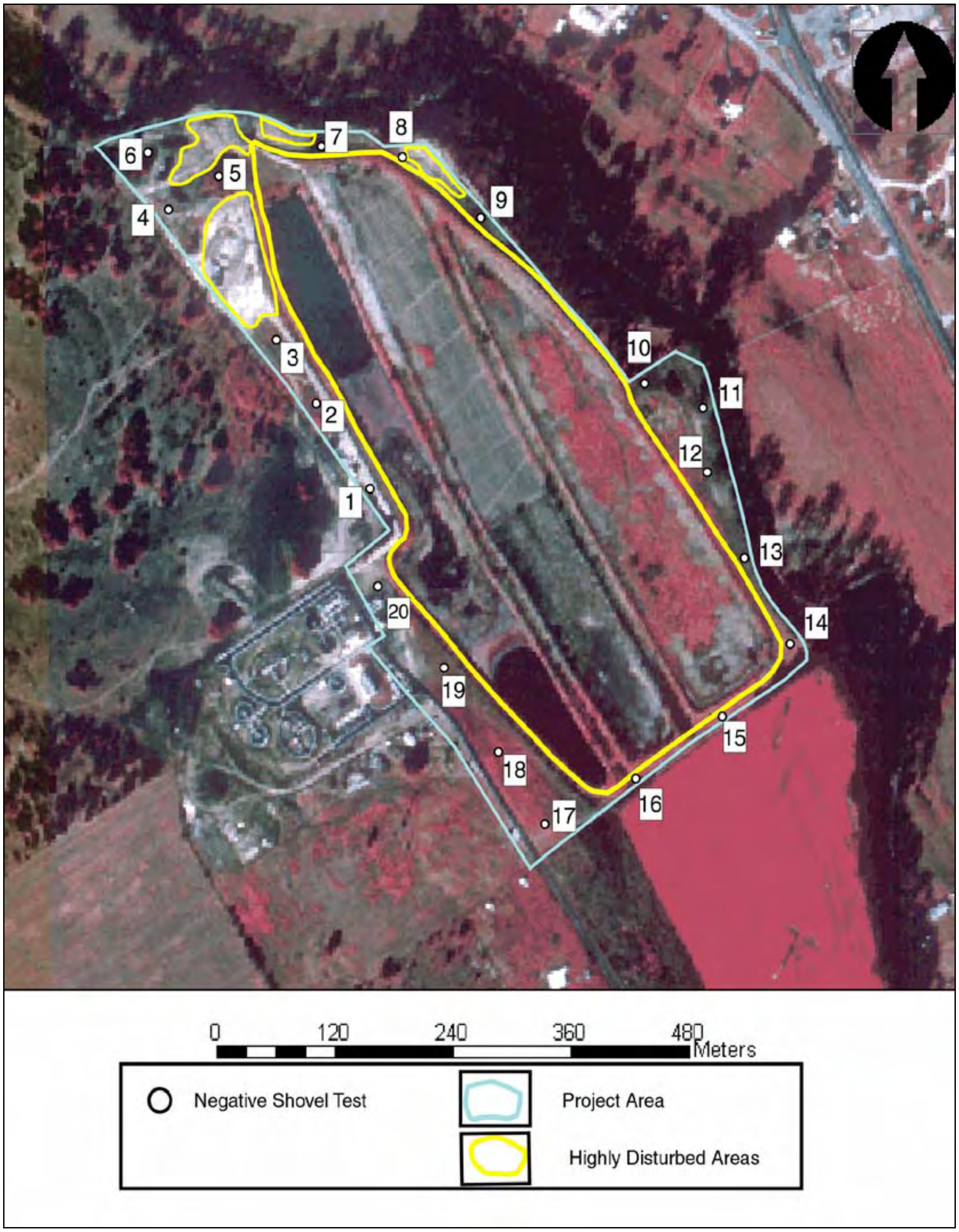


Figure 5. Aerial photograph of WWTP survey area showing location of shovel tests 1-20.

5.0 RESULTS

5.1 Stephenville City Park

The nine-acre project area EComm surveyed is located on land that has been converted into a city park by the City of Stephenville. Thus, the project area has been moderately impacted by landscaping activities associated with the park's construction, including brush clearing, periodic mowing, and construction of irrigation ditches and a walking/jogging path (see Figure 6).

Figure 6. Photograph of City Park survey area, showing irrigation ditch and concrete walkway.

No cultural resources were encountered within the project area during the pedestrian survey, shovel testing or mechanical trenching. All of the shovel tests were negative. No artifacts, features, or cultural strata were observed on any of the trenches.

The excavation of BT1 exposed deep deposits (200+ cm) of clay loam which had accumulated along the upper terrace of the Bosque River's northern convex bank (see Appendix A). Unlike BT1, the excavation of BTs 2-4 along the eastern bank of the North Bosque River exposed numerous depositional units comprised of alternating fine/course grained sand and sandy clay loam deposits within composite cross-bedded alluvial fill soil horizons (see Appendix A). All the soil horizons recorded in BTs 2-4 were distinctly separated from each other with clear to abrupt lower boundaries. This is generally indicative of sediments that were deposited during mid to high velocity flooding events (see Reineck and Singh 1975). In all likelihood, the accumulation of cultural deposits within the project area has been precluded (i.e., erosionally stripped) by numerous high energy flooding events since the onset of the Holocene.

5.2 Waste Water Treatment Plant

No cultural resources were encountered within the project area during the pedestrian survey or shovel testing. All of the shovel tests were negative.

6.0 CONCLUSIONS AND RECOMMENDATIONS

It appears that natural alluvial formation processes along the eastern bank of the Bosque River have prevented cultural resources from accumulating within the Stephenville City Park project area. In 1998, archaeologists affiliated with AR Consultants reached a similar conclusion while surveying park property located east and adjacent to the nine-acres inventoried by EComm (Skinner and Kent 1998). In contrast, modern cultural processes (i.e., construction of the WWTP) have highly disturbed the subsurface stratigraphy within the Stephenville WWTP, thus eliminating the possibility of encountering any intact cultural deposits.

The inventory did not encounter any cultural resources in either project location. No cultural resources will be affected by the proposed Section 206 Aquatic Ecosystem Restoration Project and no further archaeological work is warranted.

7.0 REFERENCES CITED

Black, S. L.

1989a South Texas Plains. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. Reinhard, and L. C. Bement, pp. 39-62. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1989b Environmental Setting. *From the Gulf Coast to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 5–17. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1989c Central Texas Plateau Prairie. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 5-16. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1995 Archaeological and Historical Background. In *Archeological Investigations at the Loma Sandia Site (41LK28): A Prehistoric Campsite in Live Oak County, Texas.* 2 volumes. Studies in Archeology No. 20, pp. 31-45. Texas Archeological Research Laboratory, The University of Texas at Austin.

Blair, F.

1950 The Biotic Provinces of Texas. *Texas Journal of Science* 2(1):93-117.

Collins, M. B.

1995 Forty Years of Archeology in Central Texas. *Bulletin of the Texas Archeological Society* 66:361-400.

Dyksterhuis, E. J.

1948 The Vegetation of the Western Cross Timbers. Ecological Monographs 18(3):327-376.

Erath County

2004 The Handbook of Texas Online. http://www.tsha.utexas.edu/handbook/online/articles/view/EE/hce6.html, accessed July 15.

Goode, G. T.

1991 Late Prehistoric Burned Rock Middens in Central Texas, In *The Burned Rock Middens of Texas: An Archaeological Symposium*, edited by T. R. Hester, pp. 71-93. Studies in Archeology 13. Texas Archeological Research Laboratory, University of Texas at Austin.

Houk, B. A., and J. C. Lohse
1993 [1990] Archeological Investigations at the Mingo Site, Bandera County, Texas. Bulletin of the Texas Archeological Society 61:193-247.

Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137): 343-358.

Jelks, E. B.
1962 *The Kyle Site: A Stratified Central Aspect Site in Hill County, Texas*. Archeology Series 5, Department of Anthropology, University of Texas at Austin.

Johnson, L. Jr., and G. T. Goode
1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archeological Society* 65: 1-51.

Kelly, J. C.
1947 The Lehmann Rock Shelter: A Stratified Site of the Toyah, Uvalde, and Round Rock Foci. *Bulletin of the Texas Archeological and Paleontological Society*, Vol. 18, pp. 115-128.

Meltzer, D. J.
1987 The Clovis Paleoindian Occupation of Texas: Results of the Texas Clovis Fluted Point Survey. Bulletin of the Texas Archeological Society 57:27-68.

Meltzer, D. J., and M. R. Bever
1995 Paleoindians of Texas: An Update on the Texas Clovis Fluted Point Survey. Bulletin of the Texas Archeological Society 66:47-81.

North Bosque River
2004 The Handbook of Texas Online. http://www.tsha.utexas.edu/handbook/online/articles/view/NN/rnn5.html, accessed July 15.

Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

1985 [1983] From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201-238.

Reineck, H. E., and I. B. Singh
1975 *Depositional Sedimentary Environments*. Springer-Verlag, Berlin.

Skinner, S. A., and F. D. Kent
1998 *Cultural Resources Evaluation of the Stephenville City Park, Erath County, Texas.* Cultural Resources Report 98-9. AR Consultants, Dallas.

Stephenville, Texas
2004 The Handbook of Texas Online. http://www.tsha.utexas.edu/handbook/online/articles/view/SS/hes7.html

Story, D. A.
1985 Adaptive Strategies of Archaic Cultures of the West Gulf Coastal Plain. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 19-56. Anthropological Papers 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Texas Commission on Environmental Quality
2004 15-minute Digital GAT Quads. Austin, Texas.

Wagner, B. J., J. R. Thomas, E. R. Harris, E. Deleon, C. G. Ford, and J. D. Kelley
1973 *Soil Survey of Erath County, Texas.* United States Department of Agriculture, Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station.

Weir, F. A.
1976 The Central Texas Archaic. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Willey, G. R.
1966 *An Introduction to American Archaeology*. Prentice Hall, New York.

APPENDIX A

Trench Profiles and Descriptions

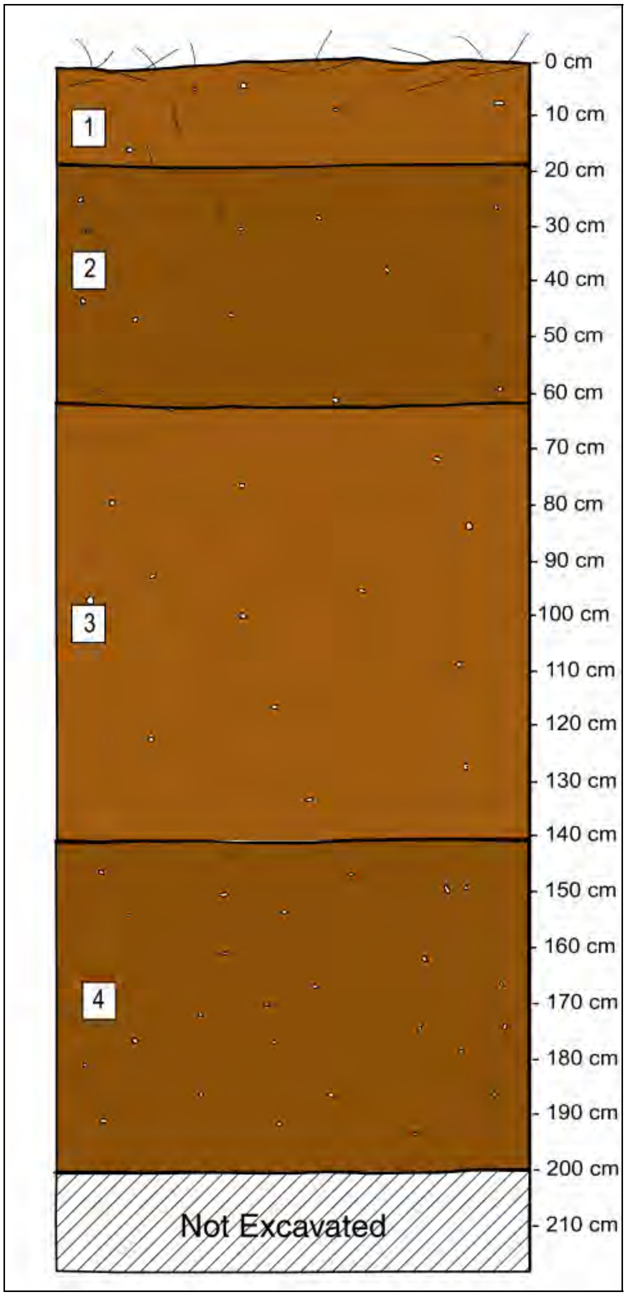


Figure 7. BT1 north wall profile.

Zone 1: 0-18 cm; 10YR 3/2 (very dark grayish brown), clay loam, firm subangular block structure; numerous rootlets, few limestone pebbles (<1 cm); clear smooth lower boundary.

Zone 2: 18-62 cm; 10YR3/1 (very dark gray) clay loam, firm subangular blocky structure; few rootlets, calcium carbonate nodules, and limestone pebbles (< 5mm); clear smooth lower boundary.

Zone 3: 62-141 cm; 10YR4/2 (dark grayish brown) clay loam, firm subangular blocky structure; few rootlets, calcium carbonate nodules, and snail shell; clear smooth lower boundary.

Zone 4: 141-200 cm; 10YR3/1 (very dark gray) clay loam, firm subangular blocky structure; few rootlets, chert pebbles (< 3 mm), and calcium carbonate nodules (>1 cm); lower boundary not observed.

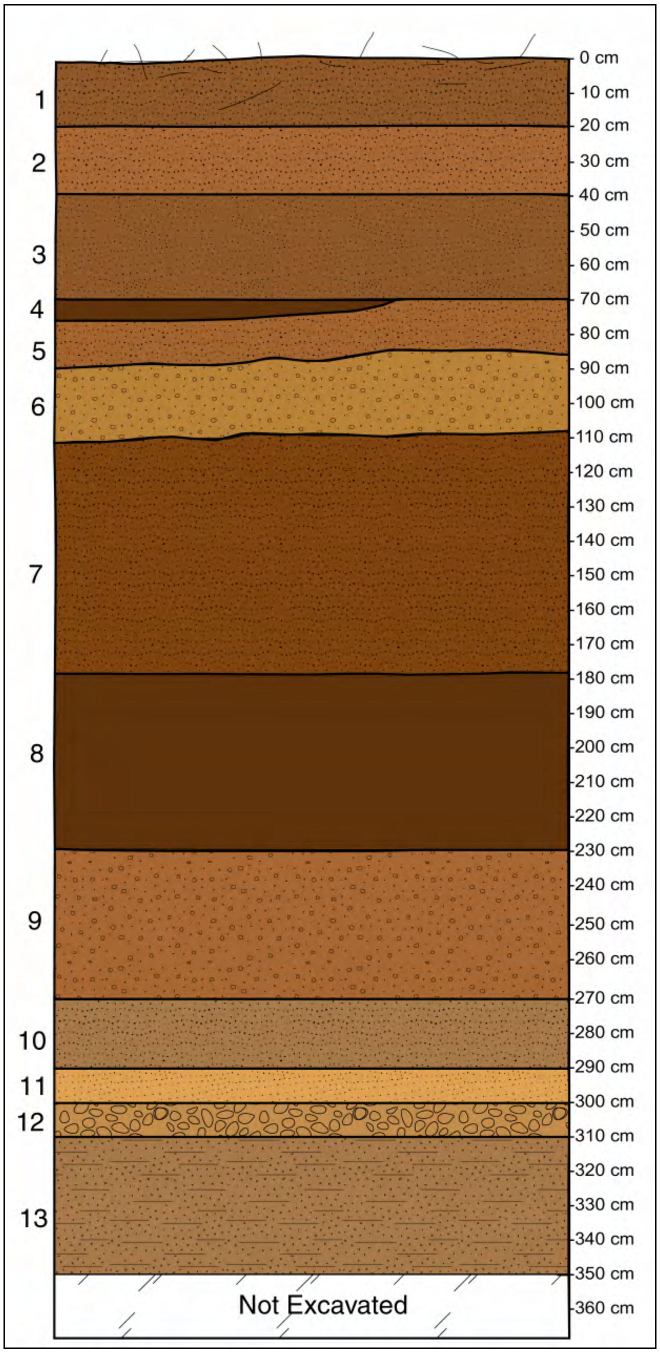


Figure 8. BT2 east wall profile.

Zone 1: 0-20 cm; 10YR4/3 (brown), sandy loam, loose slightly blocky structure; numerous rootlets; clear abrupt lower boundary.

Zone 2: 20-40 cm; 10YR4/2 (dark grayish brown) sandy loam, loose prismatic structure; 10YR7/3 (very pale brown) sand mottling (<5%); few rootlets; clear abrupt lower boundary.

Zone 3: 40-70 cm; 10YR4/3 (brown) sandy loam, loose prismatic structure; 10YR5/3 (brown) sandy loam mottling (<10%); few rootlets; clear abrupt lower boundary.

Zone 4: 70-75 cm; 10YR3/2 (very dark grayish brown) clay loam, loose subangular blocky structure; 10YR5/3 (brown) sandy loam mottling (<10%); few rootlets; clear abrupt lower boundary.

Zone 5: 70-87 cm; 10YR4/2 (dark grayish brown) sandy loam, loose prismatic structure; 10YR6/2 (light brownish gray) sand mottling (<5%); few rootlets and calcium carbonate nodules (<7 mm); clear abrupt lower boundary.

Zone 6: 87-110 cm; 10YR6/3 (pale brown) sandy loam, loose prismatic structure; 10YR7/2 (light gray) sand mottling (<5%); few rootlets; clear abrupt lower boundary.

Zone 7: 110-178 cm; 10YR3/3 (dark brown) sandy clay loam, loose subangular slightly blocky structure; 10YR5/3 (brown) silt mottling (<5%); few rootlets; clear abrupt lower boundary.

Zone 8: 178-230 cm; 10YR3/2 (very dark grayish brown) clay, firm subangular blocky structure; few rootlets; clear abrupt lower boundary.

Zone 9: 230-270 cm; 10YR4/1 (dark gray) clay loam, loose subangular blocky structure; few rootlets; clear abrupt lower boundary.

Zone 10: 270-290 cm; 10YR6/2 (light brownish gray) sandy loam, loose subangular blocky structure; few calcium carbonate nodules (<2 cm) and limestone pebbles (<5 mm); clear abrupt lower boundary.

Zone 11: 290-300 cm; 10YR6/4 (light yellowish brown) sandy loam, loose subangular blocky structure; 10YR6/2 (light brownish gray) sandy clay loam mottling (<5%), clear abrupt lower boundary.

Zone 12: 300-310 cm; 10YR6/3 (pale brown) sandy loam, loose subangular blocky structure; numerous rounded limestone and chert pebbles (>3cm); clear abrupt lower boundary.

Zone 13: 310-350+ cm; 10YR5/2 (grayish brown) sandy loam, loose subangular blocky structure; 10YR5/6 (yellowish brown) sand mottling (<5%); lower boundary not observed.

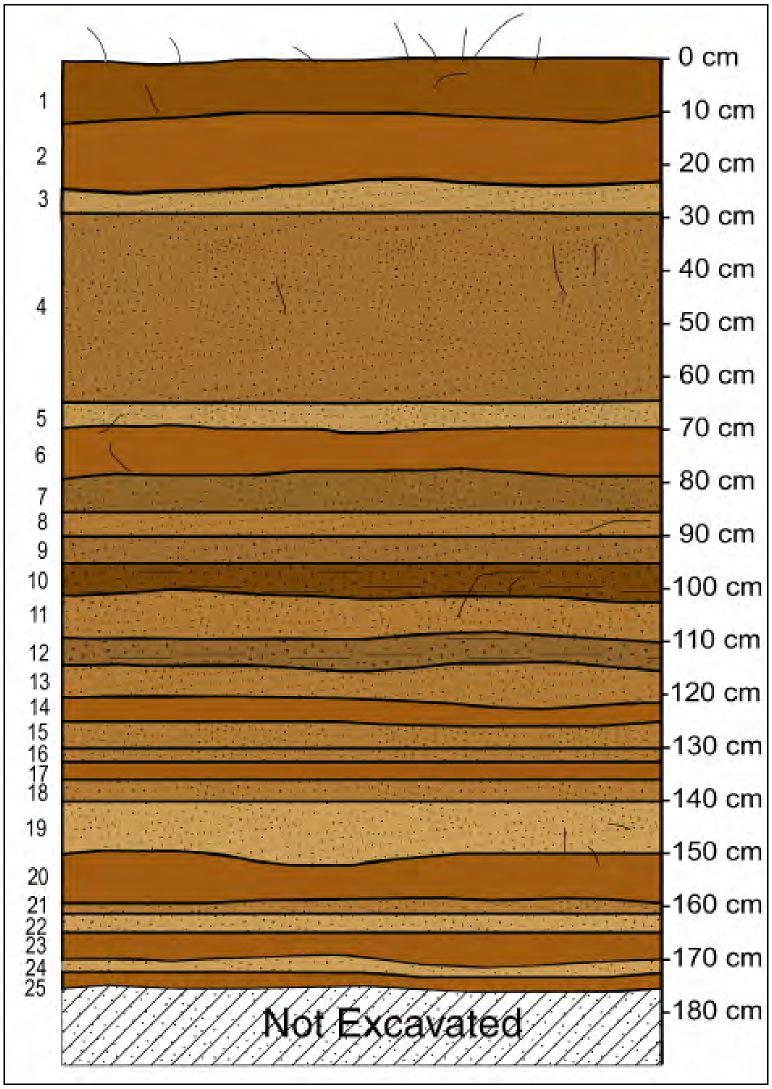


Figure 9. BT3 east wall profile.

Zone 1: 0-10 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; numerous rootlets and carbon inclusions (>60%); clear abrupt lower boundary.

Zone 2: 10-23 cm; 10YR4/4 (dark yellowish brown) sandy loam, loose subangular slightly blocky structure; few rootlets and carbon inclusions (<5%); wavy abrupt lower boundary.

Zone 3: 23-29 cm; 10YR7/3 (very pale brown) fine sandy loam, loose prismatic structure; few rootlets; clear abrupt lower boundary.

Zone 4: 29-65 cm; 10YR5/4 (yellowish brown) fine sandy loam, loose prismatic structure; few rootlets; clear abrupt lower boundary.

Zone 5: 65-69 cm; 10YR7/3 (very pale brown) fine sandy loam, loose prismatic structure; few rootlets; clear abrupt lower boundary.

Zone 6: 69-78 cm; 10YR4/4 (dark yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 7: 78-85 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 8: 85-90 cm; 10YR6/3 (pale brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 9: 90-94 cm; 10YR4/2 (dark grayish brown) fine sandy loam, loose prismatic structure; 10YR6/3 (pale brown) sandy loam mottling (<5%); clear abrupt lower boundary.

Zone 10: 94-103 cm; 10YR6/4 (light yellowish brown) fine sandy loam within fine lenticuler bedding planes, loose prismatic structure; wavy abrupt lower boundary.

Zone 11: 103-110 cm; 10YR5/3 (brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 12: 110-115 cm; 10YR6/4 (light yellowish brown) fine sandy loam within fine lenticuler bedding planes, loose prismatic structure; clear abrupt lower boundary.

Zone 13: 115-121 cm; 10YR4/4 (dark yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 14: 121-125 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 15: 125-130 cm; 10YR6/3 (pale brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 16: 130-133 cm; 10YR4/4 (dark yellowish brown) fine sandy loam, loose prismatic structure; 10YR6/4 (light yellowish brown) sand mottling (<5%); clear abrupt lower boundary.

Zone 17: 133-136 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 18: 136-140 cm; 10YR7/3 (very pale brown) fine sandy loam, loose prismatic structure; few rootlets; clear abrupt lower boundary.

Zone 19: 140-150 cm; 10YR4/3 (brown) fine sandy loam, loose prismatic structure; 10YR6/3 (pale brown) sand mottling (<5%); wavy abrupt lower boundary.

Zone 20: 150-159 cm; 10YR6/3 (pale brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 21: 159-162 cm; 10YR7/4 (very pale brown) sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 22: 162-164 cm; 10YR4/3 (brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 23: 164-170 cm; 10YR7/3 (very pale brown) fine sandy loam, loose prismatic structure; few rootlets; wavy abrupt lower boundary.

Zone 24: 170-172 cm; 10YR4/3 (brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 25: 172-175+ cm; 10YR7/3 (very pale brown) fine sandy loam, loose prismatic structure; few rootlets; lower boundary not observed.

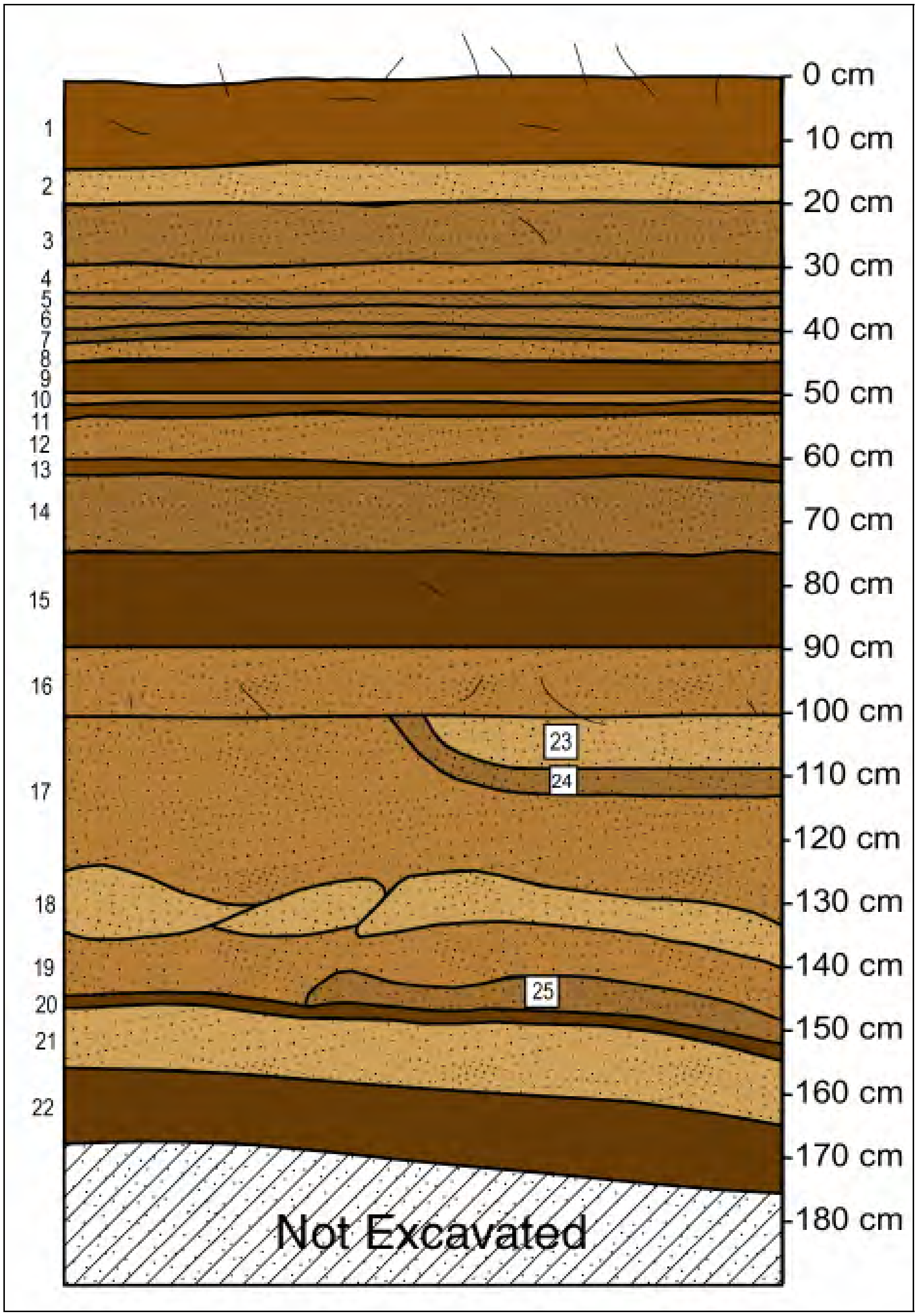


Figure 10. BT4 north wall profile.

Zone 1: 0-15 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; numerous rootlets; clear abrupt lower boundary.

Zone 2: 15-19 cm; 10YR7/4 (very pale brown) sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 3: 19-30 cm; 10YR5/4 (yellowish brown) sandy clay loam loam, loose subangular slightly blocky structure; 10YR6/4 (light yellowish brown) sand mottling (<5%); numerous rootlets; clear abrupt lower boundary.

Zone 4: 30-34 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 5: 34-37 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; few rootlets; clear abrupt lower boundary.

Zone 6: 37-39 cm; 10YR5/4 (yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 7: 39-42 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 8: 42-45 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 9: 45-50 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 10: 50-51 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 11: 51-53 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 12: 53-61 cm; 10YR6/3 (pale brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 13: 61-63 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary

Zone 14: 63-75 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary

Zone 15: 75-90 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; 10YR5/3 (brown) sand mottling (<5%); clear abrupt lower boundary.

Zone 16: 90-100 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 17: 100-133; 10YR6/4 (light yellowish brown) fine sandy loam within fine lenticular bedding planes, loose prismatic structure; abrupt wavy lower boundary.

Zone 18: 133-140 cm; 10YR5/4 (yellowish brown), fine sandy loam, loose prismatic structure; abrupt wavy lower boundary.

Zone 19: 140-147 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 20: 152-155 cm; 10YR3/2 (very dark grayish brown) sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 21: 15-165 cm; 10YR5/4 (yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 22: 165-175 cm; 10YR3/2 (very dark grayish brown) sandy clay loam, loose subangular slightly blocky structure; lower boundary not observed.

Zone 23: 101-109; 10YR4/3 (brown) fine sandy loam, loose prismatic structure; abrupt wavy lower boundary.

Zone 24: 109-112 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; abrupt wavy lower boundary.

Zone 25: 148-152 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; abrupt wavy lower boundary.

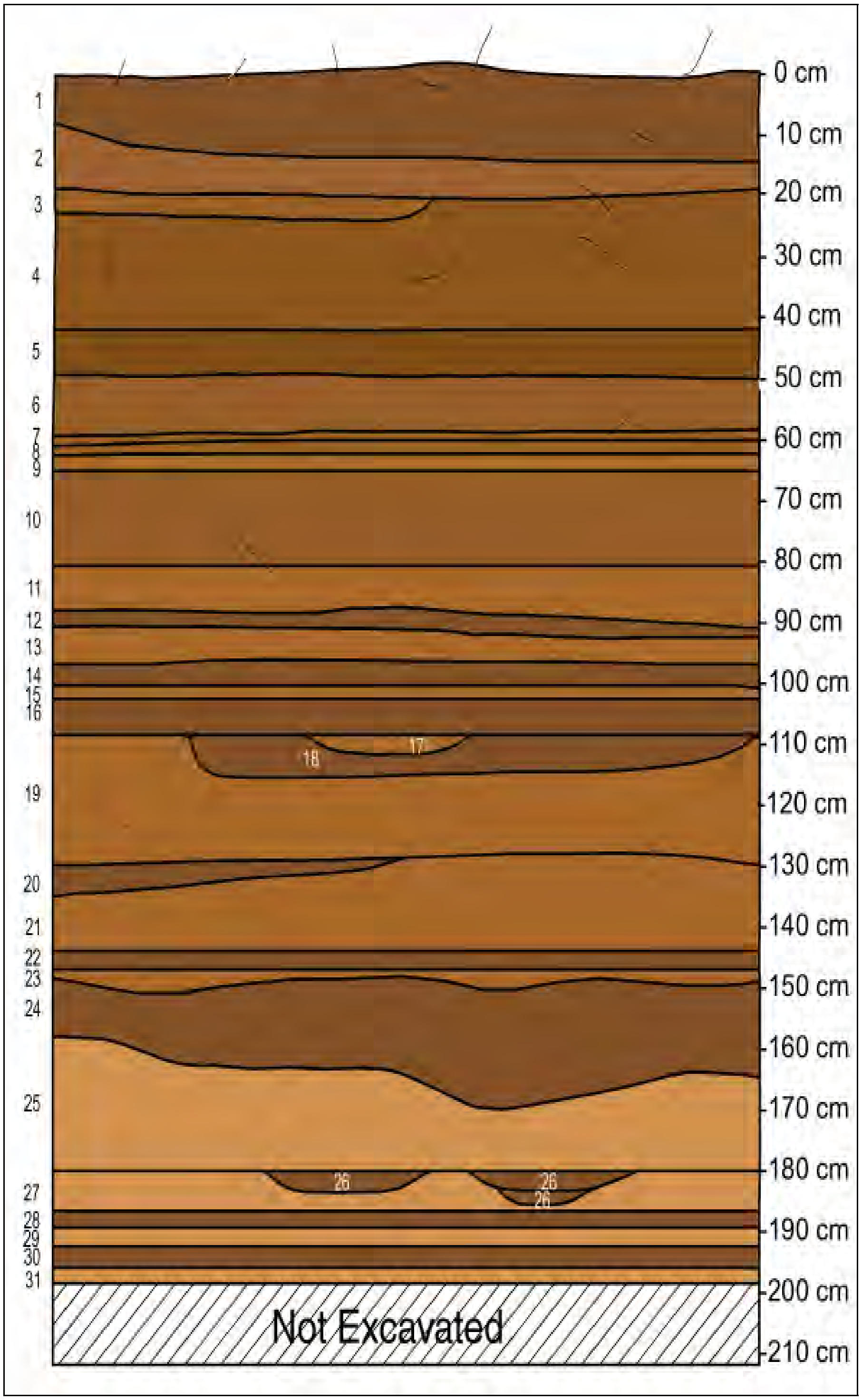


Figure 11. BT5 north wall profile.

Zone 1: 0-15 cm; 10YR4/2 (dark grayish brown), sandy clay loam, loose subangular slightly blocky structure; numerous rootlets; clear abrupt lower boundary.

Zone 2: 15-19 cm; 10YR5/3 (brown) sandy clay loam, loose subangular slightly blocky structure; numerous roots; clear abrupt lower boundary.

Zone 3: 19-22 cm; 10YR4/3 (brown), sandy clay loam, loose subangular slightly blocky structure; many limestone pebbles (<5mm) and roots; clear abrupt lower boundary.

Zone 4: 19-42 cm; 10YR4/4 (dark yellowish brown) sandy clay loam, loose subangular slightly blocky structure; 10YR6/4 (light yellowish brown) silt mottling (<5%); numerous roots; clear abrupt lower boundary.

Zone 5: 42-50 cm; 10YR3/3 (dark brown) sandy clay loam, loose subangular slightly blocky structure; numerous rootlets; clear abrupt lower boundary.

Zone 6: 50-58 cm; 10YR5/4 (yellowish brown) fine sandy loam, loose friable structure; numerous rootlets; clear abrupt lower boundary.

Zone 7: 58-60 cm; 10YR4/3 (brown) sandy clay loam, friable structure; numerous rootlets; clear abrupt lower boundary.

Zone 8: 60-62 cm; 10YR4/3 (brown) sandy clay loam, friable structure; numerous rootlets; clear abrupt lower boundary.

Zone 9: 62-65 cm; 10YR6/4 (light yellowish brown) fine sandy loam, loose prismatic structure; 10YR4/3 (brown) sandy loam mottling (<5%); clear abrupt lower boundary.

Zone 10: 65-81 cm; 10YR4/3 (brown) sandy clay loam, friable structure; numerous rootlets; clear abrupt lower boundary.

Zone 11: 81-91 cm; 10YR5/4 (yellowish brown) sandy clay loam, friable structure; clear abrupt lower boundary.

Zone 12: 91-93 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure, clear abrupt lower boundary.

Zone 13: 93-97 cm; 10YR5/4 (yellowish brown) sandy clay loam, friable structure; clear abrupt lower boundary.

Zone 14: 97-101 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure, clear abrupt lower boundary.

Zone 15: 101-103 cm; 10YR5/4 (yellowish brown) sandy clay loam, friable structure; clear abrupt lower boundary.

Zone 16: 103-108 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure, clear abrupt lower boundary.

Zone 17: 108-110 cm; 10YR5/4 (yellowish brown) sandy clay loam, friable structure; clear abrupt lower boundary.

Zone 18: 108-115 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure, clear abrupt lower boundary.

Zone 19: 108-130 cm; 10YR5/4 (yellowish brown) sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 20: 130-134 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure, clear abrupt lower boundary.

Zone 21: 130-143 cm; 10YR5/4 (yellowish brown) fine sandy loam, loose prismatic structure; clear abrupt lower boundary.

Zone 22: 143-147 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure; clear abrupt lower boundary.

Zone 23: 147-149cm; 10YR5/4 (yellowish brown) fine sandy loam, loose prismatic structure; abrupt wavy lower boundary.

Zone 24: 149-165 cm; 10YR4/2 (dark grayish brown) sandy clay loam, loose subangular slightly blocky structure; abrupt wavy lower boundary.

Zone 25: 165-180 cm; 10YR7/4 (very pale brown) sand, loose prismatic structure; clear abrupt lower boundary.

Zone 26: 180-186 cm; 10YR5/3 (brown) sandy loam; loose prismatic structure; wavy abrupt lower boundary.

Zone 27: 180-187 cm; 10YR7/4 (very pale brown) sand, loose prismatic structure; clear abrupt lower boundary.

Zone 28: 187-189 cm; 10YR5/3 (brown) sandy loam; loose prismatic structure; wavy abrupt lower boundary.

Zone 29: 189-192 cm; 10YR7/4 (very pale brown) sand, loose prismatic structure; clear abrupt lower boundary.

Zone 30: 192-196 cm; 10YR5/3 (brown) sandy loam; loose prismatic structure; wavy abrupt lower boundary.

Zone 31: 196-198+ cm; 10YR7/4 (very pale brown) sand, loose prismatic structure; lower boundary not observed.

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 17300, 819 TAYLOR STREET
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF

September 3, 2004

Planning, Environmental and Regulatory Division

SUBJECT: North Bosque River Section 206 Aquatic Ecosystem Restoration Project, Stephenville, Erath County, Texas

Mr. F. Lawerence Oaks
State Historic Preservation Office
Texas Historical Commission
P.O. Box 12276
Capital Station
Austin, Texas 78711

DRAFT REPORT
ACCEPTABLE
Please submit 20 final report copies
by William A. Martin
for F. Lawerence Oaks
State Historic Preservation Officer
Date 10/8/04

Dear Mr. Oaks:

In a letter dated October 30, 2003, we initiated consultation on the project mentioned above. Enclosed is a copy of the draft report *Archaeological Survey on Two Property Locations within the City of Stephenville, Erath County, Texas.* The archaeological survey was performed by the Ecological Communications Corporation, under contract to the US Army Corps of Engineers, Fort Worth District for the proposed project area. This work was conducted under Antiquities Permit No. 3464.

Given the findings presented in the report and in accordance with 36 CFR Part 800.4(d)(1), the U.S. Army Corps of Engineers (USACE), Fort Worth District has determined there will be no historic properties affected. We ask for your concurrence with this determination.

If you have any questions, please feel free to contact Ms. Nancy Parrish at (817) 886-1725.

NO HISTORIC
PROPERTIES AFFECTED
PROJECT MAY PROCEED
By William A. Martin
for F. Lawerence Oaks
State Historic Preservation Officer
Date 10/8/04

Sincerely,

for

William Fickel, Jr.
Chief, Planning, Environmental
and Regulatory Division

Enclosure

APPENDIX D

HTRW DATABASE SEARCH

BOSQUE RIVER AND WWTP
STEPHENVILLE, TEXAS

RECORDS REVIEW

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) INVESTIGATIONS
WASTE WATER TREATMENT PLANT
STEPHENVILLE, TEXAS

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

OCTOBER 2003

Introduction

A review of standard environmental record sources in accordance with ASTM Practice E 1527 was conducted by the Environmental Design Branch, Fort Worth District, Corps of Engineers as part of a Hazardous, Toxic, and Radioactive Waste (HTRW) Investigation for the Waste Water Treatment Plant - Stephenville, Texas. The area of study was the Waste Water Treatment Plant located in Stephenville, Texas.

Record Review Results

The following recognized environmental conditions were identified in connection with the property:

1 RCRIS-SQG site: **R**esource **C**onservation and **R**ecovery **I**nformation **S**ystem **– S**mall **Q**uantity **G**enerator.

1 LUST site: **L**eaking **U**nderground **S**torage **T**anks.

4 UST sites: Underground **S**torage **T**anks.

1 FINDS site: **F**acility **Ind**ex **S**ystem. Contains both facility information and "pointers" to other databases. These databases include: RCRIS, PCS, AIRS. FATES, FTTS, CERCLIS, DOCKET, FURS, FRDS, SIA, CICS, PADS, RCRA-J, TRIS and TSCA.

Discussion

The following is a summary of the more significant sites within the study area.

LUSTs

One LUST site was identified within the study area. The status of this site is "Final Concurrence Issued, Case Closed".

Conclusion

If no excavation is planned within the study area, it is unlikely that any of the recognized environmental conditions would pose an HTRW threat to the project. However, if the scope of work changes and excavation is considered, environmental conditions may exist that could pose a problem. It would then be necessary to, at a minimum, conduct an HTRW site survey to determine if feasible pathways exist between the recognized environmental conditions and places of planned excavation. Additionally, soil and water sampling may be needed.

The EDR Radius Map
with GeoCheck®

Waste Water Treatment Plant
Waste Water Treatment Plant
Stephenville, TX 76401

Inquiry Number: 01061751.2r

October 09, 2003

Environmental Data Resources, Inc.

***The* Source**
For Environmental
Risk Management
Data

3530 Post Road
Southport, Connecticut 06890

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-00. Search distances are per ASTM standard or custom distances requested by the user.

TARGET PROPERTY INFORMATION

ADDRESS

WASTE WATER TREATMENT PLANT
STEPHENVILLE, TX 76401

COORDINATES

Latitude (North):	32.197530 - 32˚ 11' 51.1''
Longitude (West):	98.184540 - 98˚ 11' 4.3''
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	576861.8
UTM Y (Meters):	3562433.8
Elevation:	1221 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	2432098-B2 STEPHENVILLE, TX
Source:	USGS 7.5 min quad index

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the ASTM E 1527-00 search radius around the target property for the following databases:

FEDERAL ASTM STANDARD

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP	CERCLIS No Further Remedial Action Planned
CORRACTS	Corrective Action Report
RCRIS-TSD	Resource Conservation and Recovery Information System
RCRIS-LQG	Resource Conservation and Recovery Information System
ERNS	Emergency Response Notification System

STATE ASTM STANDARD

SHWS	State Superfund Registry

EXECUTIVE SUMMARY

SWF/LF Permitted Solid Waste Facilities
CLI Closed Landfill Inventory
TX VCP Voluntary Cleanup Program Database

FEDERAL ASTM SUPPLEMENTAL

CONSENT Superfund (CERCLA) Consent Decrees
ROD Records Of Decision
Delisted NPL National Priority List Deletions
HMIRS Hazardous Materials Information Reporting System
MLTS Material Licensing Tracking System
MINES Mines Master Index File
NPL Liens Federal Superfund Liens
PADS PCB Activity Database System
DOD Department of Defense Sites
US BROWNFIELDS A Listing of Brownfields Sites
RAATS RCRA Administrative Action Tracking System
TRIS Toxic Chemical Release Inventory System
TSCA Toxic Substances Control Act
SSTS Section 7 Tracking Systems
FTTS FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

STATE OR LOCAL ASTM SUPPLEMENTAL

AST Petroleum Storage Tank Database
TX Spills Spills Database
IOP Innocent Owner/Operator Program
Multimedia Multi Media Enforcement Cases
Ind. Haz Waste Industrial & Hazardous Waste Database
WasteMgt Commercial Hazardous & Solid Waste Management Facilities
AIRS Current Emission Inventory Data

EDR PROPRIETARY HISTORICAL DATABASES

Coal Gas Former Manufactured Gas (Coal Gas) Sites

BROWNFIELDS DATABASES

US BROWNFIELDS A Listing of Brownfields Sites
Brownfields Brownfields Site Assessments
TX VCP Voluntary Cleanup Program Database

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

FEDERAL ASTM STANDARD

RCRIS: Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs): generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs): generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs): generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

A review of the RCRIS-SQG list, as provided by EDR, and dated 09/10/2003 has revealed that there is 1 RCRIS-SQG site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
DMO INDUSTRIES INC	***195 OLD HICO RD***	***1/2 - 1 NNW***	***1***	***6***

STATE ASTM STANDARD

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Texas Commission on Environmental Quality's Leaking Petroleum Storage Tank Database.

A review of the LUST list, as provided by EDR, and dated 07/07/2003 has revealed that there is 1 LUST site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
ONE STOP 3	***HWY 281 & 67***	***1/2 - 1 N***	***A2***	***6***

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Texas Commission on Environmental Quality's Petroleum Storage Tank Database.

A review of the UST list, as provided by EDR, and dated 08/08/2003 has revealed that there are 4 UST sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
ONE STOP 3	***HWY 281 & 67***	***1/2 - 1 N***	***A2***	***6***
TEXAS DEPT OF PUBLIC SAFETY	HWY 281 & US 67	1/2 - 1 N	3	11
ERATH CNTY ELEC COOPERATIVE AS	HWY 67 & HWY 281	1/2 - 1 N	A4	13
BLACKWELL ELECTRIC INC	205 E BALLOW	1/2 - 1 NNW	5	18

EXECUTIVE SUMMARY

FEDERAL ASTM SUPPLEMENTAL

FINDS: The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 07/25/2003 has revealed that there is 1 FINDS site within approximately 1 mile of the target property.

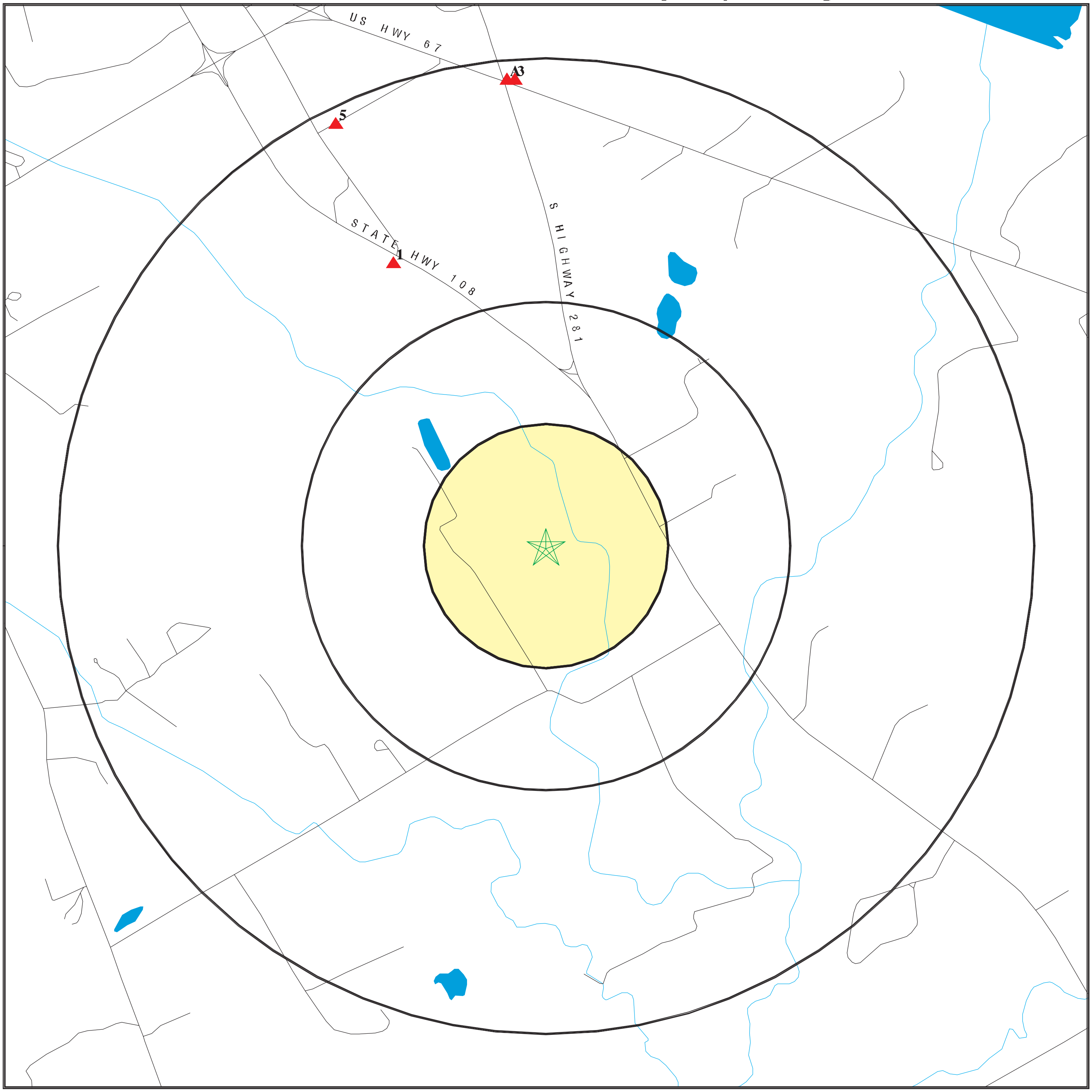
Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
DMO INDUSTRIES INC	*195 OLD HICO RD*	*1/2 - 1 NNW*	*1*	*6*

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
RATLIFF AERIAL SPRAYING	CERC-NFRAP
2 MILES N OF ERATH COUNTY COURTHOUSE, .5 M N OF TX	SWF/LF
5.0 MI. N. ON SH-108, 1.5 MI. W. ON FM-3025,1.0M.N	SWF/LF
CITY OF STEPHENVILLE	SWF/LF
ERATH CNTY ELECTRIC COOP ASS	LUST
INGRAM TRUCK STOP	AST
JAY MILLS CONTRACTING INC	AST
ERATH IRON & METAL INC	AST
B&S EXCAVATION CO	AST
MILLER NURSERY	AST
ERATH RECYCLING	RCRIS-SQG, FINDS, Ind. Haz Waste
ASSOCIATED MILK PRODUCERS INC	RCRIS-SQG, FINDS
STEPHENVILLE WASTEWATER TREATMENT PLANT	FINDS
DAIRY FARMERS OF AMERICA	Ind. Haz Waste
DAIRY FARMERS OF AMERICA	Ind. Haz Waste
DAIRY FARMERS OF AMERICA	Ind. Haz Waste
POLE HOLLOW RANCH	Ind. Haz Waste
ERATH RECYCLING	Ind. Haz Waste
TEX ALLISON BULK PLANT	Ind. Haz Waste
POLE HOLLOW RANCH	Ind. Haz Waste
POLE HOLLOW RANCH	Ind. Haz Waste
ERATH COUNTY ELECTRIC	Ind. Haz Waste
ERATH COUNTY ELECTRIC	Ind. Haz Waste
ASSOCIATED MILK PRODUCERS	Ind. Haz Waste
DMO INDUS. INC.	Ind. Haz Waste
DMO INDUS INC	Ind. Haz Waste, AIRS
OIL FIELD VALVES	AIRS

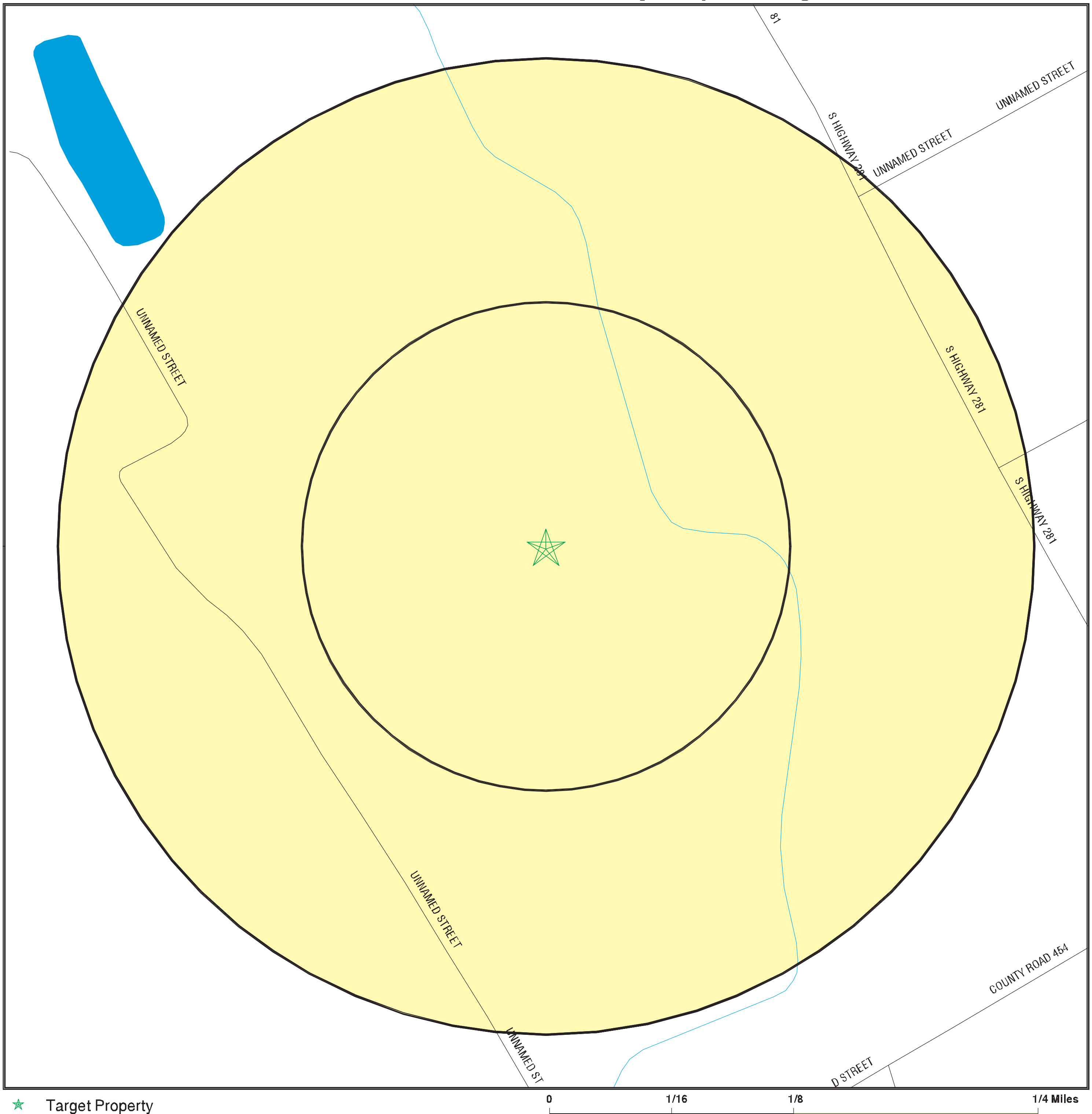
OVERVIEW MAP - 01061751.2r - U.S. Army Corps of Engineers



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites
- Oil & Gas pipelines

TARGET PROPERTY:	Waste Water Treatment Plant	CUSTOMER:	U.S. Army Corps of Engineers
ADDRESS:	Waste Water Treatment Plant	CONTACT:	William Crump
CITY/STATE/ZIP:	Stephenville TX 76401	INQUIRY #:	01061751.2r
LAT/LONG:	32.1975 / 98.1845	DATE:	October 09, 2003 12:34 pm

DETAIL MAP - 01061751.2r - U.S. Army Corps of Engineers



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Coal Gasification Sites
- Sensitive Receptors
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites

Oil & Gas pipelines

TARGET PROPERTY:	Waste Water Treatment Plant	CUSTOMER:	U.S. Army Corps of Engineers
ADDRESS:	Waste Water Treatment Plant	CONTACT:	William Crump
CITY/STATE/ZIP:	Stephenville TX 76401	INQUIRY #:	01061751.2r
LAT/LONG:	32.1975 / 98.1845	DATE:	October 09, 2003 12:34 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL ASTM STANDARD								
NPL		1.000	0	0	0	0	NR	0
Proposed NPL		1.000	0	0	0	0	NR	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		1.000	0	0	0	0	NR	0
CORRACTS		1.000	0	0	0	0	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		1.000	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		1.000	0	0	0	1	NR	1
ERNS		1.000	0	0	0	0	NR	0
STATE ASTM STANDARD								
State Haz. Waste		1.000	0	0	0	0	NR	0
State Landfill		1.000	0	0	0	0	NR	0
CLI		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	1	NR	1
UST		1.000	0	0	0	4	NR	4
TX VCP		1.000	0	0	0	0	NR	0
FEDERAL ASTM SUPPLEMENTAL								
CONSENT		1.000	0	0	0	0	NR	0
ROD		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
FINDS		1.000	0	0	0	1	NR	1
HMIRS		1.000	0	0	0	0	NR	0
MLTS		1.000	0	0	0	0	NR	0
MINES		1.000	0	0	0	0	NR	0
NPL Liens		1.000	0	0	0	0	NR	0
PADS		1.000	0	0	0	0	NR	0
DOD		1.000	0	0	0	0	NR	0
US BROWNFIELDS		1.000	0	0	0	0	NR	0
RAATS		1.000	0	0	0	0	NR	0
TRIS		1.000	0	0	0	0	NR	0
TSCA		1.000	0	0	0	0	NR	0
SSTS		1.000	0	0	0	0	NR	0
FTTS		1.000	0	0	0	0	NR	0
STATE OR LOCAL ASTM SUPPLEMENTAL								
AST		1.000	0	0	0	0	NR	0
TX Spills		1.000	0	0	0	0	NR	0
IOP		1.000	0	0	0	0	NR	0
Multimedia		1.000	0	0	0	0	NR	0
Ind. Haz Waste		1.000	0	0	0	0	NR	0
WasteMgt		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
AIRS		1.000	0	0	0	0	NR	0
EDR PROPRIETARY HISTORICAL DATABASES								
Coal Gas		1.000	0	0	0	0	NR	0
BROWNFIELDS DATABASES								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Brownfields		1.000	0	0	0	0	NR	0
TX VCP		1.000	0	0	0	0	NR	0

NOTES:

AQUIFLOW - see EDR Physical Setting Source Addendum

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

1	**DMO INDUSTRIES INC**	**RCRIS-SQG**	**1000119855**
NNW	**195 OLD HICO RD**	**FINDS**	**TXD982290439**
1/2-1	**STEPHENVILLE, TX 76401**		
3488 ft.			

Relative: Higher

Actual: 1254 ft.

RCRIS:

Owner: L G BILLS
(000) 000-0000
EPA ID: TXD982290439
Contact: GARY BILLS
(817) 968-2948
Classification: Small Quantity Generator
TSDF Activities: Not reported
Violation Status: No violations found

FINDS:

Other Pertinent Environmental Activity Identified at Site:
Facility Registry System (FRS)
Resource Conservation and Recovery Act Information system (RCRAINFO)

A2	**ONE STOP 3**	**LUST**	**U001292496**
North	**HWY 281 & 67**	**UST**	**N/A**
1/2-1	**STEPHENVILLE, TX 76401**		
5049 ft.			

Site 1 of 2 in cluster A

Relative: Higher

Actual: 1304 ft.

LUST:

Facility ID: 0063431
Facility Location: HWY 281 & HWY 67
Reported Date: 11/9/92
Entered Date: 2/1/93
RPR Coordinator: HLN
Region: 04
Region City ID: ARLINGTON
LPST Id: 105882
Responsible Party: HUDGINS CHRISTINE
RP Contact: CHRISTINE HUDGINS
RP Telephone: 254/965-7173
County Code: 072
RP Address: PO BOX 382
STEPHENVILLE, TX 76401
Priority: NO GW IMPACT, NO APPARENT THREATS OR IMPACTS TO RECEPTORS
Status: FINAL CONCURRENCE ISSUED, CASE CLOSED

UST:

Facility ID:	0063431	Tank Installer:	Not reported
Tank ID:	2	Installation Date:	Not reported
Tank Emptied:	Yes	Status Date:	09/09/92
Capacity:	3000	Unit ID:	00146422

Tank Material of Construction: Steel
Pipe Material of Construction: Steel
Other Materials of Construction: Not reported
Tank Status: Removed from the Ground
Tank Construction & Containment: Single Wall
Pipe Construction & Containment: Single Wall

ONE STOP 3 (Continued) **U001292496**

Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	08/06/92
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	B
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported

ONE STOP 3 (Continued) **U001292496**

Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	HUDGINS CHRISTINE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 965-7173
Owner Type :	Individual
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	08/01/10
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0001
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0003
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Individual
Owner Contact Name:	CHRISTINE HUDGINS
Date Registration Form Received :	06/92/08
Facility Type :	Retail
Name of Facility Manager :	CHRISTINE HUDGINS
Title of Facility Manager :	Not reported
Facility Manager Phone :	8179657173
Sign Name on Registration Form :	CHRISTINE HUDGINS
Title of Signer of Registration Form :	OWNER
Date of Signature on Registration Form :	080392
Facility in Ozone non-attainment area :	Not reported

Facility ID:	0063431	Tank Installer:	Not reported
Tank ID:	1	Installation Date:	Not reported
Tank Emptied:	No	Status Date:	09/09/92
Capacity:	3000	Unit ID:	00146423

Tank Material of Construction:	Steel
Pipe Material of Construction:	Steel
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Single Wall
Pipe Construction & Containment:	Single Wall
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	08/06/92

ONE STOP 3 (Continued) **U001292496**

Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	B
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	HUDGINS CHRISTINE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 965-7173
Owner Type :	Individual
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	08/01/10
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0001
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0003
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Individual
Owner Contact Name:	CHRISTINE HUDGINS
Date Registration Form Received :	06/92/08
Facility Type :	Retail
Name of Facility Manager :	CHRISTINE HUDGINS

ONE STOP 3 (Continued) **U001292496**

Title of Facility Manager :	Not reported
Facility Manager Phone :	8179657173
Sign Name on Registration Form :	CHRISTINE HUDGINS
Title of Signer of Registration Form :	OWNER
Date of Signature on Registration Form :	080392
Facility in Ozone non-attainment area :	Not reported

Facility ID:	0063431	Tank Installer:	Not reported
Tank ID:	3	Installation Date:	Not reported
Tank Emptied:	Yes	Status Date:	09/09/92
Capacity:	3000	Unit ID:	00146424

Tank Material of Construction:	Steel
Pipe Material of Construction:	Steel
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Single Wall
Pipe Construction & Containment:	Single Wall
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	08/06/92
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported

ONE STOP 3 (Continued) **U001292496**

Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	B
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	HUDGINS CHRISTINE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 965-7173
Owner Type :	Individual
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	08/01/10
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0001
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0003
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Individual
Owner Contact Name:	CHRISTINE HUDGINS
Date Registration Form Received :	06/92/08
Facility Type :	Retail
Name of Facility Manager :	CHRISTINE HUDGINS
Title of Facility Manager :	Not reported
Facility Manager Phone :	8179657173
Sign Name on Registration Form :	CHRISTINE HUDGINS
Title of Signer of Registration Form :	OWNER
Date of Signature on Registration Form :	080392
Facility in Ozone non-attainment area :	Not reported

3
North
1/2-1
5070 ft.

TEXAS DEPT OF PUBLIC SAFETY
HWY 281 & US 67
STEPHENVILLE, TX 76401

UST **U001241409**
N/A

Relative:
Higher

Actual:
1304 ft.

UST:

Facility ID:	0004734	Tank Installer:	Not reported
Tank ID:	1	Installation Date:	01/01/82
Tank Emptied:	No	Status Date:	10/30/98
Capacity:	2090	Unit ID:	00011496

Tank Material of Construction:	Steel
Pipe Material of Construction:	Steel
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Single Wall

TEXAS DEPT OF PUBLIC SAFETY (Continued) **U001241409**

Pipe Construction & Containment:	Single Wall
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	05/08/86
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	Not reported
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	Not reported
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported

TEXAS DEPT OF PUBLIC SAFETY (Continued) **U001241409**

Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	TEXAS DEPARTMENT OF PUBLIC SAFETY
Owner Address :	MAIL STOP 0255 AUSTIN, TX 78773
Owner Contact Telephone :	512-424-5277
Owner Type :	State Government
Owner Amendment Reason Code :	035
Owner Amendment Date :	14/03/04
Owner Tax ID :	0046147017
Number of Facilities reported by Owner :	0109
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0144
# Of Aboveground Storage Tanks :	0011
Operator Effective Date :	Not reported
Operator Type :	State Government
Owner Contact Name:	JOHN HARDEE
Date Registration Form Received :	08/86/05
Facility Type :	Fleet Refueling
Name of Facility Manager :	Taylor
Title of Facility Manager :	Not reported
Facility Manager Phone :	512-424-2172
Sign Name on Registration Form :	CLETA KENDRICK
Title of Signer of Registration Form :	ADJ. REG. DPS
Date of Signature on Registration Form :	031986
Facility in Ozone non-attainment area :	Not reported

A4
North
1/2-1
5076 ft.

Relative:
Higher

Actual:
1304 ft.

ERATH CNTY ELEC COOPERATIVE ASS **UST** **1000485202**
HWY 67 & HWY 281 **N/A**
STEPHENVILLE, TX 76401

Site 2 of 2 in cluster A

UST:

Facility ID:	0001387	Tank Installer:	Not reported
Tank ID:	1	Installation Date:	01/01/71
Tank Emptied:	No	Status Date:	09/28/91
Capacity:	8000	Unit ID:	00003488

Tank Material of Construction:	Steel
Pipe Material of Construction:	Not reported
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Not reported
Pipe Construction & Containment:	Not reported
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported

ERATH CNTY ELEC COOPERATIVE ASS (Continued) **1000485202**

Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	05/08/86
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	Not reported
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	ERATH COUNTY ELEC COOPERATIVE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 435-2832
Owner Type :	Private or Corporate
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	06/01/09
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0002
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0004

ERATH CNTY ELEC COOPERATIVE ASS (Continued) **1000485202**

# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Private or Corporate
Owner Contact Name:	
Date Registration Form Received :	08/86/05
Facility Type :	None of the above, or unidentified
Name of Facility Manager :	CHARLES CASTLEBERRY
Title of Facility Manager :	GENERAL MANAGER
Facility Manager Phone :	8179653153
Sign Name on Registration Form :	C. CASTLEBERRY
Title of Signer of Registration Form :	GENERAL MANAGER
Date of Signature on Registration Form :	020586
Facility in Ozone non-attainment area :	Not reported

Facility ID:	0001387	Tank Installer:	Not reported
Tank ID:	2	Installation Date:	12/01/83
Tank Emptied:	No	Status Date:	09/28/91
Capacity:	2000	Unit ID:	00003489

Tank Material of Construction:	Steel
Pipe Material of Construction:	Steel
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Single Wall
Pipe Construction & Containment:	Single Wall
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	05/08/86
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported

ERATH CNTY ELEC COOPERATIVE ASS (Continued) **1000485202**

Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	B
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	ERATH COUNTY ELEC COOPERATIVE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 435-2832
Owner Type :	Private or Corporate
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	06/01/09
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0002
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0004
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Private or Corporate
Owner Contact Name:	
Date Registration Form Received :	08/86/05
Facility Type :	None of the above, or unidentified
Name of Facility Manager :	CHARLES CASTLEBERRY
Title of Facility Manager :	GENERAL MANAGER
Facility Manager Phone :	8179653153
Sign Name on Registration Form :	C. CASTLEBERRY
Title of Signer of Registration Form :	GENERAL MANAGER
Date of Signature on Registration Form :	020586
Facility in Ozone non-attainment area :	Not reported

Facility ID:	0001387	Tank Installer:	Not reported
Tank ID:	3	Installation Date:	Not reported
Tank Emptied:	No	Status Date:	09/28/91
Capacity:	0	Unit ID:	00003490

Tank Material of Construction:	Not reported
Pipe Material of Construction:	Not reported

ERATH CNTY ELEC COOPERATIVE ASS (Continued) **1000485202**

Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Not reported
Pipe Construction & Containment:	Not reported
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported
Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	05/08/86
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	Not reported
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	None
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported

ERATH CNTY ELEC COOPERATIVE ASS (Continued) **1000485202**

Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	ERATH COUNTY ELEC COOPERATIVE
Owner Address :	STEPHENVILLE, TX 76401
Owner Contact Telephone :	(817) 435-2832
Owner Type :	Private or Corporate
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	06/01/09
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0002
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported
# Of Underground Storage Tanks :	0004
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Private or Corporate
Owner Contact Name:	
Date Registration Form Received :	08/86/05
Facility Type :	None of the above, or unidentified
Name of Facility Manager :	CHARLES CASTLEBERRY
Title of Facility Manager :	GENERAL MANAGER
Facility Manager Phone :	8179653153
Sign Name on Registration Form :	C. CASTLEBERRY
Title of Signer of Registration Form :	GENERAL MANAGER
Date of Signature on Registration Form :	020586
Facility in Ozone non-attainment area :	Not reported

5
NNW
1/2-1
5113 ft.

BLACKWELL ELECTRIC INC
205 E BALLOW
STEPHENVILLE, TX 76401

UST **U001259435**
N/A

Relative:
Higher

Actual:
1291 ft.

UST:

Facility ID:	0025347	Tank Installer:	Not reported
Tank ID:	H-818842	Installation Date:	01/01/80
Tank Emptied:	No	Status Date:	12/31/86
Capacity:	4000	Unit ID:	00065124

Tank Material of Construction:	Steel
Pipe Material of Construction:	Steel
Other Materials of Construction:	Not reported
Tank Status:	Removed from the Ground
Tank Construction & Containment:	Not reported
Pipe Construction & Containment:	Not reported
Other Construction & Containment:	Not reported
Compartment Substance Stored:	Gasoline
Compartment Other Substance:	Not reported
Tank Release Detection Method:	Not reported
Tank Release Method Detection II:	Not reported
Tank Release Method Detection III:	Not reported
Other Tank Release Method Detection:	None
Tank Release Detection Variance :	No Variance
Pipe Release Detection Method:	Not reported
Other Pipe Release Detection Method :	None
Pipe Release Detection Variance :	No Variance
Spill and Overfill Protection:	Not reported

BLACKWELL ELECTRIC INC (Continued) **U001259435**

Tank Corrosion Protection:	Not reported
Pipe Corrosion Protection:	Not reported
Other Corrosion Protection:	None
Vapor Recovery Equipment Status:	Not reported
Equipment Installed Date:	Not reported
Equipment Installer:	Not reported
Contractor Registration Number:	Not reported
Tank Registration Date:	05/08/86
Installer License Number:	Not reported
Operator Name:	Not reported
Operator Telephone number:	Not reported
Operator Address:	
Operator Address building:	Not reported
Contact Operator Name:	
Contact Operator title:	Not reported
Contact Operator Phone:	Not reported
Self-Certification date:	Not reported
Signature Name:	Not reported
Signature Title Name:	Not reported
Signature Type Text:	Not reported
Certification Submitted Type:	Not reported
Registration Self-Certification Flag:	Not reported
Fees Self-Certification Flag:	Not reported
Financial Assurance Self-Certification flag:	Not reported
Technical standards Self-Certification flag:	Not reported
UST Delivery Certificate Expiration Date:	Not reported
Compartment letter:	Not reported
Financial Responsibility Type:	Not reported
Corrective Action Met Flag:	Not reported
Third Party Met Flag:	Not reported
Financial Assurance Beginning Date:	Not reported
Piping Design & Ext. Containment 3 :	Not reported
Piping Design & Ext. Containment 4 :	Not reported
Type of Piping :	Not reported
Internal Tank Lining Date :	00/00/00
Pipe Connectors and Valves 1 :	Not reported
Pipe Connectors and Valves 2 :	Not reported
Pipe Connectors and Valves 3 :	Not reported
Other Tank Corrosion Protection Text:	Not reported
Tank Corrosion Protection Variance :	No Variance
Pipe Corrosion Protection iii3 :	Not reported
Pipe Corrosion Protection Variance :	No Variance
Stage 2 Vapor Recry Equipment Status :	Not reported
Stage 1 Equipment Installed Date :	Not reported
Tank Tested :	Not reported
Compartment Capacity :	0000000
Owner ID :	Not reported
Owner Name :	BLACKWELL ELECTRIC INC
Owner Address :	Stephenville, TX 76401
Owner Contact Telephone :	254-760-1477
Owner Type :	Corporation
Owner Amendment Reason Code :	Owner Name Changed
Owner Amendment Date :	02/03/01
Owner Tax ID :	Not reported
Number of Facilities reported by Owner :	0001
Mail Undeliverable :	Not reported
Bankruptcy In Effect :	Not reported

BLACKWELL ELECTRIC INC (Continued) **U001259435**

# Of Underground Storage Tanks :	0001
# Of Aboveground Storage Tanks :	0000
Operator Effective Date :	Not reported
Operator Type :	Corporation
Owner Contact Name:	DON BLACKWELL
Date Registration Form Received :	08/86/05
Facility Type :	Fleet Refueling
Name of Facility Manager :	DON BLACKWELL
Title of Facility Manager :	PRES
Facility Manager Phone :	254-760-1677
Sign Name on Registration Form :	DON BLACKWELL
Title of Signer of Registration Form :	PRES
Date of Signature on Registration Form :	041586
Facility in Ozone non-attainment area :	Not reported

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
STEPHENVILLE	S105787300	DAIRY FARMERS OF AMERICA	RT 1 BOX 69 .25 MI S DUBLIN HWY 377 STEPHENVILLE T	76401	Ind. Haz Waste
STEPHENVILLE	S105787301	DAIRY FARMERS OF AMERICA	RT 1 BOX 69 .25 MI S DUBLIN HWY 377 STEPHENVILLE T	76401	Ind. Haz Waste
STEPHENVILLE	S105837277	DAIRY FARMERS OF AMERICA	RT 1 BOX 69 .25 MI S ON DUBLIN HWY 377	76401	Ind. Haz Waste
STEPHENVILLE	A100118180	INGRAM TRUCK STOP	HWY 281 N	76401	AST
STEPHENVILLE	S105778486	POLE HOLLOW RANCH	US 281, 3 MILES SOUTHEAST OF, STEPHENVILLE, TX	76401	Ind. Haz Waste
STEPHENVILLE	1004788023	ERATH RECYCLING	HWY 377 SOUTH	76401	RCRIS-SQG, FINDS, Ind. Haz Waste
STEPHENVILLE	S105837445	ERATH RECYCLING	HWY 377 S .5 MI SW OF	76401	Ind. Haz Waste
STEPHENVILLE	1001965070	ERATH CNTY ELECTRIC COOP ASS	HWY 67	76401	LUST
STEPHENVILLE	1005985460	STEPHENVILLE WASTEWATER TREATMENT PLANT	COUNTY ROAD 454	76401	FINDS
STEPHENVILLE	1003875026	RATLIFF AERIAL SPRAYING	3 MI E OF HWY 377	76401	CERC-NFRAP
STEPHENVILLE	S102749118	TEX ALLISON BULK PLANT	W HIGHWAY 377	76401	Ind. Haz Waste
STEPHENVILLE	A100178731	JAY MILLS CONTRACTING INC	6126 N HWY 377	76401	AST
STEPHENVILLE	A100210681	ERATH IRON & METAL INC	US HWY 377	76401	AST
STEPHENVILLE	S105778487	POLE HOLLOW RANCH	US HWY 281 3 MI SE	76401	Ind. Haz Waste
STEPHENVILLE	S105778488	POLE HOLLOW RANCH	US HWY 281 3 MI SE, STEPHENVILLE, TX	76401	Ind. Haz Waste
STEPHENVILLE	S105779735	ERATH COUNTY ELECTRIC	US HWY 281 / 67	76401	Ind. Haz Waste
STEPHENVILLE	S105779736	ERATH COUNTY ELECTRIC	US HWY 281 / 67 STEPHENVILLE TX	76401	Ind. Haz Waste
STEPHENVILLE	S105787299	ASSOCIATED MILK PRODUCERS	.25 MI S DUBLIN HWY 377 OF, STEPHENVILLE, TX	76401	Ind. Haz Waste
STEPHENVILLE	S105243589		2 MILES N OF ERATH COUNTY COURTHOUSE, M N OF TX		SWF/LF
STEPHENVILLE	A100189285	B&S EXCAVATION CO	1 MI N ON US HWY 281	76401	AST
STEPHENVILLE	S105243641		5.0 MI. N. ON SH-108, 1.5 MI. W. ON FM-3025,1.0M.N		SWF/LF
STEPHENVILLE	S105122699	OIL FIELD VALVES	NEAR HWY.377	76401	AIRS
STEPHENVILLE	S105749871	CITY OF STEPHENVILLE	NORTH OF THE INTERSECTION OF COUNTY R 385 / 242		SWF/LF
STEPHENVILLE	S102743796	DMO INDUS. INC.	195 OLD HICO RD	76401	Ind. Haz Waste
STEPHENVILLE	S104811634	DMO INDUS INC	195 OLD HICO RD	76401	Ind. Haz Waste, AIRS
STEPHENVILLE	1001203750	ASSOCIATED MILK PRODUCERS INC	ONE 4TH MILE S DUBLIN HWY 377	76401	RCRIS-SQG, FINDS
STEPHENVILLE	A100118174	MILLER NURSERY	W US HWY 67 & HWY 377	76401	AST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM STANDARD RECORDS

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/22/03
Date Made Active at EDR: 08/26/03
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 08/04/03
Elapsed ASTM days: 22
Date of Last EDR Contact: 08/04/03

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 6
Telephone: 214-655-6659

EPA Region 8
Telephone: 303-312-6774

Proposed NPL: Proposed National Priority List Sites
Source: EPA
Telephone: N/A

Date of Government Version: 06/10/03
Date Made Active at EDR: 08/26/03
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 08/04/03
Elapsed ASTM days: 22
Date of Last EDR Contact: 08/04/03

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/16/03
Date Made Active at EDR: 08/01/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 06/23/03
Elapsed ASTM days: 39
Date of Last EDR Contact: 09/24/03

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 06/11/03
Date Made Active at EDR: 08/01/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 06/23/03
Elapsed ASTM days: 39
Date of Last EDR Contact: 09/24/03

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 08/13/03
Date Made Active at EDR: 09/18/03
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 08/22/03
Elapsed ASTM days: 27
Date of Last EDR Contact: 09/08/03

RCRIS: Resource Conservation and Recovery Information System
Source: EPA
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs): generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs): generate between 100 kg and 1,000 kg of hazardous waste per month. Large quantity generators (LQGs): generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/10/03
Date Made Active at EDR: 10/01/03
Database Release Frequency: Varies
Date of Data Arrival at EDR: 09/11/03
Elapsed ASTM days: 20
Date of Last EDR Contact: 09/11/03

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/02
Date Made Active at EDR: 02/03/03
Database Release Frequency: Annually
Date of Data Arrival at EDR: 01/27/03
Elapsed ASTM days: 7
Date of Last EDR Contact: 07/28/03

FEDERAL ASTM SUPPLEMENTAL RECORDS

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/99
Database Release Frequency: Biennially
Date of Last EDR Contact: 10/01/03
Date of Next Scheduled EDR Contact: 12/15/03

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: N/A
Database Release Frequency: Varies
Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

ROD: Records Of Decision
Source: EPA
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/09/03
Database Release Frequency: Annually
Date of Last EDR Contact: 07/07/03
Date of Next Scheduled EDR Contact: 10/06/03

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/22/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/04/03
Date of Next Scheduled EDR Contact: 11/03/03

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/25/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/02/03
Date of Next Scheduled EDR Contact: 10/06/03

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/31/03
Database Release Frequency: Annually
Date of Last EDR Contact: 07/23/03
Date of Next Scheduled EDR Contact: 10/20/03

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/16/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/02/03
Date of Next Scheduled EDR Contact: 10/06/03

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 06/07/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 10/01/03
Date of Next Scheduled EDR Contact: 12/29/03

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 202-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 08/25/03
Date of Next Scheduled EDR Contact: 11/24/03

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-564-3887
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/30/03
Database Release Frequency: Annually
Date of Last EDR Contact: 08/13/03
Date of Next Scheduled EDR Contact: 11/10/03

DOD: Department of Defense Sites
Source: USGS
Telephone: 703-648-5920
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 04/01/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/15/03
Date of Next Scheduled EDR Contact: 11/10/03

US BROWNFIELDS: A Listing of Brownfields Sites
Source: Environmental Protection Agency
Telephone: 202-566-2777
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become BCRLF cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 07/15/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 09/15/03
Date of Next Scheduled EDR Contact: 12/15/03

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 09/08/03
Date of Next Scheduled EDR Contact: 12/08/03

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/01
Database Release Frequency: Annually
Date of Last EDR Contact: 09/23/03
Date of Next Scheduled EDR Contact: 12/22/03

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/98
Database Release Frequency: Every 4 Years
Date of Last EDR Contact: 09/02/03
Date of Next Scheduled EDR Contact: 12/08/03

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-564-2501

Date of Government Version: 08/21/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/23/03
Date of Next Scheduled EDR Contact: 12/22/03

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-5008
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/01
Database Release Frequency: Annually
Date of Last EDR Contact: 07/24/03
Date of Next Scheduled EDR Contact: 10/20/03

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-564-2501
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/21/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/23/03
Date of Next Scheduled EDR Contact: 12/22/03

STATE OF TEXAS ASTM STANDARD RECORDS

SHWS: State Superfund Registry
Source: Texas Commission on Environmental Quality
Telephone: 512-239-5680
State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 06/27/03
Date Made Active at EDR: 08/26/03
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 07/29/03
Elapsed ASTM days: 28
Date of Last EDR Contact: 07/11/03

SWF/LF: Permitted Solid Waste Facilities
Source: Texas Commission on Environmental Quality
Telephone: 512-239-6706
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 08/01/03
Date Made Active at EDR: 09/19/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/29/03
Elapsed ASTM days: 21
Date of Last EDR Contact: 08/26/03

CLI: Closed Landfill Inventory
Source: Texas Commission on Environmental Quality
Telephone: 512-239-6016
Closed and abandoned landfills (permitted as well as unauthorized) across the state of Texas.

Date of Government Version: 08/30/99
Date Made Active at EDR: 10/30/00
Database Release Frequency: Varies
Date of Data Arrival at EDR: 09/28/00
Elapsed ASTM days: 32
Date of Last EDR Contact: 08/05/03

LUST: Leaking Petroleum Storage Tank Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2200
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 07/07/03
Date Made Active at EDR: 09/08/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/19/03
Elapsed ASTM days: 20
Date of Last EDR Contact: 07/29/03

UST: Petroleum Storage Tank Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/08/03
Date Made Active at EDR: 09/11/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/19/03
Elapsed ASTM days: 23
Date of Last EDR Contact: 07/29/03

VCP: Voluntary Cleanup Program Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-5891
The Texas Voluntary Cleanup Program was established to provide administrative, technical, and legal incentives to encourage the cleanup of contaminated sites in Texas.

Date of Government Version: 06/12/03
Date Made Active at EDR: 08/14/03
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 08/04/03
Elapsed ASTM days: 10
Date of Last EDR Contact: 08/04/03

STATE OF TEXAS ASTM SUPPLEMENTAL RECORDS

AST: Petroleum Storage Tank Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Registered Aboveground Storage Tanks.

Date of Government Version: 08/08/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 07/29/03
Date of Next Scheduled EDR Contact: 10/27/03

SPILLS: Spills Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-0983

Date of Government Version: 08/15/02
Database Release Frequency: Quarterly
Date of Last EDR Contact: 09/23/03
Date of Next Scheduled EDR Contact: 12/22/03

IOP: Innocent Owner/Operator Program
Source: Texas Commission on Environmental Quality
Telephone: 512-239-5894
Contains information on all sites that are in the IOP. An IOP is an innocent owner or operator whose property is contaminated as a result of a release or migration of contaminants from a source or sources not located on the property, and they did not cause or contribute to the source or sources of contamination.

Date of Government Version: 06/12/03 Date of Last EDR Contact: 08/12/03
Database Release Frequency: Quarterly Date of Next Scheduled EDR Contact: 11/10/03

Multimedia: Multi Media Enforcement Cases
Source: Texas Commission on Environmental Quality
Telephone: 512-239-6012
Any enforcement case with more than one media (water, waste, etc.) violation.

Date of Government Version: 03/07/03 Date of Last EDR Contact: 09/08/03
Database Release Frequency: Semi-Annually Date of Next Scheduled EDR Contact: 12/08/03

Ind. Haz Waste: Industrial & Hazardous Waste Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-0985
Summary reports reported by waste handlers, generators and shippers in Texas.

Date of Government Version: 12/31/02 Date of Last EDR Contact: 08/05/03
Database Release Frequency: Annually Date of Next Scheduled EDR Contact: 11/03/03

WASTEMGT: Commercial Hazardous & Solid Waste Management Facilities
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2920
This list contains commercial recycling facilities and facilities permitted or authorized (interim status) by the Texas Natural Resource Conservation Commission.

Date of Government Version: 06/01/98 Date of Last EDR Contact: 08/05/03
Database Release Frequency: Varies Date of Next Scheduled EDR Contact: 11/03/03

AIRS: Current Emission Inventory Data
Source: Texas Commission on Environmental Quality
Telephone: N/A
The database lists by company, along with their actual emissions, the TNRCC air accounts that emit EPA criteria pollutants.

Date of Government Version: 07/25/03 Date of Last EDR Contact: 07/08/03
Database Release Frequency: Semi-Annually Date of Next Scheduled EDR Contact: 10/13/03

EDR PROPRIETARY HISTORICAL DATABASES

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

Disclaimer Provided by Real Property Scan, Inc.

The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

BROWNFIELDS DATABASES

Brownfields: Brownfields Site Assessments
Source: TCEQ
Telephone: 512-239-5872
Brownfield site assessments that are being cleaned under EPA grant monies.

Date of Government Version: 06/13/03
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 08/04/03
Date of Next Scheduled EDR Contact: 11/03/03

US BROWNFIELDS: A Listing of Brownfields Sites
Source: Environmental Protection Agency
Telephone: 202-566-2777
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become BCRLF cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: N/A
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: N/A
Date of Next Scheduled EDR Contact: N/A

VCP: Voluntary Cleanup Program Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-5891
The Texas Voluntary Cleanup Program was established to provide administrative, technical, and legal incentives to encourage the cleanup of contaminated sites in Texas.

Date of Government Version: 06/12/03
Database Release Frequency: Quarterly
Date of Last EDR Contact: 08/04/03
Date of Next Scheduled EDR Contact: 11/03/03

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: PennWell Corporation
Telephone: (800) 823-6277
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Protective & Regulatory Services
Telephone: 512-438-3269

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

WASTE WATER TREATMENT PLANT
WASTE WATER TREATMENT PLANT
STEPHENVILLE, TX 76401

TARGET PROPERTY COORDINATES

Latitude (North):	32.197529 - 32˚ 11’ 51.1’’
Longitude (West):	98.184540 - 98˚ 11’ 4.3’’
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	576861.8
UTM Y (Meters):	3562433.8
Elevation:	1221 ft. above sea level

EDR’s GeoCheck Physical Setting Source Addendum has been developed to assist the environmental professional with the collection of physical setting source information in accordance with ASTM 1527-00, Section 7.2.3. Section 7.2.3 requires that a current USGS 7.5 Minute Topographic Map (or equivalent, such as the USGS Digital Elevation Model) be reviewed. It also requires that one or more additional physical setting sources be sought when (1) conditions have been identified in which hazardous substances or petroleum products are likely to migrate to or from the property, and (2) more information than is provided in the current USGS 7.5 Minute Topographic Map (or equivalent) is generally obtained, pursuant to local good commercial or customary practice, to assess the impact of migration of recognized environmental conditions in connection with the property. Such additional physical setting sources generally include information about the topographic, hydrologic, hydrogeologic, and geologic characteristics of a site, and wells in the area.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata. EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

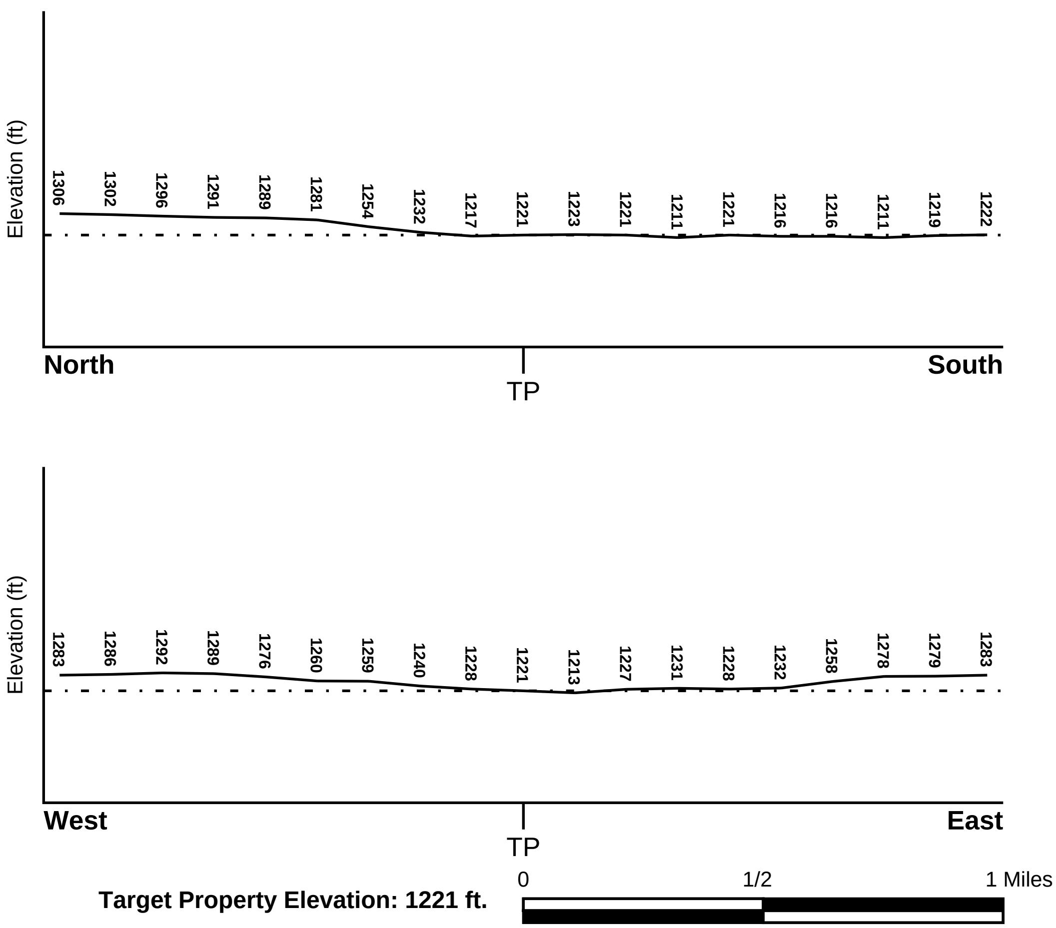
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

USGS Topographic Map:	2432098-B2 STEPHENVILLE, TX
General Topographic Gradient:	General SE
Source:	USGS 7.5 min quad index

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Target Property Elevation: 1221 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
ERATH, TX	Not Available

Flood Plain Panel at Target Property: Not Reported

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
STEPHENVILLE	Not Available

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era: Mesozoic
System: Cretaceous
Series: Trinity Group
Code: lK1 *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name: PURVES

Soil Surface Texture: stony - clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: HIGH

Depth to Bedrock Min: > 8 inches

Depth to Bedrock Max: > 20 inches

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	12 inches	stony - clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.60 Min: 0.20	Max: 8.40 Min: 7.90
2	12 inches	14 inches	gravelly - clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 0.60 Min: 0.20	Max: 8.40 Min: 7.90
3	14 inches	20 inches	unweathered bedrock	Not reported	Not reported	Max: 2.00 Min: 0.06	Max: 0.00 Min: 0.00

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: stony - clay loam
gravelly - clay loam
clay loam
clay
silty clay
loam

Surficial Soil Types: stony - clay loam
gravelly - clay loam
clay loam
clay
silty clay
loam

Shallow Soil Types: silty clay
silty clay loam

Deeper Soil Types: weathered bedrock
silty clay
loam

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

According to ASTM E 1527-00, Section 7.2.2, "one or more additional state or local sources of environmental records may be checked, in the discretion of the environmental professional, to enhance and supplement federal and state sources... Factors to consider in determining which local or additional state records, if any, should be checked include (1) whether they are reasonably ascertainable, (2) whether they are sufficiently useful, accurate, and complete in light of the objective of the records review (see 7.1.1), and (3) whether they are obtained, pursuant to local, good commercial or customary practice." One of the record sources listed in Section 7.2.2 is water well information. Water well information can be used to assist the environmental professional in assessing sources that may impact groundwater flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

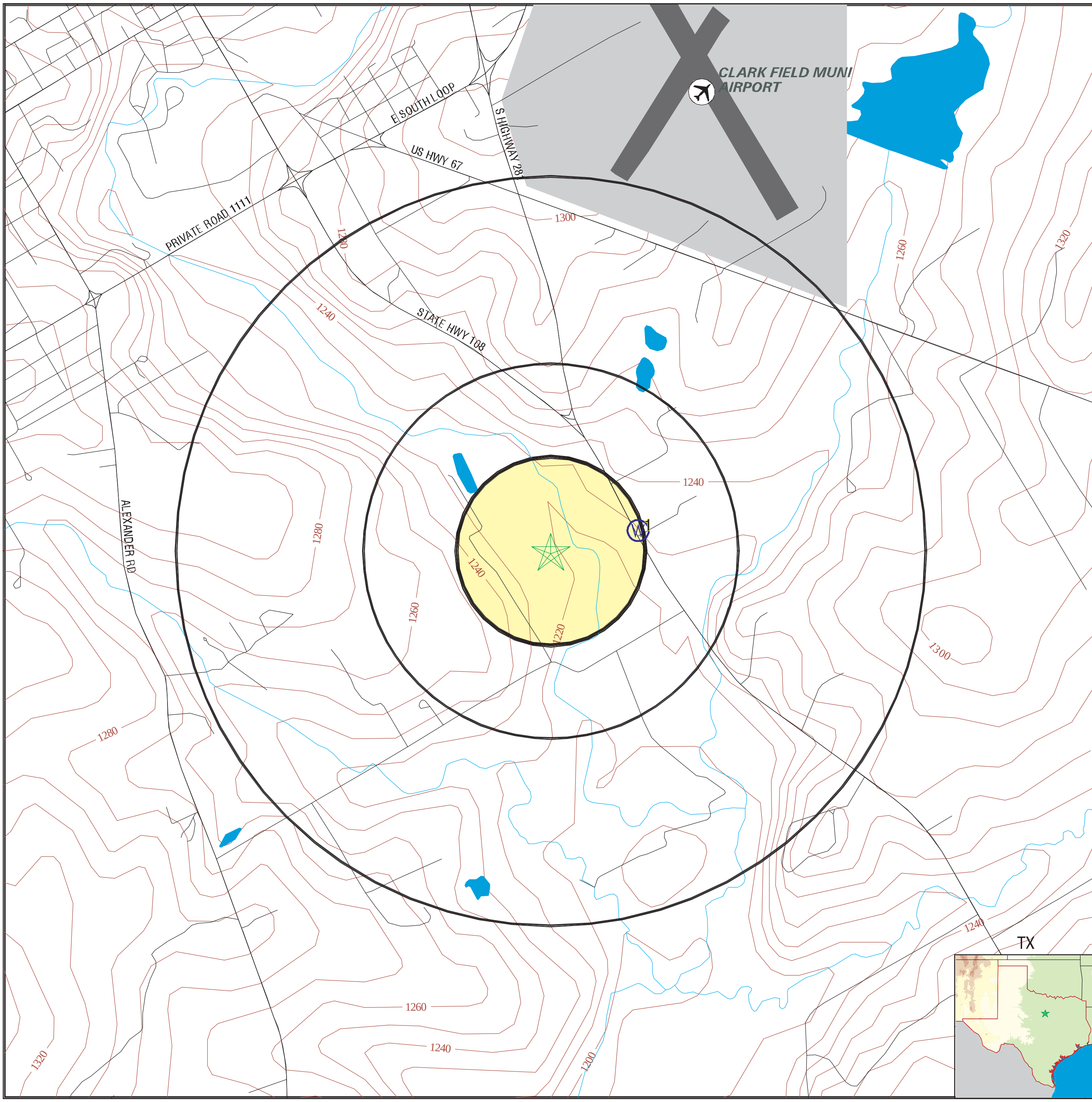
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	B3155504	1/8 - 1/4 Mile ENE

PHYSICAL SETTING SOURCE MAP - 01061751.2r



- County Boundary
- Major Roads
- Contour Lines
- Airports
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons

0 1/4 1/2 1 Miles

- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location
- Closest Hydrogeological Data
- Oil or gas wells (in certain Texas counties)

TARGET PROPERTY:	Waste Water Treatment Plant	CUSTOMER:	U.S. Army Corps of Engineers
ADDRESS:	Waste Water Treatment Plant	CONTACT:	William Crump
CITY/STATE/ZIP:	Stephenville TX 76401	INQUIRY #:	01061751.2r
LAT/LONG:	32.1975 / 98.1845	DATE:	October 09, 2003 12:34 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **ENE** **1/8 - 1/4 Mile** **Higher**	**TX WELLS**	**B3155504**

St_well_nu:	3155504	Cnty_code:	Erath
Basin:	BRAZOS RIVER	Zone:	3
Reg_num:	12	Prev_well_:	Not Reported
Longitude:	981050	Latitude:	321154
Owner:	Donna Dowell		
Driller:	Dowell Water Well Drilling		
Coord_src:	1		
Aqu_code:	TWIN MOUNTAINS FORMATION		
Aqu_id1:	28	Aqu_id2:	Not Reported
Aqu_id3:	Not Reported	Lsd_elev:	1230
Meas_elev:	M	Use_cd_eco:	Not Reported
Date_drill:	Not Reported	Well_typ:	W
Well_depth:	332	Src_depth:	Geologist-Consultant/University Associate
Type_lift:	None	Type of Power:	Not Reported
Horsepower:	Not Reported	Primary use:	Unused
Secondary use:	Not Reported	Tert use:	Not Reported
Avg Level:	R	Water quality:	N
Water Logs Available:	Fluid-Conductivity,Geologists or sample,Temperature		
Other data avail:	Not Reported		
Date collected:	02092000	Reporting agency:	Texas Water Development Board
Well_sched:	Y	Const method:	hydraulic rotary
Completion:	perforated or slotted	Case_mater:	Steel
Screen_mat:	steel	Lith_log:	Not Reported
Int_lith_b:	Not Reported	Lith_date:	Not Reported

Water Level Information - 2x Month::

Measurement Number:	01		
Depth from land surface:	-187.85	Measurement Date:	2/9/2000
Visit Mark:	Publishable - water-level is indicative of aquifer’s piezometric surface		
Measurement Method:	Steel Tape	Measuring Agency:	Texas Water Development Board
Remark:	MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE		

Measurement Number:	01		
Depth from land surface:	-189.6	Measurement Date:	2/18/2000
Visit Mark:	Publishable - water-level is indicative of aquifer’s piezometric surface		
Measurement Method:	Recorder	Measuring Agency:	Texas Water Development Board
Remark:	MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE		

Measurement Number:	01		
Depth from land surface:	-190.93	Measurement Date:	6/23/2000
Visit Mark:	Publishable - water-level is indicative of aquifer’s piezometric surface		
Measurement Method:	Steel Tape	Measuring Agency:	Texas Water Development Board
Remark:	MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE		

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 6/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -204.33 Measurement Date: 7/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.93 Measurement Date: 8/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.34 Measurement Date: 8/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -204.38 Measurement Date: 9/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -200.01 Measurement Date: 9/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.09 Measurement Date: 10/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.26 Measurement Date: 10/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -191.62 Measurement Date: 11/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.17 Measurement Date: 11/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.69 Measurement Date: 12/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.42 Measurement Date: 12/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.89 Measurement Date: 1/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.57 Measurement Date: 1/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.62 Measurement Date: 2/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.73 Measurement Date: 2/28/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -187.77 Measurement Date: 3/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.17 Measurement Date: 3/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.39 Measurement Date: 4/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.31 Measurement Date: 4/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.26 Measurement Date: 5/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.5 Measurement Date: 5/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -192.8 Measurement Date: 6/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -193.53 Measurement Date: 6/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.38 Measurement Date: 7/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -202.52 Measurement Date: 7/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Water Level Information - 5x Month::

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 6/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 6/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.83 Measurement Date: 7/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -204.33 Measurement Date: 7/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -205.78 Measurement Date: 8/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -205.01 Measurement Date: 8/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.93 Measurement Date: 8/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.76 Measurement Date: 8/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.53 Measurement Date: 8/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -206.34 Measurement Date: 8/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -205.65 Measurement Date: 9/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -205.43 Measurement Date: 9/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -204.38 Measurement Date: 9/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -203.44 Measurement Date: 9/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -202.09 Measurement Date: 9/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -200.01 Measurement Date: 9/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -200.01 Measurement Date: 10/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -198.42 Measurement Date: 10/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.09 Measurement Date: 10/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.26 Measurement Date: 10/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.26 Measurement Date: 10/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.26 Measurement Date: 10/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.26 Measurement Date: 11/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer’s piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -192.29 Measurement Date: 11/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -191.62 Measurement Date: 11/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -191.92 Measurement Date: 11/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.98 Measurement Date: 11/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.17 Measurement Date: 11/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.99 Measurement Date: 12/5/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.7 Measurement Date: 12/10/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.69 Measurement Date: 12/15/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.53 Measurement Date: 12/20/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.72 Measurement Date: 12/25/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.42 Measurement Date: 12/30/2000
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.29 Measurement Date: 1/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.24 Measurement Date: 1/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.89 Measurement Date: 1/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.06 Measurement Date: 1/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.11 Measurement Date: 1/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.57 Measurement Date: 1/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.81 Measurement Date: 2/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.95 Measurement Date: 2/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.62 Measurement Date: 2/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.77 Measurement Date: 2/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.76 Measurement Date: 2/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.73 Measurement Date: 2/28/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.9 Measurement Date: 3/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.26 Measurement Date: 3/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -187.77 Measurement Date: 3/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.26 Measurement Date: 3/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.17 Measurement Date: 3/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.17 Measurement Date: 3/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.77 Measurement Date: 4/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -188.85 Measurement Date: 4/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.39 Measurement Date: 4/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.41 Measurement Date: 4/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.22 Measurement Date: 4/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.31 Measurement Date: 4/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.89 Measurement Date: 5/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.24 Measurement Date: 5/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.26 Measurement Date: 5/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -189.55 Measurement Date: 5/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.3 Measurement Date: 5/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.5 Measurement Date: 5/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -190.34 Measurement Date: 6/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -191.28 Measurement Date: 6/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -192.8 Measurement Date: 6/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -192.01 Measurement Date: 6/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -192.17 Measurement Date: 6/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -193.53 Measurement Date: 6/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -193.2 Measurement Date: 7/5/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -194.84 Measurement Date: 7/10/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -197.38 Measurement Date: 7/15/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -198.85 Measurement Date: 7/20/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -201.52 Measurement Date: 7/25/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Measurement Number: 01
Depth from land surface: -202.52 Measurement Date: 7/30/2001
Visit Mark: Publishable - water-level is indicative of aquifer's piezometric surface
Measurement Method: Recorder Measuring Agency: Texas Water Development Board
Remark: MEASUREMENT GOOD. NO UNUSUAL CONDITIONS NOTED AT OR NEAR WELL SITE

Well Casing Information::

Indicator	Diameter	Top of Interval	Bottom of Interval
Casing	6	0	268
Screen	6	268	332

AREA RADON INFORMATION

State Database: TX Radon

Radon Test Results

County	Mean	Total Sites	%>4 pCi/L	%>20 pCi/L	Min pCi/L	Max pCi/L
ERATH	<.5	6	.0	.0	<.5	.7

Federal EPA Radon Zone for ERATH County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 76401

Number of sites tested: 4

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.450 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002. 7.5-Minute DEMs correspond to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the national Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

ADDITIONAL ENVIRONMENTAL RECORD SOURCES

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STATE RECORDS

Texas Groundwater Database
Source: Texas Water Development Board
Telephone: 512-936-0837

Texas Oil and Gas Wells: Inventory of oil and gas wells in select Texas counties
Source: Texas Railroad Commission

Texas Public Water Supply Database on Ground and Surface Water
Source: Texas Commission on Environmental Quality

RADON

State Database: TX Radon
Source: Department of Health
Telephone: 512-834-6688
Rinal Report of the Texas Indoor Radon Survey

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

APPENDIX E

INCREMENTAL COST ANALYSIS INFORMATION

SCENARIO STATISTICS

11/19/2004 2:45 PM

SCENARIO: Run Sixteen Stephenville

FILE: C:\IWRPLAN\Data\Stephenville WWTP.mdb

COST VARIABLE: CostUnits Total Annual Charges **SENSITIVITY:** Expected

OUTPUT VARIABLE: HabitatUnit Average Annual Habitat Units **SENSITIVITY:** Expected

CREATED: 7/28/2004 12:54:00 P **EDITED:** **ANALYZED:** 7/28/2004 12:54:00 P

POSSIBLE COMBINATIONS: 768 **COST EFFECTIVE:** 102

ACTUAL COMBINATIONS: 768 **BEST BUY:** 14

CONSTRAINT GROUP: NONE

EXCLUDED SOLUTIONS

DERIVED VARIABLES

DEPENDENCY / NON-COMBINABILITY

SOLUTION LEGEND

Solution / Scale Code		Solution Description	Scale Description
A	0	WWTP Wetland	No Action
A	1	WWTP Wetland	Entire Footprint (16.9 acres)
A	2	WWTP Wetland	Eastern Two Cells Only (8.5 acres)
A	3	WWTP Wetland	Southern Half Only (11.3 acres)
B	0	WWTP Reforestation	No Action
B	1	WWTP Reforestation	Screen (20 ft); NW (5 tr/ac); River (5 tr/a
B	2	WWTP Reforestation	Screen (20 ft); NW (15 tr/ac); River (15 t
B	3	WWTP Reforestation	Screen (20 ft); NW (25 tr/ac); River (25 t
B	4	WWTP Reforestation	Screen (20 ft); NW (50 tr/ac); River (50 t
B	5	WWTP Reforestation	Scren (20 ft); NW (100 tr/ac); River (100
B	6	WWTP Reforestation	Screen (20 ft); NW (200 tr/ac); River (20
B	7	WWTP Reforestation	Screen (20 ft); NW (300 tr/ac); River (30
C	0	Park In-Stream	No Action
C	1	Park In-Stream	2 weirs; 5 riffles; 4 rootwads
C	2	Park In-Stream	2 weirs; 7 riffles; 2 rootwads
C	3	Park In-Stream	2 weirs; 6 riffles; 2 rootwads
D	0	Park Reforestation	No Action
D	1	Park Reforestation	Zone 2 (5 ft); Zone 3 (36 tr/ac); Seeding
D	2	Park Reforestation	Zone 2 (5 ft); Zone 3 (48 tr/ac); Seeding
D	3	Park Reforestation	Zone 2 (5 ft); Zone 3 (70 tr/ac); Seeding
D	4	Park Reforestation	Zone 2 (5 ft); Zone 3 (109 tr/ac); Seedin
D	5	Park Reforestation	Zone 2 (5 ft); Zone 3 (194 tr/ac); Seedin

Incremental Cost Of Best Buy Plan Combinations (Ordered By Output)

Scenario: Run Sixteen

Counter	Plan Code	HabitatUnit (AAHU)	CostUnits ($1000s)	Avg. Cost $1000s / AAHU	Inc. Cost ($1000s)	Inc. Output (AAHU)	Incremental Cost Per Output
1	A0 B0 C0 D0	27.44	0.00	0.0000	0.0000	27.4400	0
2	A2 B0 C0 D0	56.92	85.50	1.5022	85.5030	29.4800	2.900373
3	A2 B3 C0 D0	61.71	108.53	1.7588	23.0300	4.7900	4.807933
4	A2 B3 C0 D1	64.38	125.22	1.9450	16.6870	2.6700	6.249813
5	A2 B3 C0 D2	64.59	126.60	1.9601	1.3830	0.2100	6.585714
6	A2 B3 C0 D3	64.84	128.25	1.9779	1.6470	0.2500	6.588
7	A1 B3 C0 D3	70.24	164.95	2.3484	36.7000	5.4000	6.796296
8	A1 B3 C2 D3	72.26	185.55	2.5679	20.6040	2.0200	10.2
9	A1 B4 C2 D3	72.47	187.90	2.5928	2.3480	0.2100	11.18095
10	A1 B4 C2 D4	72.57	190.00	2.6181	2.0930	0.1000	20.93

Incremental Cost Of Best Buy Plan Combinations (Ordered By Output)

Scenario: Run Sixteen

Counter	Plan Code	HabitatUnit (AAHU)	CostUnits ($1000s)	Avg. Cost $1000s / AAHU	Inc. Cost ($1000s)	Inc. Output (AAHU)	Incremental Cost Per Output
11	A1 B4 C3 D4	72.73	195.55	2.6888	5.5590	0.1600	34.74375
12	A1 B5 C3 D4	72.83	199.18	2.7349	3.6270	0.1000	36.27
13	A1 B5 C3 D5	72.87	202.49	2.7787	3.3040	0.0400	82.6
14	A1 B7 C3 D5	72.95	214.86	2.9453	12.3750	0.0800	154.6875

Stephenville Aquatic Ecosystem Restoration Project (Section 206)					
WWTP Wetland Restoration	**Scale A0**	**Scale A1**	**Scale A2**	**Scale A3**	
FIRST COST	$0	$1,666,414	$1,125,537	$1,176,780	
ANNUAL INTEREST RATE (decimal)	0.05625	0.05625	0.05625	0.05625	
PROJECT LIFE (years)	50	50	50	50	
CONSTRUCTION PERIOD (months)	24	24	24	24	
INTEREST DURING CONSTRUCTION	$0	$94,613	$63,904	$66,813	
INVESTMENT COST	$0	$1,761,027	$1,189,441	$1,243,593	
INTEREST	$0	$99,058	$66,906	$69,952	
AMORTIZATION	$0	$6,865	$4,637	$4,848	
OPERATIONS & MAINTENANCE	$0	$16,280	$13,960	$13,960	
REPLACEMENTS	$0	$0	$0	$0	
TOTAL ANNUAL CHARGES	$0	$122,203	$85,503	$88,760	
With Project AAHU	14.98	49.86	44.46	40.71	
No Action AAHU	14.98	14.98	14.98	14.98	
With Project Acres	45.1	52.4	47.2	44	
AAHU GAIN BY PLAN	0.00	34.88	29.48	25.73	
ANNUAL COST/AAHU GAIN	#DIV/0!	$3,503.53	$2,900.37	$3,449.68	
Annual Cost per acre	$0.00	$2,332.12	$1,811.50	$2,017.28	
First Cost/acre	$0.00	$31,801.79	$23,846.12	$26,745.00	

Stephenville Aquatic Ecosystem Restoration Project (Section 206)									
WWTP Bottomland Forest Restoration	**Scale B0**	**Scale B1**	**Scale B2**	**Scale B3**	**Scale B4**	**Scale B5**	**Scale B6**	**Scale B7**	
FIRST COST	$0	$180,455	$188,947	$197,439	$218,013	$258,722	$339,702	$420,682	
ANNUAL INTEREST RATE (decimal)	0.05625	0.05625	0.05625	0.05625	0.05625	0.05625	0.05625	0.05625	
PROJECT LIFE (years)	50	50	50	50	50	50	50	50	
CONSTRUCTION PERIOD (months)	24	24	24	24	24	24	24	24	
INTEREST DURING CONSTRUCTION	$0	$10,246	$10,728	$11,210	$12,378	$14,689	$19,287	$23,885	
INVESTMENT COST	$0	$190,701	$199,675	$208,649	$230,391	$273,411	$358,989	$444,567	
INTEREST	$0	$10,727	$11,232	$11,736	$12,959	$15,379	$20,193	$25,007	
AMORTIZATION	$0	$743	$778	$813	$898	$1,066	$1,399	$1,733	
OPERATIONS & MAINTENANCE	$0	$8,400	$9,440	$10,480	$11,520	$12,560	$13,600	$14,640	
REPLACEMENTS	$0	$0	$0	$0	$0	$0	$0	$0	
TOTAL ANNUAL CHARGES	$0	$19,870	$21,450	$23,030	$25,378	$29,005	$35,193	$41,380	
With Project AAHU	5.89	10.01	10.34	10.68	10.89	10.99	11.03	11.07	
No Action AAHU	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	
With Project Acres	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	
AAHU GAIN BY PLAN	0.00	4.12	4.45	4.79	5.00	5.10	5.14	5.18	
ANNUAL COST/AAHU GAIN	#DIV/0!	$4,822.90	$4,820.25	$4,807.91	$5,075.53	$5,687.31	$6,846.81	$7,988.41	
Annual Cost per acre	$0.00	$1,727.86	$1,865.23	$2,002.60	$2,206.75	$2,522.20	$3,060.23	$3,598.26	
First Cost/acre	$0.00	$15,691.74	$16,430.17	$17,168.61	$18,957.65	$22,497.57	$29,539.30	$36,581.04	

Stephenville Aquatic Ecosystem Restoration Project (Section 206)				
Park In-Stream Restoration	**Scale C0**	**Scale C1**	**Scale C2**	**Scale C3**
FIRST COST	$0	$303,228	$231,326	$294,240
ANNUAL INTEREST RATE (decimal)	0.05625	0.05625	0.05625	0.05625
PROJECT LIFE (years)	50	50	50	50
CONSTRUCTION PERIOD (months)	24	24	24	24
INTEREST DURING CONSTRUCTION	$0	$17,216	$13,134	$16,706
INVESTMENT COST	$0	$320,444	$244,460	$310,946
INTEREST	$0	$18,025	$13,751	$17,491
AMORTIZATION	$0	$1,249	$953	$1,212
OPERATIONS & MAINTENANCE	$0	$7,980	$5,900	$7,460
REPLACEMENTS	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$0	$27,254	$20,604	$26,163
With Project AAHU	3.2	5.27	5.22	5.38
No Action AAHU	3.2	3.2	3.2	3.2
With Project Acres	5.82	5.82	5.82	5.82
AAHU GAIN BY PLAN	0.00	2.07	2.02	2.18
ANNUAL COST/AAHU GAIN	#DIV/0!	$13,166.29	$10,199.94	$12,001.33
Annual Cost per acre	$0.00	$4,682.85	$3,540.18	$4,495.34
First Cost/acre	$0.00	$52,101.03	$39,746.74	$50,556.70

Stephenville Aquatic Ecosystem Restoration Project (Section 206)							
Park Bottomland Forest Restoration	**Scale D0**	**Scale D1**	**Scale D2**	**Scale D3**	**Scale D4**	**Scale D5**	
FIRST COST	$0	$174,735	$180,139	$189,680	$206,256	$241,867	
ANNUAL INTEREST RATE (decimal)	0.05625	0.05625	0.05625	0.05625	0.05625	0.05625	
PROJECT LIFE (years)	50	50	50	50	50	50	
CONSTRUCTION PERIOD (months)	24	24	24	24	24	24	
INTEREST DURING CONSTRUCTION	$0	$9,921	$10,228	$10,769	$11,710	$13,732	
INVESTMENT COST	$0	$184,656	$190,367	$200,449	$217,966	$255,599	
INTEREST	$0	$10,387	$10,708	$11,275	$12,261	$14,377	
AMORTIZATION	$0	$720	$742	$781	$850	$996	
OPERATIONS & MAINTENANCE	$0	$5,580	$6,620	$7,660	$8,700	$9,740	
REPLACEMENTS	$0	$0	$0	$0	$0	$0	
TOTAL ANNUAL CHARGES	$0	$16,687	$18,070	$19,717	$21,810	$25,114	
With Project AAHU	3.37	6.04	6.25	6.5	6.6	6.64	
No Action AAHU	3.37	3.37	3.37	3.37	3.37	3.37	
With Project Acres	6.90	6.90	6.90	6.90	6.90	6.90	
AAHU GAIN BY PLAN	0.00	2.67	2.88	3.13	3.23	3.27	
ANNUAL COST/AAHU GAIN	#DIV/0!	$6,249.72	$6,274.39	$6,299.27	$6,752.43	$7,680.09	
Annual Cost per acre	$0.00	$2,418.37	$2,618.88	$2,857.49	$3,160.92	$3,639.69	
First Cost/acre	$0.00	$25,323.91	$26,107.10	$27,489.86	$29,892.17	$35,053.19	

Stephenville HEP Assessment and Incremental Cost Analysis
WWTP Wetland

WWTP Wetland Scales by Measure

Scale	Land Acquisition	Wetland Construction	Zone 1	Zone 2	Berm & Island Seeding	Recreation Costs
A0	No Action	No Action	No Action	No Action	No Action	No Action
A1	45.1 acres	Entire Footprint	Seed 16.9 acres	15 trees/ac on 19.2 ac	15 trees-shrubs/ac + seeding on 9	2450 ft stone dust trail
A2	45.1 acres	Eastern 2 Cells Only	Seed 8.5 acres	15 trees/ac on 27.6 ac	15 trees-shrubs/ac + seeding on 7.5	2450 ft stone dust trail
A3	45.1 acres	Southern Half Only	Seed 11.3 acres	15 trees/ac on 24.8 ac	15 trees-shrubs/ac + seeding on 5	800 ft stone dust trail

***includes wood duck boxes and bluebird boxes

***placement of hydric soils is not needed

***a clay liner may or may not be required, based upon results of soil testing; TtNUS will indacte in DPR that soil testing is needed to determine if a clay liner is required

Wetland Costs by Scale

Scale	Land Acquisition	Wetland Construction	Zone 1	Zone 2	Berm & Island Seeding	Recreation Costs	Total Const Cost
A0	$0	$0	$0	$0	$0	$0	$0
A1	$392,911	$664,338	$28,781	$47,616	$22,320	$11,916	$1,167,882
A2	$392,911	$281,672	$14,391	$68,448	$18,600	$11,916	$787,938
A3	$392,911	$331,658	$19,283	$61,504	$12,400	$6,243	$823,999

Wetland O&M Costs by Scale

Scale	Veg O&M	Wetland O&M	Total O&M Cost
A0	$0	$0	$0
A1	$9,360	$6,920	$16,280
A2	$8,320	$5,640	$13,960
A3	$8,320	$5,640	$13,960

Wetland Habitat Values by Measure (emergent wetland habitat)

Scale	HSI Base Year	HSI Year 1	HSI Year 3	HSI Year 10	HSI Year 25	HSI Year 50
A0	0.00	0.00	0.00	0.00	0.00	0.00
A1	0.60	0.70	0.90	1.00	1.00	0.90
A2	0.60	0.62	0.75	0.90	1.00	0.90
A3	0.60	0.65	0.80	0.98	1.00	0.90

Wetland Total Cost

Scale	Contingency	Total Cost
A0	$0	$0
A1	$491,678	$1,659,560
A2	$338,576	$1,142,794
A3	$352,781	$1,190,740

***habitat quality increases over time until Year 50 and then the vegetation becomes too dense

***need to maintain a density of 25% trees and shrubs around the wetland perimeter; most critical habitat component was the need for canopy cover and woody debris around the wetland

Wetland Habitat Values by Measure (perimeter terrestrial habitat)

Scale	HSI Base Year	HSI Year 1	HSI Year 3	HSI Year 10	HSI Year 25	HSI Year 50
A0	0.65	0.65	0.63	0.60	0.52	0.44
A1	0.68	0.72	0.78	0.83	0.88	0.98
A2	0.68	0.72	0.78	0.83	0.88	0.98
A3	0.68	0.72	0.78	0.83	0.88	0.98

Wetland Water Quality Values by Measure (water quality)

Scale	WQI Base Year	WQI Year 1	WQI Year 3	WQI Year 10	WQI Year 25	WQI Year 50
A0	0.00	0.00	0.00	0.00	0.00	0.00
A1	0.93	0.95	0.99	1.00	1.00	1.00
A2	0.84	0.86	0.90	0.95	0.98	0.98
A3	0.79	0.81	0.85	0.90	0.93	0.93

Stephenville HEP Assessment and Incremental Cost Analysis
WWTP Wetland

Notes:

Zone 1 = herbaceous plants	**Zone 2 = bank plantings**	**Zone 3 = native terrestrial vegetation**		
sedges (Eleocharis spp., Carex spp., Cyperus spp	Black Willow (TT, FWS)	Green Ash (TT)	Canada Wild Rye (FWS)	
rushes (Juncus spp.) (TT)	Cottonwood (TT, FWS)	American Elm (TT, FWS)	Eastern Gama Grass (FWS)	***Native American Seed
bullrushes (Scirpus spp.) (TT)	Common Buttonbush (TT, FWS)	Texas Sugarberry (TT, FWS)	Green Sprangletop (FWS)	
smartweeds (Polygonum spp.) (TT)	Boxelder (TT, FWS)	Pecan (TT, FWS)	Prairie Wildrye (FWS)	
Curlytop Smartweed (FWS)	Sugar Hackberry (TT, FWS)	Black Walnut (TT, FWS)	Clasping Coneflower (FWS)	
Pennsylvania Smartweed (FWS)		Burr Oak (TT, FWS)	Cutleaf Daisy (FWS)	
Softstem Bullrush (FWS)		Mexican Plum (TT, FWS)	Scarlet Sage (FWS)	
Leafy Pondweed (FWS)		Prairie Sumac (TT)	Black-Eyed Susan (FWS)	
Water Smartweed (FWS)		Hawthorne (TT)	Pitcher Sage (FWS)	
Yellow Nutsedge (FWS)		Coral-Berry (TT, FWS)	Obedient Plant (FWS)	
Delta Arrowhead (FWS)		Thicket Plum (TT, FWS)	Plains Coreopsis (FWS)	
		Sand Plum (TT, FWS)	Pink Evening Primrose (FWS)	
		Red Mulberry (TT, FWS)	Virginia Wildrye (FWS)	
		Little Bluestem (TT, FWS)	Chinquapin Oak (FWS)	
		Big Bluestem (TT, FWS)	Eastern Redbud (FWS)	
		Indian Grass (TT)	Osage Orange (FWS)	
		Side-Oats Grama (TT)	Shumard Oak (FWS)	
		Switch Grass (TT, FWS)	Bigelow Oak (FWS)	
		Vine-Mesquite (TT)	Texas Red Oak (FWS)	
		Illinois Bundleflower (TT, FWS)	Blackjack Oak (FWS)	
		Maximillian Sunflower (TT, FWS)	Post Oak (FWS)	
		Engelmann's Daisy (TT)	Deciduous Holly (FWS)	
		Common Persimmon (FWS)	Cockspur Hawthorn (FWS)	
		Common Honey Locust (FWS)	Green Hawthorn (FWS)	
		Indigo Bush (FWS)	Praire Flameleaf Sumac (FWS)	
		Possum Haw (FWS)	Purpletop (TT)	
		Roughlead Dogwood (FWS)	Vine Mesquite (TT)	

Stephenville HEP Assessment and Incremental Cost Analysis
WWTP Reforestation

Reforestation Scales by Measure

Scale	Land Acquisition	Tree Screen Area (0.60 ac)	NW Area (8.6 acres)	Levee to River Area (2.3 acres)
B0	No Action	No Action	No Action	No Action
B1	11.5 acres	20 ft centers	5 trees-shrubs/ac + seeding	5 trees-shrubs/ac + seeding
B2	11.5 acres	20 ft centers	15 trees-shrubs/ac + seeding	15 trees-shrubs/ac + seeding
B3	11.5 acres	20 ft centers	25 trees-shrubs/ac + seeding	25 trees-shrubs/ac + seeding
B4	11.5 acres	20 ft centers	50 trees-shrubs/ac + seeding	50 trees-shrubs/ac + seeding
B5	11.5 acres	20 ft centers	100 trees-shrubs/ac + seeding	100 trees-shrubs/ac + seeding
B6	11.5 acres	20 ft centers	200 trees-shrubs/ac + seeding	200 trees-shrubs/ac + seeding
B7	11.5 acres	20 ft centers	300 trees-shrubs/ac + seeding	300 trees-shrubs/ac + seeding

***30 containerized to 100 saplings/acre for trees; 20 containerized to 50 samplings/acre for shrubs; 4:1 ration

***Composition of 80% trees and 20% shrubs

***Base all plantings on exisitng soil types

Reforestation Costs by Scale

Scale	Land Acquisition	Tree Screen Area	NW Area	Levee to River Area	Const Cost
B0	$0	$0	$0	$0	$0
B1	$101,059	$2,080	$16,856	$4,508	$124,503
B2	$101,059	$2,080	$21,328	$5,704	$130,171
B3	$101,059	$2,080	$25,800	$6,900	$135,839
B4	$101,059	$2,080	$36,980	$9,890	$150,009
B5	$101,059	$2,080	$59,340	$15,870	$178,349
B6	$101,059	$2,080	$104,060	$27,830	$235,029
B7	$101,059	$2,080	$148,780	$39,790	$291,709

Reforestation O&M Costs by Scale

Scale	Veg O&M	O&M Cost
B0	$0	$0
B1	$8,400	$8,400
B2	$9,440	$9,440
B3	$10,480	$10,480
B4	$11,520	$11,520
B5	$12,560	$12,560
B6	$13,600	$13,600
B7	$14,640	$14,640

Reforestation Total Costs

Scale	Contingency	Total Cost
B0	$0	$0
B1	$55,952	$188,855
B2	$58,776	$198,387
B3	$61,600	$207,919
B4	$68,004	$229,533
B5	$80,373	$271,282
B6	$104,673	$353,302
B7	$128,973	$435,322

Reforestation Habitat Values by Measure

Scale	HSI Base Year	HSI Year 5	HSI Year 10	HSI Year 15	HSI Year 25	HSI Year 50
B0	0.65	0.65	0.63	0.60	0.52	0.44
B1	0.68	0.70	0.75	0.80	0.85	0.95
B2	0.68	0.72	0.78	0.83	0.88	0.98
B3	0.68	0.74	0.80	0.85	0.95	1.00
B4	0.68	0.75	0.85	0.91	0.98	1.00
B5	0.68	0.76	0.86	0.94	1.00	1.00
B6	0.68	0.77	0.87	0.95	1.00	1.00
B7	0.68	0.78	0.89	0.96	1.00	1.00

***Benefits needed for HEP Species: (1) chickadee = increase in overstory height and canopy cover; (2) raccoon = increase in refuge sites and tree dbh; (3) barred owl = increase in tree dbh and a optimum of 60%

(4) fox squirrel = 40-60% canopy closure of hard mast trees; 20-60% total tree canopy closure; 0-50% shrub crown cover; (5) redtail hawk = 40-60% canopy cover for an HSI of

(6) wood duck = needs brood cover and overhanging limbs.

***50-70% canopy cover = 0.8 to 1.0 HSI range for fox squirrel and barred owl; increase in overstory dbh = increase HSI for the fox squirrel, barred owl, and raccon; fox squirrel and redtail hawk HSI will decrease

Stephenville HEP Assessment and Incremental Cost Analysis
WWTP Reforestation

Notes:

Zone 1 = herbaceous plants	**Zone 2 = bank plantings**	**Zone 3/4 = native terrestrial vegetation**		
sedges (Eleocharis spp., Carex spp., Cyperus spp	Black Willow (TT, FWS)	Green Ash (TT)	Canada Wild Rye (FWS)	***Native American Seed
rushes (Juncus spp.) (TT)	Cottonwood (TT, FWS)	American Elm (TT, FWS)	Eastern Gama Grass (FWS)	
bullrushes (Scirpus spp.) (TT)	Common Buttonbush (TT, FWS)	Texas Sugarberry (TT, FWS)	Green Sprangletop (FWS)	
smartweeds (Polygonum spp.) (TT)	Boxelder (TT, FWS)	Pecan (TT, FWS)	Prairie Wildrye (FWS)	
Curlytop Smartweed (FWS)	Sugar Hackberry (TT, FWS)	Black Walnut (TT, FWS)	Clasping Coneflower (FWS)	
Pennsylvania Smartweed (FWS)		Burr Oak (TT, FWS)	Cutleaf Daisy (FWS)	
Softstem Bullrush (FWS)		Mexican Plum (TT, FWS)	Scarlet Sage (FWS)	
Leafy Pondweed (FWS)		Prairie Sumac (TT)	Black-Eyed Susan (FWS)	
Water Smartweed (FWS)		Hawthorne (TT)	Pitcher Sage (FWS)	
Yellow Nutsedge (FWS)		Coral-Berry (TT, FWS)	Obedient Plant (FWS)	
Delta Arrowhead (FWS)		Thicket Plum (TT, FWS)	Plains Coreopsis (FWS)	
		Sand Plum (TT, FWS)	Pink Evening Primrose (FWS)	
		Red Mulberry (TT, FWS)	Virginia Wildrye (FWS)	
		Little Bluestem (TT, FWS)	Chinquapin Oak (FWS)	
		Big Bluestem (TT, FWS)	Eastern Redbud (FWS)	
		Indian Grass (TT)	Osage Orange (FWS)	
		Side-Oats Grama (TT)	Shumard Oak (FWS)	
		Switch Grass (TT, FWS)	Bigelow Oak (FWS)	
		Vine-Mesquite (TT)	Texas Red Oak (FWS)	
		Illinois Bundleflower (TT, FWS)	Blackjack Oak (FWS)	
		Maximillian Sunflower (TT, FWS)	Post Oak (FWS)	
		Engelmann's Daisy (TT)	Deciduous Holly (FWS)	
		Common Persimmon (FWS)	Cockspur Hawthorn (FWS)	
		Common Honey Locust (FWS)	Green Hawthorn (FWS)	
		Indigo Bush (FWS)	Praire Flameleaf Sumac (FWS)	
		Possum Haw (FWS)	Purpletop (TT)	
		Roughlead Dogwood (FWS)	Vine Mesquite (TT)	

Stephenville HEP Assessment and Incremental Cost Analysis
Park In-Stream Habitat

In-Stream Habitat Scales by Measure

Scale	Land Acquisition	In-Stream Construction	Stream Diversion	Weirs; Riffles	Bank Stabilization	Bank Structures	Zone 1 (0.1 acres)
C0	No Action	No Action	Dewatering Costs	No Action	No Action	No Action	No Action
C1	1.4 acres	General Construction Cost	Dewatering Costs	2 ponds; 5 riffles; 4	General Construction	A-seeding; B/C-brush mattress; A/B/C-fiber roll; B/C-15ft centers	4 ft spacing
C2	1.4 acres	General Construction Cost	Dewatering Costs	2 ponds; 7 riffles; 2	General Construction	A/C-seeding; B-brush mattress; B-fiber roll; B-20ft centers	4 ft spacing
C3	1.4 acres	General Construction Cost	Dewatering Costs	2 ponds; 6 riffles; 2	General Construction	A-seeding; B/C-brush mattress; Riffle Toe Protection; B/C-25ft	4 ft spacing

In-Stream Habitat Costs by Scale

Scale	Land Acquisition	In-Stream Construction	Stream Diversion	Weirs; Riffles	Bank Stabilization	Bank Structures	Zone 1 (0.1 acres)	Const Cost
C0	$0	$0	$0	$0	$0	$0	$0	$0
C1	$12,197	$30,330	$23,640	$44,746	$18,710	$80,709	$694	$211,026
C2	$12,197	$30,330	$23,640	$46,234	$18,710	$29,238	$694	$161,043
C3	$12,197	$30,330	$23,640	$44,664	$18,710	$74,620	$694	$204,855

In-Stream O&M Costs by Scale

Scale	In-Stream O&M	Bank O&M	O&M Cost
C0	$0	$0	$0
C1	$3,620	$4,360	$7,980
C2	$3,620	$2,280	$5,900
C3	$3,620	$3,840	$7,460

In-Stream Total Costs

Scale	Contingency	Total Cost
C0	$0	$0
C1	$92,202	$311,208
C2	$70,283	$237,226
C3	$89,385	$301,700

In-Stream Habitat Values by Measure

Scale	IBI Base Year	IBI Year1	IBI Year 3	IBI Year 10	IBI Year 25	IBI Year 50
C0	42/60=0.70	42/60 = 0.70	41/60 = 0.68	38/60 = 0.63	34/60 = 0.57	30/60 = 0.50
C1	43/60=0.72	51/60 = 0.85	53/60 = 0.88	55/60 = 0.92	57/60 = 0.95	53/60 = 0.88
C2	43/60=0.72	50/60 = 0.83	52/60 = 0.87	54/60 = 0.90	56/60 = 0.93	53/60 = 0.88
C3	43/60=0.72	52/60 = 0.87	54/60 = 0.90	56/60 = 0.93	58/60 = 0.97	54/60 = 0.90

***No intolerant or sucker species were present; statwide IBI = 40 (intermediate); regional IBI = 46 (good)

***Areas for improvement include: (1) increase the total number of intolerant species; (2) decrease the % of tolerant species; (3) increase the percentage of piscivorous individuals; (4) increase the number of darter, sucker, and sunfish species.

***(1) Increase in ponded habitat will help the number of sunfish species and % of piscivorous individuals present; (2) increases in riffle habitat will help the number of darter and sucker species present; (3) increase in darter, sucker, and sunfish species will raise the total number of intolerant species that are present; (4) installation of herbaceous emergent plants will provide food, shelter, nursery areas; (5) riparian corridor plantings will increase canopy cover and shade, provide food, and increase water quality through filtration of run-off from lawns; (6) off-channel wetlands will increase water quality through filtration of WWTP effluent and agriculture surface run-off; (7) the existing permanent water supply via the pump and pipeline system will provide a constant supply of water.

***Restoration for 1.6 miles of stream length (reduce sedimentation, increase filtration, new habitat, WWTP nutrient removal, corridor inputs/shading); average of 30 feet wide; 5.82 acres restored.

Stephenville HEP Assessment and Incremental Cost Analysis
Park Reforestation

Reforestation Scales by Measure

Scale	Land Acquisition	Reforestation Construction	Zone 2 (0.3 acres)	Zone 3 (5.6 acres)	Zone 4 (1.0 acres)	Recreation
D0	No Action	No Action	No Action	No Action	No Action	No Action
D1	6.9 acres	General Construction Cost	5 ft spacing	36 trees-shrubs/acre	seed 10, 0.1acre plots	2830 ft X 4 ft X 0.4 ft asphalt
D2	6.9 acres	General Construction Cost	5 ft spacing	48 trees-shrubs/acre	seed 10, 0.1acre plots	2830 ft X 4 ft X 0.4 ft asphalt
D3	6.9 acres	General Construction Cost	5 ft spacing	70 trees-shrubs/acre	seed 10, 0.1acre plots	2830 ft X 4 ft X 0.4 ft asphalt
D4	6.9 acres	General Construction Cost	5 ft spacing	109 trees-shrubs/acre	seed 10, 0.1acre plots	2830 ft X 4 ft X 0.4 ft asphalt
D5	6.9 acres	General Construction Cost	5 ft spacing	194 trees-shrubs/acre	seed 10, 0.1acre plots	2830 ft X 4 ft X 0.4 ft asphalt

***30 containerized to 100 saplings/acre for trees; 20 containerized to 50 samplings/acre for shrubs; 4:1 ration of trees

***Composition of 80% trees and 20% shrubs

***Base all plantings on exisitng soil types

Reforestation Costs by Scale

Scale	Land Acquisition	Reforestation Construction	Zone 2 (0.3 acres)	Zone 3 (5.6 acres)	Zone 4 (1.0 acres)	Recreation	Const Cost
D0	$0	$0	$0	$0	$0	$0	$0
D1	$60,113	$29,907	$1,045	$10,483	$1,700	$18,065	$121,313
D2	$60,113	$29,907	$1,045	$13,978	$1,700	$18,065	$124,808
D3	$60,113	$29,907	$1,045	$20,384	$1,700	$18,065	$131,214
D4	$60,113	$29,907	$1,045	$31,741	$1,700	$18,065	$142,571
D5	$60,113	$29,907	$1,045	$56,493	$1,700	$18,065	$167,323

Reforestation O&M Costs by Scale

Scale	Veg O&M	O&M Cost
D0	$0	$0
D1	$5,580	$5,580
D2	$6,620	$6,620
D3	$7,660	$7,660
D4	$8,700	$8,700
D5	$9,740	$9,740

Reforestation Total Cost

Scale	Contingency	Total Cost
D0	$0	$0
D1	$53,422	$180,315
D2	$55,331	$186,759
D3	$58,466	$197,340
D4	$63,685	$214,956
D5	$74,544	$251,607

Reforestation Habitat Values by Measure

Scale	HSI Base Year	HSI Year 5	HSI Year 10	HSI Year 15	HSI Year 25	HSI Year 50
D0	0.65	0.65	0.63	0.60	0.50	0.40
D1	0.68	0.70	0.75	0.80	0.88	0.95
D2	0.68	0.73	0.78	0.83	0.91	0.98
D3	0.68	0.74	0.82	0.90	0.98	1.00
D4	0.68	0.75	0.86	0.95	1.00	1.00
D5	0.68	0.76	0.88	0.98	1.00	1.00

***Benefits needed for HEP Species: (1) chickadee = increase in overstory height and canopy cover; (2) raccoon = increase in refuge sites and tree dbh; (3) barred owl = increase in
(4) fox squirrel = 40-60% canopy closure of hard mast trees; 20-60% total tree canopy closure; 0-50% shrub crown cover; (5) redtail hawk = 40-60% canopy cover for an HSI of
(6) wood duck = needs brood cover and overhanging limbs.

***50-70% canopy cover = 0.8 to 1.0 HSI range for fox squirrel and barred owl; increase in overstory dbh = increase HSI for the fox squirrel, barred owl, and raccon; fox squirrel and redtail hawk HSI will decrease with increasing

Stephenville HEP Assessment and Incremental Cost Analysis
Park Reforestation

Notes:

Zone 1 = herbaceous plants	**Zone 2 = bank plantings**	**Zone 3/4 = native terrestrial vegetation**		
sedges (Eleocharis spp., Carex spp., Cyperus s	Black Willow (TT, FWS)	Green Ash (TT)	Canada Wild Rye (FWS)	***Native American Seed
rushes (Juncus spp.) (TT)	Cottonwood (TT, FWS)	American Elm (TT, FWS)	Eastern Gama Grass (FWS)	
bullrushes (Scirpus spp.) (TT)	Common Buttonbush (TT, FWS)	Texas Sugarberry (TT, FWS)	Green Sprangletop (FWS)	
smartweeds (Polygonum spp.) (TT)	Boxelder (TT, FWS)	Pecan (TT, FWS)	Prairie Wildrye (FWS)	
Curlytop Smartweed (FWS)	Sugar Hackberry (TT, FWS)	Black Walnut (TT, FWS)	Clasping Coneflower (FWS)	
Pennsylvania Smartweed (FWS)		Burr Oak (TT, FWS)	Cutleaf Daisy (FWS)	
Softstem Bullrush (FWS)		Mexican Plum (TT, FWS)	Scarlet Sage (FWS)	
Leafy Pondweed (FWS)		Prairie Sumac (TT)	Black-Eyed Susan (FWS)	
Water Smartweed (FWS)		Hawthorne (TT)	Pitcher Sage (FWS)	
Yellow Nutsedge (FWS)		Coral-Berry (TT, FWS)	Obedient Plant (FWS)	
Delta Arrowhead (FWS)		Thicket Plum (TT, FWS)	Plains Coreopsis (FWS)	
		Sand Plum (TT, FWS)	Pink Evening Primrose (FWS)	
		Red Mulberry (TT, FWS)	Virginia Wildrye (FWS)	
		Little Bluestem (TT, FWS)	Chinquapin Oak (FWS)	
		Big Bluestem (TT, FWS)	Eastern Redbud (FWS)	
		Indian Grass (TT)	Osage Orange (FWS)	
		Side-Oats Grama (TT)	Shumard Oak (FWS)	
		Switch Grass (TT, FWS)	Bigelow Oak (FWS)	
		Vine-Mesquite (TT)	Texas Red Oak (FWS)	
		Illinois Bundleflower (TT, FWS)	Blackjack Oak (FWS)	
		Maximillian Sunflower (TT, FWS)	Post Oak (FWS)	
		Engelmann's Daisy (TT)	Deciduous Holly (FWS)	
		Common Persimmon (FWS)	Cockspur Hawthorn (FWS)	
		Common Honey Locust (FWS)	Green Hawthorn (FWS)	
		Indigo Bush (FWS)	Praire Flameleaf Sumac (FWS)	
		Possum Haw (FWS)	Purpletop (TT)	
		Roughlead Dogwood (FWS)	Vine Mesquite (TT)	

Average Annual Habitat Units
ICA Recommended Plan
Stephenville Aquatic Ecosystem Restoration Project (Section 206)

WWTP Wetland Complex Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0	1	2	7	15	25		
	HSI	0.60	0.70	0.90	1.00	1.00	0.90		
(Wetland HU's)	ACRES	16.90	16.90	16.90	16.90	16.90	16.90		
	HU at TY	10.14	11.83	15.21	16.90	16.90	15.21		
	Interval HU's	0.00	11.83	30.42	118.30	253.50	380.25	794.30	15.89

WWTP Wetland Complex Scale A0	Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0	1	2	7	15	25		
		HSI	0.00	0.00	0.00	0.00	0.00	0.00		
(Wetland HU's)		ACRES	0.00	0.00	0.00	0.00	0.00	0.00		
		HU at TY	0.00	0.00	0.00	0.00	0.00	0.00		
		Interval HU's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WWTP Wetland Complex Scale A1	Year	Base	5yr	10yr	15yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.72	0.78	0.83	0.88	0.98		
(Reforestation HU's)	ACRES	28.20	28.20	28.20	28.20	28.20	28.20		
	HU at TY	19.18	20.30	22.00	23.41	24.82	27.64		
	Interval HU's	0.00	101.52	109.98	117.03	248.16	690.90	1267.59	25.35

WWTP Wetland Complex Scale A0	Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0	1	2	7	15	25		
		HSI	0.65	0.65	0.63	0.60	0.52	0.44		
(Reforestation HU's)		ACRES	45.10	45.10	45.10	45.10	45.10	45.10		
		HU at TY	29.32	29.32	28.41	27.06	23.45	19.84		
		Interval HU's	0.00	29.32	56.83	189.42	351.78	496.10	1123.44	22.47

WWTP Wetland Complex Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0	1	2	7	15	25		
	HSI	0.93	0.95	0.99	1.00	1.00	1.00		
(Water Quality HU's)	ACRES	7.30	7.30	7.30	7.30	7.30	7.30		
	HU at TY	6.79	6.94	7.23	7.30	7.30	7.30		
	Interval HU's	0.00	6.94	14.45	51.10	109.50	182.50	364.49	7.29

WWTP Wetland Complex Scale A0	Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0	1	2	7	15	25		
		HSI	0.00	0.00	0.00	0.00	0.00	0.00		
(Water Quality HU's)		ACRES	0.00	0.00	0.00	0.00	0.00	0.00		
		HU at TY	0.00	0.00	0.00	0.00	0.00	0.00		
		Interval HU's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WWTP Wetland Complex (Scale A1 Average)	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0	1	2	7	15	25		
	HSI/WQI	0.74	0.79	0.89	0.94	0.96	0.96		
(emergent + terrestrial + water quality)	ACRES	52.40	52.40	52.40	52.40	52.40	52.40		
	HU at TY	38.60	41.40	46.64	49.43	50.30	50.30		
	Interval HU's	0.00	41.40	93.27	346.00	754.56	1257.60	2492.83	49.86

WWTP Wetland Complex (Scale A0 Average)	Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0	1	2	7	15	25		
		HSI/WQI	0.43	0.43	0.42	0.40	0.35	0.29		
		ACRES	45.10	45.10	45.10	45.10	45.10	45.10		
(emergent + terrestrial + water quality)		HU at TY	19.53	19.53	18.94	18.04	15.65	13.21		
		Interval HU's	0.00	19.53	37.88	126.28	234.75	330.36	748.80	14.98

WWTP Reforestation Scale B3	Year	Base	5yr	10yr	15yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.74	0.80	0.85	0.95	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.51	9.20	9.78	10.93	11.50		
	Interval HU's	0.00	42.55	46.00	48.88	109.25	287.50	534.18	10.68

WWTP Reforestation Scale B0	Scale B0	Year	Base	5yr	10yr	15yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0	5	5	5	10	25		
		HSI	0.65	0.65	0.63	0.60	0.52	0.44		
		ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
		HU at TY	7.48	7.48	7.25	6.90	5.98	5.06		
		Interval HU's	0.00	37.38	36.23	34.50	59.80	126.50	294.40	5.89

Park In-Stream Scale C2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
	Year Interval	0.00	1.00	2.00	7.00	15.00	25.00		
	HSI	0.72	0.83	0.87	0.90	0.93	0.88		
	ACRES	5.82	5.82	5.82	5.82	5.82	5.82		
	HU at TY	4.19	4.83	5.06	5.24	5.41	5.12		
	Interval HU's	0.00	4.83	10.13	36.67	81.19	128.04	260.85	5.22

Park In-Stream Scale C0	Scal C0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cum. HU's	AAHU
		Year Interval	0.00	1.00	2.00	7.00	15.00	25.00		
		HSI	0.70	0.70	0.68	0.63	0.57	0.50		
		ACRES	5.82	5.82	5.82	5.82	5.82	5.82		
		HU at TY	4.07	4.07	3.96	3.67	3.32	2.91		
		Interval HU's	0.00	4.07	7.92	25.67	49.76	72.75	160.17	3.20

Average Annual Habitat Units
ICA Recommended Plan
Stephenville Aquatic Ecosystem Restoration Project (Section 206)

	Year	Base	5yr	10yr	15yr	25yr	50yr	Cum. HU's	AAHU
Park Reforestation Scale D3	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.74	0.82	0.90	0.98	1.00		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	5.11	5.66	6.21	6.76	6.90		
	Interval HU's	0.00	25.53	28.29	31.05	67.62	172.50	324.99	6.50

TOTAL							**Cumulative HU's**		**AAHU**
							3612.85		**72.26**

	Scale D0	Year	Base	5yr	10yr	15yr	25yr	50yr	Cum. HU's	AAHU
Park Reforestation Scale D0		Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
		HSI	0.65	0.65	0.63	0.60	0.50	0.40		
		ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
		HU at TY	4.49	4.49	4.35	4.14	3.45	2.76		
		Interval HU's	0.00	22.43	21.74	20.70	34.50	69.00	168.36	3.37

TOTAL									**Cumulative HU's**	**AAHU**
									1371.72	**27.43**

NET GAIN	**Cumulative HU's**	**AAHU**
	2241.13	**44.82**

Stephenville Aquatic Ecosystem Restoration Project (Section 206)											
			Wetland Habitat Values								
Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	HSI	0.65	0.65	0.63	0.60	0.52	0.44				
	ACRES	0.00	0.00	0.00	0.00	0.00	0.00				
	HU at TY	0.00	0.00	0.00	0.00	0.00	0.00				
	Interval HU's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	HSI	0.60	0.70	0.90	1.00	1.00	0.90				
	ACRES	16.90	16.90	16.90	16.90	16.90	16.90				
	HU at TY	10.14	11.83	15.21	16.90	16.90	15.21				
	Interval HU's	0.00	11.83	30.42	118.30	253.50	380.25	794.30	15.89		
Scale A2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	HSI	0.60	0.70	0.90	1.00	1.00	0.90				
	ACRES	8.50	8.50	8.50	8.50	8.50	8.50				
	HU at TY	5.10	5.95	7.65	8.50	8.50	7.65				
	Interval HU's	0.00	5.95	15.30	59.50	127.50	191.25	399.50	7.99		
Scale A3	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	HSI	0.60	0.70	0.90	1.00	1.00	0.90				
	ACRES	11.30	11.30	11.30	11.30	11.30	11.30				
	HU at TY	6.78	7.91	10.17	11.30	11.30	10.17				
	Interval HU's	0.00	7.91	20.34	79.10	169.50	254.25	531.10	10.62		
			Wetland Water Quality Values								
Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	WQI	0.00	0.00	0.00	0.00	0.00	0.00				
	ACRES	0.00	0.00	0.00	0.00	0.00	0.00				
	HU at TY	0.00	0.00	0.00	0.00	0.00	0.00				
	Interval HU's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	WQI	0.93	0.95	0.99	1.00	1.00	1.00				
	ACRES	7.30	7.30	7.30	7.30	7.30	7.30				
	HU at TY	6.79	6.94	7.23	7.30	7.30	7.30				
	Interval HU's	0.00	6.94	14.45	51.10	109.50	182.50	364.49	7.29		
Scale A2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	WQI	0.84	0.86	0.90	0.95	0.98	0.98				
	ACRES	3.60	3.60	3.60	3.60	3.60	3.60				
	HU at TY	3.02	3.10	3.24	3.42	3.53	3.53				
	Interval HU's	0.00	3.10	6.48	23.94	52.92	88.20	174.64	3.49		
Scale A3	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU		
	Year Interval	0	1	2	7	15	25				
	WQI	0.79	0.81	0.85	0.90	0.93	0.93				
	ACRES	2.90	2.90	2.90	2.90	2.90	2.90				
	HU at TY	2.29	2.35	2.47	2.61	2.70	2.70				
	Interval HU's	0.00	2.35	4.93	18.27	40.46	67.43	133.43	2.67		

***The total habitat gain at the wetland complex includes wetland benefits and remainder/island/berm terrestrial benefits and water quality benefits

***Terrestrial acreages are dependent upon the wetland scale

***HSI's used for remainder of wetland plantings are from 15-tree/shrub per acre WWTP Reforestation measure

***The water quality benefits from each wetland scale were calculated using PREWet.

***Water quality was benefits were dependent on each wetland scale size (16.9, 8.5, 11.3 acres), provides (2.0 miles at 30 ft = 7.3 acres; 1.0 mile at 30 ft width = 3.6 acres; .8 miles at 30 ft = 2.9 acres) of downstream benefits to the North Bosque River.

			Wetland Remainder, Island, and Berm Planting Values							
Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI	0.65	0.65	0.63	0.60	0.52	0.44			
	ACRES	45.10	45.10	45.10	45.10	45.10	45.10			
	HU at TY	29.32	29.32	28.41	27.06	23.45	19.84			
	Interval HU's	0.00	29.32	56.83	189.42	351.78	496.10	1123.44	22.47	
Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI	0.68	0.72	0.78	0.83	0.88	0.98			
	ACRES	28.20	28.20	28.20	28.20	28.20	28.20			
	HU at TY	19.18	20.30	22.00	23.41	24.82	27.64			
	Interval HU's	0.00	20.30	43.99	163.84	372.24	690.90	1291.28	25.83	
Scale A2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI	0.68	0.72	0.78	0.83	0.88	0.98			
	ACRES	35.10	35.10	35.10	35.10	35.10	35.10			
	HU at TY	23.87	25.27	27.38	29.13	30.89	34.40			
	Interval HU's	0.00	25.27	54.76	203.93	463.32	859.95	1607.23	32.14	
Scale A3	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI	0.68	0.72	0.78	0.83	0.88	0.98			
	ACRES	29.80	29.80	29.80	29.80	29.80	29.80			
	HU at TY	20.26	21.46	23.24	24.73	26.22	29.20			
	Interval HU's	0.00	21.46	46.49	173.14	393.36	730.10	1364.54	27.29	
			Wetland (emergent + terrestrial + water quality)							
Scale A0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI/WQI	0.43	0.43	0.42	0.40	0.35	0.29			
	ACRES	45.10	45.10	45.10	45.10	45.10	45.10			
	HU at TY	19.54	19.54	18.94	18.04	15.63	13.23			
	Interval HU's	0.00	19.54	37.88	126.28	234.52	330.73	748.96	14.98	
Scale A1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI/WQI	0.74	0.79	0.89	0.94	0.96	0.96			
	ACRES	52.40	52.40	52.40	52.40	52.40	52.40			
	HU at TY	38.60	41.40	46.64	49.43	50.30	50.30			
	Interval HU's	0.00	41.40	93.27	346.01	754.56	1257.60	2492.84	49.86	
Scale A2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI/WQI	0.71	0.76	0.86	0.93	0.95	0.95			
	ACRES	47.20	47.20	47.20	47.20	47.20	47.20			
	HU at TY	33.35	35.87	40.59	43.74	45.00	45.00			
	Interval HU's	0.00	35.87	81.18	306.17	674.96	1124.93	2223.12	44.46	
Scale A3	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0	1	2	7	15	25			
	HSI/WQI	0.69	0.74	0.84	0.91	0.94	0.94			
	ACRES	44.00	44.00	44.00	44.00	44.00	44.00			
	HU at TY	30.36	32.71	37.11	40.04	41.21	41.21			
	Interval HU's	0.00	32.71	74.21	280.28	618.20	1030.33	2035.73	40.71	

***The total habitat gain at the wetland complex includes wetland benefits and remainder/island/berm terrestrial benefits and water quality benefits

***Terrestrial acreages are dependent upon the wetland scale

***HSI's used for remainder of wetland plantings are from 15-tree/shrub per acre WWTP Reforestation measure

***The water quality benefits from each wetland scale were calculated using PREWet.

***Water quality was benefits were dependent on each wetland scale size (16.9, 8.5, 11.3 acres), provides (2.0 miles at 30 ft = 7.3 acres; 1.0 mile at 30 ft width = 3.6 acres; .8 miles at 30 ft = 2.9 acres) of downstream benefits to the North Bosque River.

Stephenville Aquatic Ecosystem Restoration Project (Section 206)									
			WWTP Bottomland Forest Restoration						
Scale B0	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.65	0.65	0.63	0.60	0.52	0.44		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.48	7.48	7.25	6.90	5.98	5.06		
	Interval HU's	0.00	37.38	36.23	34.50	59.80	126.50	294.40	5.89
Scale B1	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.70	0.75	0.80	0.85	0.95		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.05	8.63	9.20	9.78	10.93		
	Interval HU's	0.00	40.25	43.13	46.00	97.75	273.13	500.25	10.01
Scale B2	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.72	0.78	0.83	0.88	0.98		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.28	8.97	9.55	10.12	11.27		
	Interval HU's	0.00	41.40	44.85	47.73	101.20	281.75	516.93	10.34
Scale B3	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.74	0.80	0.85	0.95	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.51	9.20	9.78	10.93	11.50		
	Interval HU's	0.00	42.55	46.00	48.88	109.25	287.50	534.18	10.68
Scale B4	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.75	0.85	0.91	0.98	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.63	9.78	10.47	11.27	11.50		
	Interval HU's	0.00	43.13	48.88	52.33	112.70	287.50	544.53	10.89
Scale B5	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.76	0.86	0.94	1.00	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.74	9.89	10.81	11.50	11.50		
	Interval HU's	0.00	43.70	49.45	54.05	115.00	287.50	549.70	10.99
Scale B6	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.77	0.87	0.95	1.00	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.86	10.01	10.93	11.50	11.50		
	Interval HU's	0.00	44.28	50.03	54.63	115.00	287.50	551.43	11.03
Scale B7	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	5	5	5	10	25		
	HSI	0.68	0.78	0.89	0.96	1.00	1.00		
	ACRES	11.50	11.50	11.50	11.50	11.50	11.50		
	HU at TY	7.82	8.97	10.24	11.04	11.50	11.50		
	Interval HU's	0.00	44.85	51.18	55.20	115.00	287.50	553.73	11.07

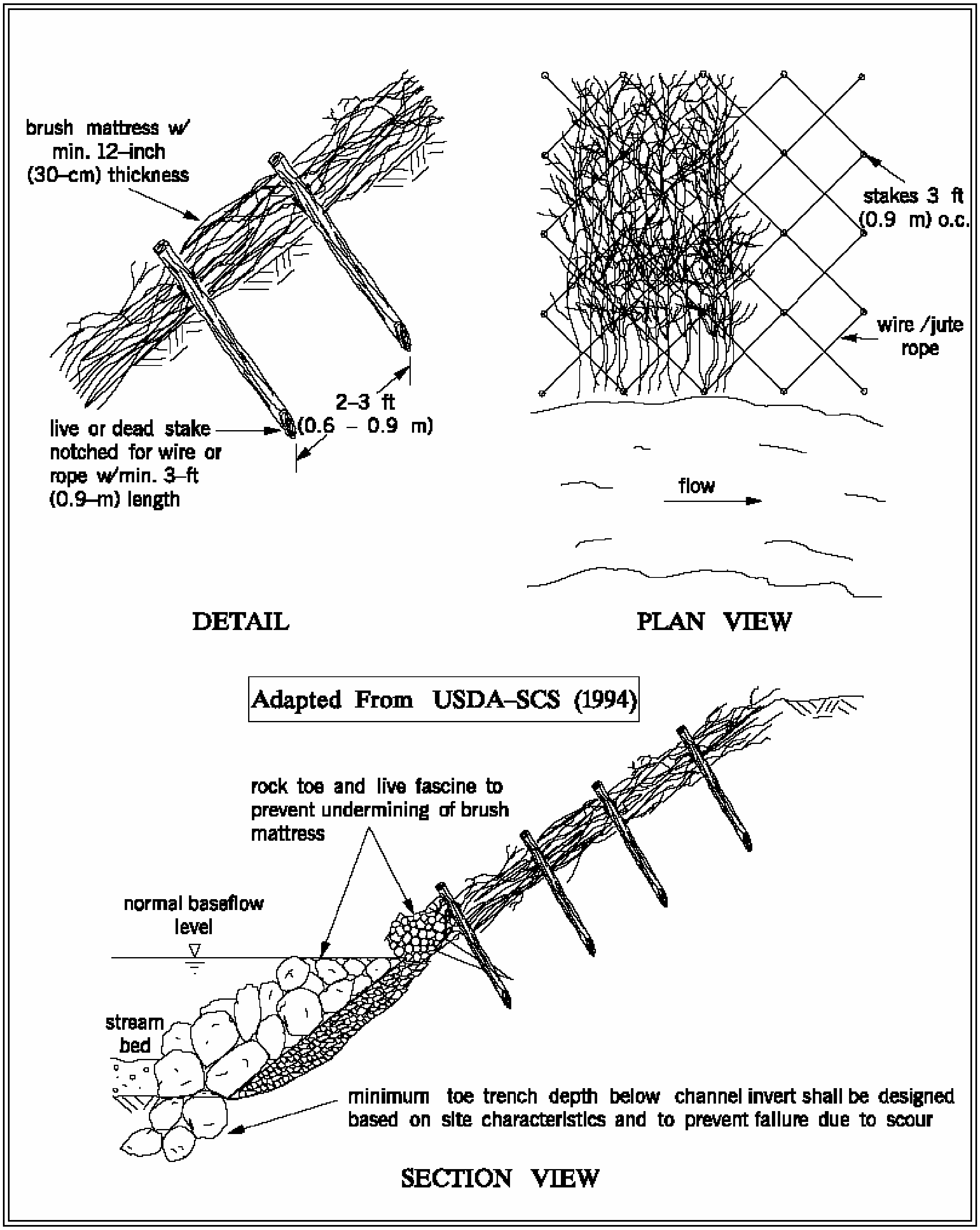
Stephenville Aquatic Ecosystem Restoration Project (Section 206)										
			Park In-Stream Restoration							
Scal C0	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0.00	1.00	2.00	7.00	15.00	25.00			
	IBI	0.70	0.70	0.68	0.63	0.57	0.50			
	ACRES	5.82	5.82	5.82	5.82	5.82	5.82			
	HU at TY	4.07	4.07	3.96	3.67	3.32	2.91			
	Interval HU's	0.00	4.07	7.92	25.67	49.76	72.75	160.17	3.20	
Scal C1	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0.00	1.00	2.00	7.00	15.00	25.00			
	IBI	0.72	0.85	0.88	0.92	0.95	0.88			
	ACRES	5.82	5.82	5.82	5.82	5.82	5.82			
	HU at TY	4.19	4.95	5.12	5.35	5.53	5.12			
	Interval HU's	0.00	4.95	10.24	37.48	82.94	128.04	263.65	5.27	
Scale C2	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0.00	1.00	2.00	7.00	15.00	25.00			
	IBI	0.72	0.83	0.87	0.90	0.93	0.88			
	ACRES	5.82	5.82	5.82	5.82	5.82	5.82			
	HU at TY	4.19	4.83	5.06	5.24	5.41	5.12			
	Interval HU's	0.00	4.83	10.13	36.67	81.19	128.04	260.85	5.22	
Scale C3	Year	Base	1yr	3yr	10yr	25yr	50yr	Cumulative HU's	AAHU	
	Year Interval	0.00	1.00	2.00	7.00	15.00	25.00			
	IBI	0.72	0.87	0.90	0.93	0.97	0.90			
	ACRES	5.82	5.82	5.82	5.82	5.82	5.82			
	HU at TY	4.19	5.06	5.24	5.41	5.65	5.24			
	Interval HU's	0.00	5.06	10.48	37.89	84.68	130.95	269.06	5.38	
***Measures were implemented on 1.4 acres, but total project benefits were for 5.82 acres due to 4.42 acres (i.e., 1.2 miles at 30 ft width) of downstream benefits										

Stephenville Aquatic Ecosystem Restoration Project (Section 206)									
			Park Bottomland Forest Restoration						
Scale D0	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.65	0.65	0.63	0.60	0.50	0.40		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.49	4.49	4.35	4.14	3.45	2.76		
	Interval HU's	0.00	22.43	21.74	20.70	34.50	69.00	168.36	3.37
Scale D1	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.70	0.75	0.80	0.88	0.95		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	4.83	5.18	5.52	6.07	6.56		
	Interval HU's	0.00	24.15	25.88	27.60	60.72	163.88	302.22	6.04
Scale D2	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.73	0.78	0.83	0.91	0.98		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	5.04	5.38	5.73	6.28	6.76		
	Interval HU's	0.00	25.19	26.91	28.64	62.79	169.05	312.57	6.25
Scale D3	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.74	0.82	0.90	0.98	1.00		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	5.11	5.66	6.21	6.76	6.90		
	Interval HU's	0.00	25.53	28.29	31.05	67.62	172.50	324.99	6.50
Scale D4	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.75	0.86	0.95	1.00	1.00		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	5.18	5.93	6.56	6.90	6.90		
	Interval HU's	0.00	25.88	29.67	32.78	69.00	172.50	329.82	6.60
Scale D5	Year	Base	5yr	10yr	15yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0.00	5.00	5.00	5.00	10.00	25.00		
	HSI	0.68	0.76	0.88	0.98	1.00	1.00		
	ACRES	6.90	6.90	6.90	6.90	6.90	6.90		
	HU at TY	4.69	5.24	6.07	6.76	6.90	6.90		
	Interval HU's	0.00	26.22	30.36	33.81	69.00	172.50	331.89	6.64

APPENDIX F

TYPICAL DESIGN DETAILS

Section 206 - Stream Corridor Restoration
Typical Brush-Mattress Construction Diagram
Stephenville, Texas

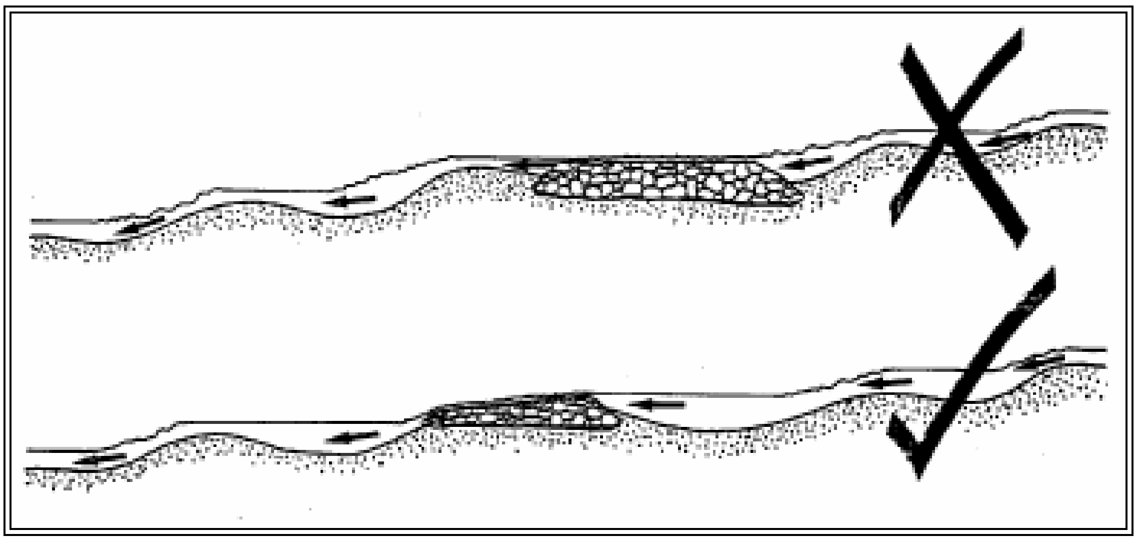


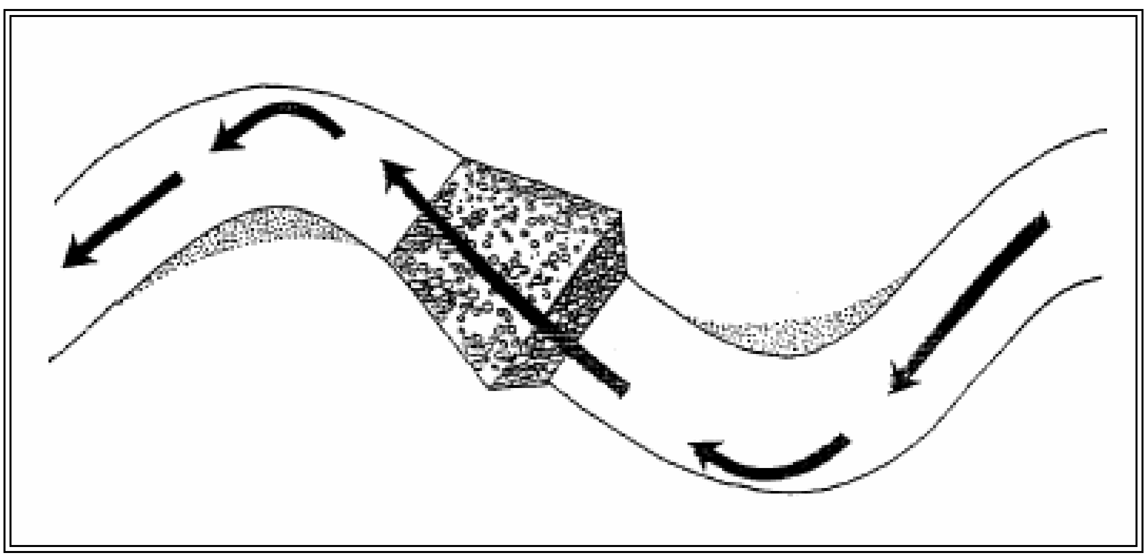
Ref.: http://www.mde.state.md.us/assets/document/wetlandswaterways/sec2-8.pdf

Section 206 - Stream Corridor Restoration

Riffle Placement Diagram

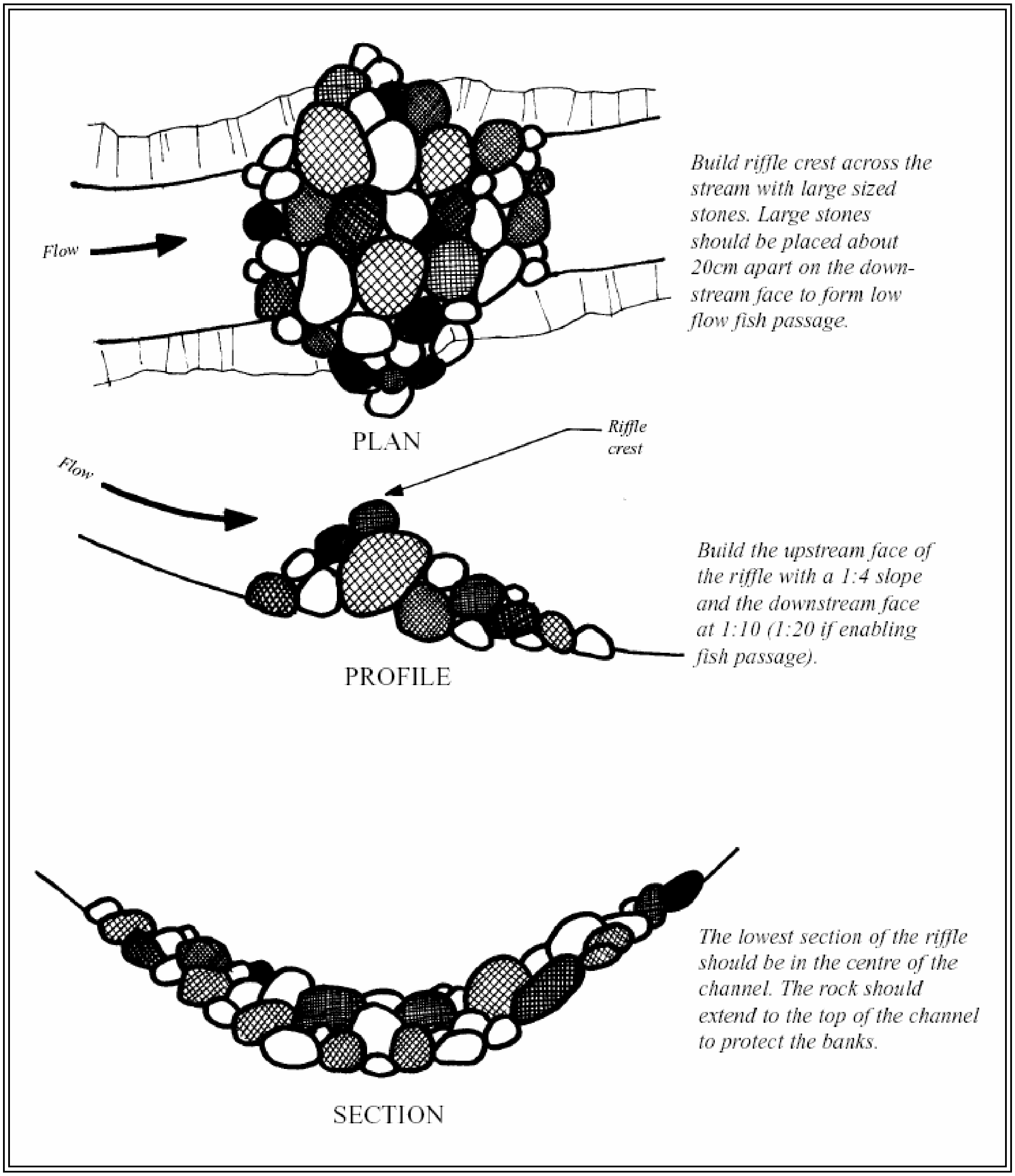
Stephenville, Texas





Ref.: http://www.nww.usace.army.mil/planning/er/studies/Ronde/default.htm#plate10

Section 206 - Stream Corridor Restoration
Typical Riffle Construction Diagram
Stephenville, Texas

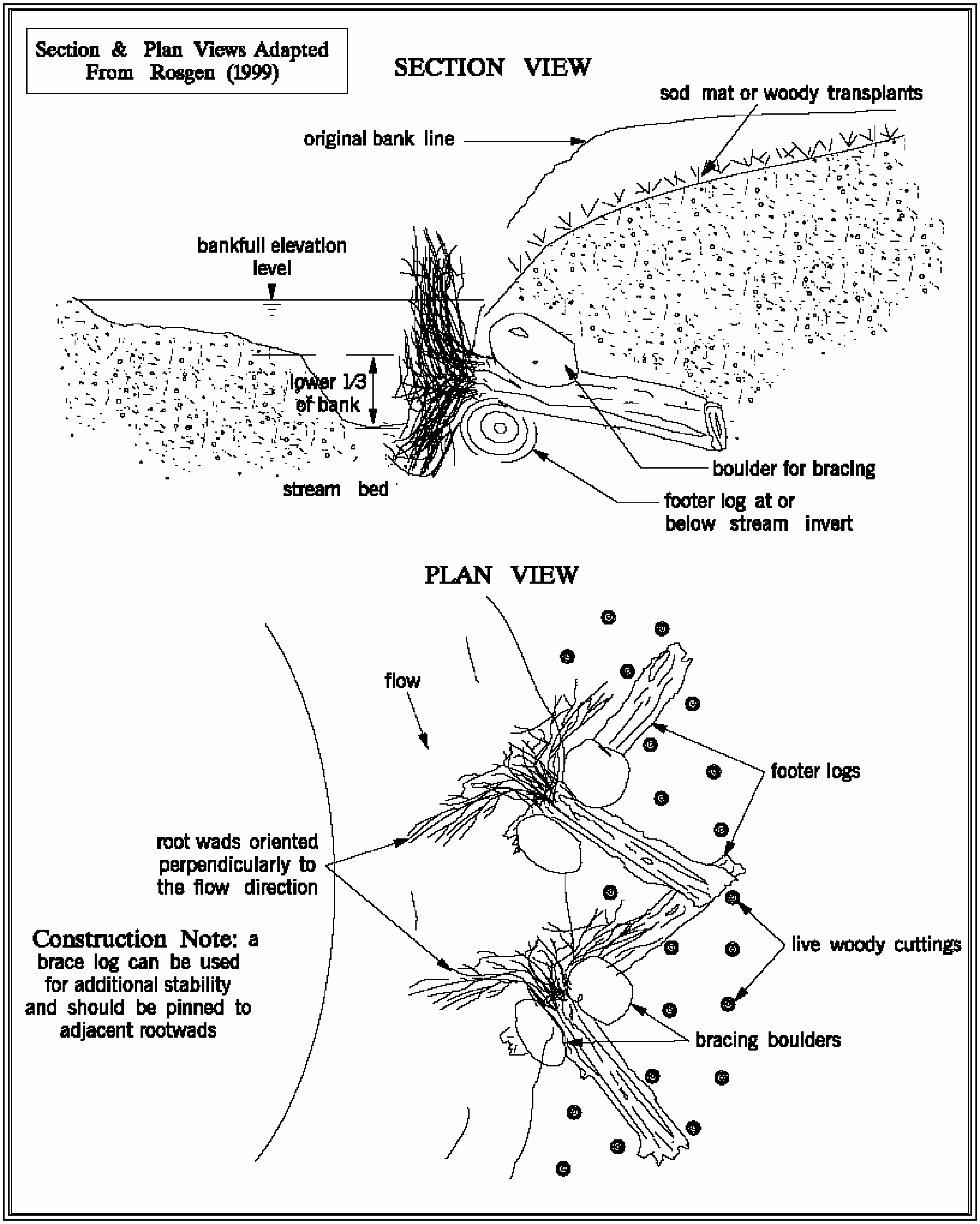


Ref.: http://www.wrc.wa.gov.au/public/RiverRestoration/publications/rr10/part2.pdf

Section 206 - Stream Corridor Restoration

Typical Root-wad Construction Diagram

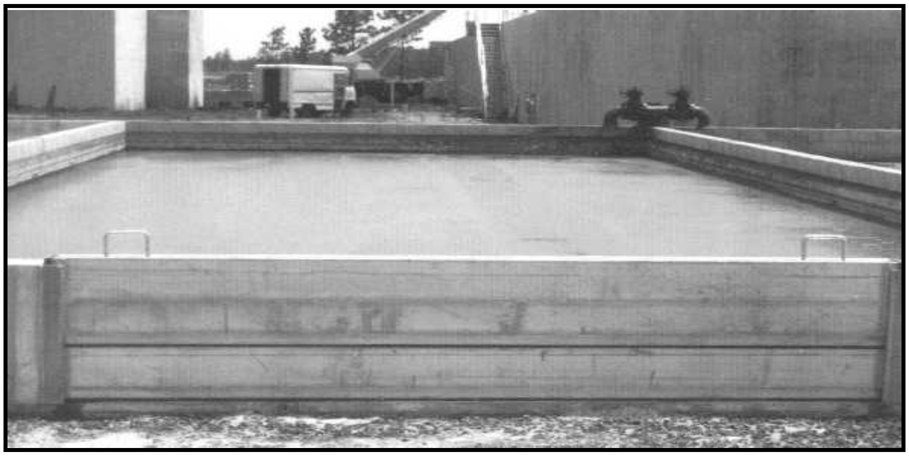
Stephenville, Texas



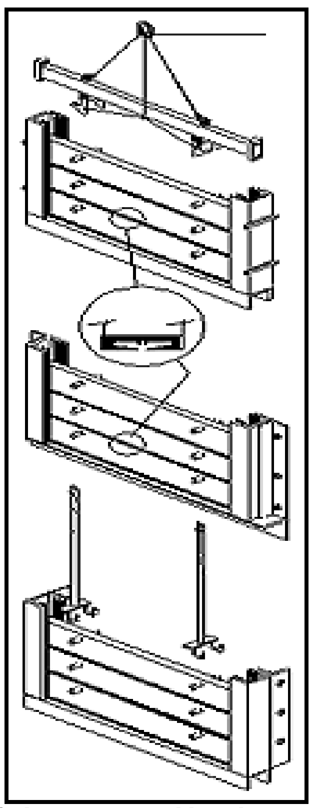
Ref.: http://www.mde.state.md.us/assets/document/wetlandswaterways/sec2-10.pdf

Section 206 - Stream Corridor Restoration
Typical Stop Log
Stephenville, Texas

A stop log is used to contain water in ponds, tanks, or channels. They are used in applications where their installation or removal is required infrequently.

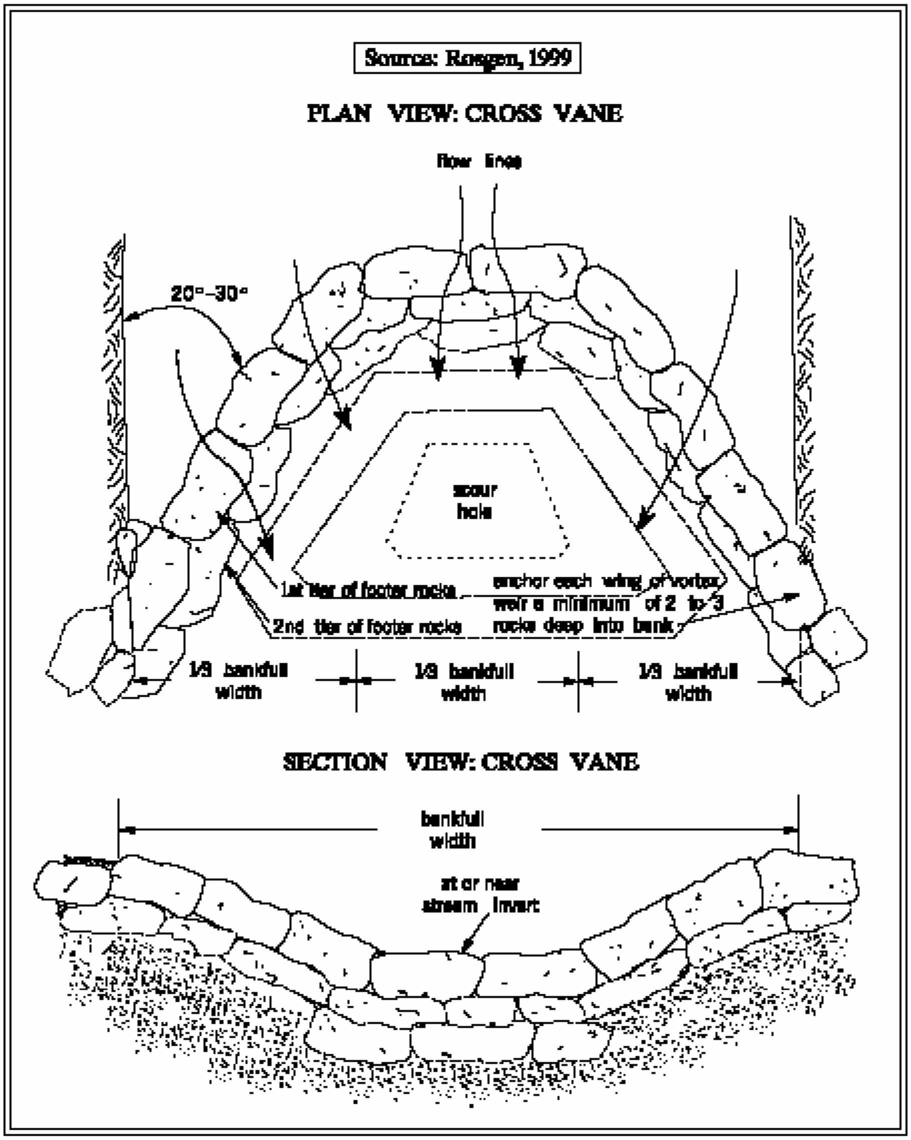


Ref: http://www.whips.com/series509-511.html



Ref: http://www.ashbrookcorp.com

Section 206 - Stream Corridor Restoration
Cross Vane Construction Diagram
Stephenville, Texas

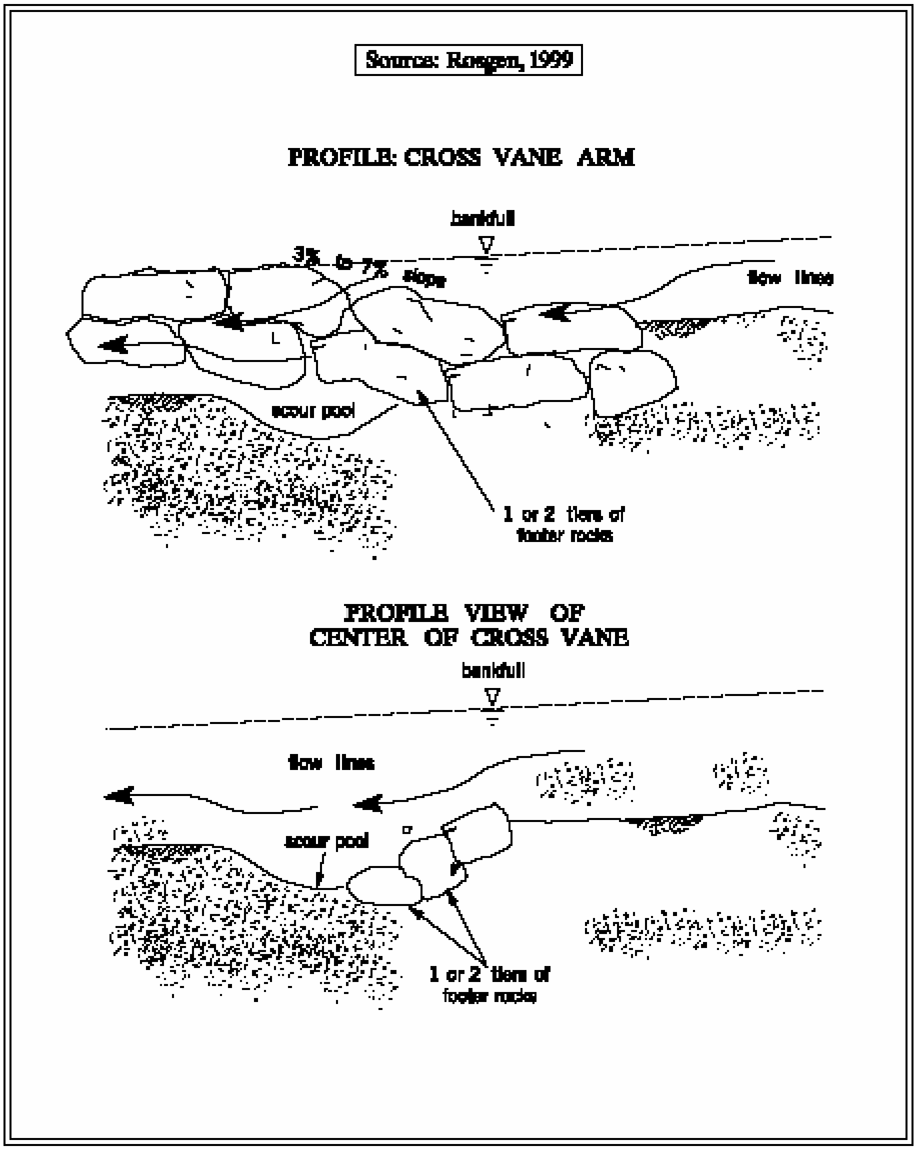


Ref.: http://www.mde.state.md.us/assets/document/wetlandswaterways/mgwc.pdf

Section 206 - Stream Corridor Restoration

Cross Vane Construction Diagram

Stephenville, Texas



Ref.: http://www.mde.state.md.us/assets/document/wetlandswaterways/mgwc.pdf

Construction Activities and Itemized Costs for Recommended Plan 8
Stephenville, Texas Section 206 Restoration Project
North Bosque River, Erath County, Texas

Tetra Tech NUS
Houston, TX

Line Number	Description		Unit	Unit Price	Comment	Estimated Quantity	Estimated Amount
0001	**WWTP Wetland Complex**						**$798,540**
0002	***General Wetland Construction***						**$653,178**
0003	Light Clearing & Grubbing		AC	790		10	7900
0004	Concrete Gate Removal		SY	11		104	1098
0005	Debris Removal		HR	155		40	6200
0006	Excavation and Placement of Soil		CY	4		87304	353581
0007	Stripping Organic Soil Layer and Stockpile		CY	3	6" layer	22667	62334
0008	Replace Organic Soil Layer		CY	4		22667	93841
0009	Placement of Clay Layer		CY	7		17746	118898
0010	Stop Log Water Control Structure		EA	2,700		1	2700
0011	Spillway Rip Rap		CY	34	12-24"	150	5025
0012	Blue Bird Boxes		EA	100		6	600
0013	Wood Duck Boxes		EA	100		10	1000
0014	***Recreation Wetland Construction***						**$11,916**
0015	Trail 4' Stone Dust 4" thick		SY	8	(2450' x 4')	1088	8,421
0016	Parking Area Aggregate		CY	5	(150' x 150' x 0.4')	333	1,815
0017	Trash Bins		EA	300	(Circular, 2' diameter, 2'-6" high)	2	600
0018	Benches		EA	540		2	1,080
0019	***Wetland Planting***						**$133,446**
0020	Berm & Island Seeding (Zone 2)		AC	2,480	seed + 15 trees	9	22320
0021	Planting (Wetland Area) Aquatic Plants	Zone 1 Herb	AC	1,697	seeding	16.9	28,730
0022	Planting (Wetland Area)	Zone 2 Upla	AC	2,480	seed + 15 trees	19.20	47,616
0023	Planting (Wetland Area)	Tree Screen	EA	52	800 ft @ 20ft centers 3 gal tree	40	2,080
0024	Planting (Wetland Area)	Zone 2 NW !	AC	3,000		8.60	25,800
0025	Planting (Wetland Area)	Zone 2 East	AC	3,000		2.30	6,900
0026	**Park Reforestation**						**$71,796**
0027	***Recreation Park Construction***						**$18,065**
0028	4' Trail		SY	8	(2830' x 4' x 0.4') Asphalt Sidewalk, 2" thick	1258	9,875
0029	Trash Bins		EA	300	(Circular, 2' diameter, 2'-6" high)	9	2,700
0030	Cable Guide Rail w/ Wooden Posts		LF	9	[Repair Only]	100	930
0031	Benches		EA	540		7	3,780
0032	Stairs		LF	26		30	780
0033	***General Construction***						**$29,907**
0034	Light Clearing/Grubbing		AC	790		16	12,640
0035	Grading (gentle slope)		SY	0.13		77440	10,067
0036	Debris Removal		HR	155		40	6,200
0037	Wood Duck Boxes		EA	100		10	1,000
0038	***Park Planting***						**$23,823**
0039	Planting (Park Area)	Zone 1 Wetl	AC	6,940	4' spacing	0.1	694
0040	Planting (Park Area)	Zone 2 Perm	AC	3,484	5' spacing	0.3	1,045
0041	Planting (Park Area)	Zone 3 Mast	AC	3,640	70 trees	5.6	20,384
0042	Planting (Park Area)	Zone 4 Nativ	AC	1,700	seeding	1.0	1,700
0043	**Park In-Stream**						**$148,151**
0044	***General***						**$30,330**
0045	Temporary Access Roads		SY	12	(4" gravel fill)	75	900
0046	Light Clearing & Grubbing		AC	790		2	1,185
0047	Grading (steep slope)		SY	2		4840	9,680
0048	Crew B-1 (1 foreman, 2 laborers)		DAY	883		14	12,365
0049	Debris Removal		HR	155		40	6,200
0050	***In-stream structures (weirs, riffles, rootwads)***						**$46,234**
0051	Cross Vanes		EA	1,300		2	2,600
0052	Natural stone rip-rap under 18" thick, machine placed		TON	31	18" thick / 7 riffles	1311	40,634
0053	Rootwads		EA	1,500		2	3,000
0054	***Stream Diversion (Dewatering) Subtotal***						**$23,640**
0055	Stream Diversion						-
0056	Excavate Drainage Trench with Backhoe Loader		CY	9		100	945
0057	4" Diaphram Pump, Attended 2Hrs/day for 8 Hrs		DAY	157		30	4,710
0058	CMP incl. excavation 3' deep, 18" diameter		LF	20	18" diameter	200	4,000
0059	Sandbag Material (dam materials) 30mi haul		CY	19.85		100	1,985
0060	Channel Excavation		CY	8		1500	12,000
0061	***Bank Stabilization***						**$18,710**
0062	Light Clearing & Grubbing		AC	790		10	7,900
0063	Chainsaw/Chipping (not incl. stump)		EA	291		16	4,656
0064	Stump Removal by Backhoe		EA	112		16	1,792
0065	Grading (steep slope)		SY	2		1681	3,362
0066	Grading (gentle slope)		SY	2		500	1,000
0067	***Bank Planting***						**$29,238**
0068	Brush Mattress		SF	34	(25% of slope area) B1-B	664	22,241
0069	Toe Protection		LF	61	Fiber Roll @ B1-B	100	6,100
0070	Planting	Zone 3 Mast	AC	2,520	20' spacing B and C	0.2	504
0071	Planting	Zone 4 Nativ	AC	3,930	Seeding @ A and C	0.10	393
0072	**Total Construction Cost (+/- 30%)**						**$1,018,488**

Notes: Contingency includes unforeseen or unanticipated design requirements or alterations.

Operation and Maintenance Costs
Section 206 - Ecosystem Restoration Project - Stephenville, Texas
North Bosque River, Erath County, Texas

Tetra Tech NUS
Houston, TX

Line Number	Description	Unit	Unit Price	Comment	Estimated Quantity	Estimated Amount
0001	**WWTP**					**$27,800**
0002	***Wetland Complex Operation and Maintenance [Annual Cost]***					**$17,320**
0003	Care of Water	HR	10	(8 hrs per week)	416	4,160
0004	Miscellaneous parts and supplies	EA	1,480		1	1,480
0005	Care of Aquatic Vegetation	HR	10	(10 hrs per week)	520	5,200
0006	Care of Terrestrial Vegetation	HR	10	(10 hrs per week)	520	5,200
0007	Care of Recreational Amenities	HR	10	(8 hrs per month)	96	960
0008	Care of Duck/Bird Boxes (4 days per year)	HR	10		32	320
0009	***Reforestation Operation and Maintenance [Annual Cost]***					**$10,480**
0010	Care of saplings	HR	10		1048	10,480
0011	**Park**					**$13,560**
0012	***In-stream Structures Operation and Maintenance [Annual Cost]***					**$3,620**
0013	Care of Structures (4 hrs per week)	HR	10		208	2,080
0014	Miscellaneous parts and supplies	EA	500		1	500
0015	Care of Aquatic Vegetation (2 hrs per week)	HR	10		104	1,040
0016	***Bank Stabilization Operation and Maintenance [Annual Cost]***					**$2,280**
0017	Care of Banks	HR	10	(2 hrs per week)	104	1,040
0018	Miscellaneous parts and supplies	EA	200		1	200
0019	Care of Bank Vegetation	HR	10	(2 hrs per week)	104	1,040
0020	***Reforestation (Planting) Operation and Maintenance [Annual Cost]***					**$7,660**
0021	Miscellaneous parts and supplies	EA	300		1	300
0022	Care of Aquatic Vegetation	HR	10	(4 hrs per week)	208	2080
0023	Care of Terrestrial Vegetation	HR	10	(8 hrs per week)	416	4160
0024	Care of Recreational Amenities	HR	10	(8 hrs per month)	96	960
0025	Care of Duck/Bird Boxes	HR	10	(2 days per year)	16	160
0026	**Total Operation and Maintenance Cost (+/- 30%)**					**$41,360**

Notes: Contingency includes unforeseen or unanticipated design requirements or alterations.

Preliminary Scales Estimate
Stephenville, Texas
North Bosque River, Erath County, Texas
COE Contract No. DACA63-97-D-0030
Task Order No. 0038

Tetra Tech NUS
Houston, TX

Section 206 - Ecosystem Restoration Project				Scale 1				Scale 2				Scale 3				
Line Number	Description	Unit	Unit Price	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Construction Year
0001	**Wetland Complex** Subtotal			**Entire pond footprint**			**$935,042**	**Eastern 2 Cells Only**			**$466,505**	**Southern half only (3 cells)**			**$464,888**	
0002	***General Wetland Subtotal***						**$681,978**				**$296,372**				**$341,458**	
0003	Light Clearing & Grubbing	AC	790			10	7900	50%		5	3,950	50%		5	3,950	1
0004	Concrete Gate Removal	SY	11			104	1098	100%		104	1,098	100%		104	1,098	1
0005	Debris Removal	HR	155			40	6200	50%		20	3,100	50%		20	3,100	1
0006	Excavation and Placement of Soil	CY	4			87304	353581	50%		43652	176,791	67%		58494	236,901	1
0007	Berm & Island Seeding (Zone 2)	AC	3,200	seed + 25 trees		9	28,800	seed + 15 trees	2,480	7.5	18,600	seed + 5 trees	1,960	5	9,800	1
0008	Stripping Organic Soil Layer and Stockpile	CY	3	6" layer		22667	62334	6" layer		11333	31,166	6" layer, 50%		11333	31,166	1
0009	Replace Organic Soil Layer	CY	4			22667	93841	50%		11333	46,919	50%		11333	46,919	1
0010	Placement of Clay Layer	CY	7			17746	118898	No Liner Installed		0	-	No Liner Installed		0	-	1
0011	Stop Log Water Control Structure	EA	2,700			1	2700	100%		1	2,700	100%		1	2,700	1
0012	Waterline Excavation	CY	4	Assume use of old effluent line to				Line installed to second berm		400	1,624	Assume use of old effluent line			-	
0013	Waterline Backfill	CY	4	ponds				area		400	1,600	to ponds			-	
0014	PVC Pipe (gravity flow from WWTP to wetland)	LF	10					24" diam		300	3,000				-	
0015	Spillway Rip Rap	CY	34	12-24"		150	5025	12-24"		150	5,025	12-24" 100%		150	5,025	2
0016	Blue Bird Boxes	EA	100			6	600	50%		3	300	50%		3	300	2
0017	Wood Duck Boxes	EA	100			10	1000	50%		5	500	50%		5	500	2
0018	***Wetland Planting Subtotal***						**$225,264**				**$156,173**				**$110,510**	
0019	Planting (Wetland Area) Aquatic Plants Zone 1 Herb Emerg	AC	7,849	3' spacing		16.9	132,884	4' spacing	6,944	8.5	58,781	seeding	1,700	11.3	19,283	2
0020	Planting (Wetland Area) Zone 2 Upland Veg	AC	3,000	seed + 25 trees		19.20	57,600	seed + 15 trees	2480	27.70	68,696	seed + 5 trees	1960	24.83	48,662	2
0021	Planting (Wetland Area) Tree Screen btwn WWTP & Wetland	EA	52	800 ft @ 20ft centers 3 gal tree		40	2,080	800 ft @ 15ft centers 3 gal tree		32	1,664	800 ft @ 20ft centers 2.5 - 3in caliper, oak, balled nd burlapped tree	530	40	21,200	2
0022	Planting (Wetland Area) Zone 2 NW Savannah Grasses and Trees	AC	3,000			8.60	25,800		2480	8.60	21,328		1960	8.60	16,856	2
0023	Planting (Wetland Area) Zone 2 East - levee to river	AC	3,000			2.30	6,900		2480	2.30	5,704		1960	2.30	4,508	2
0024	***Operation and Maintenance (Wetland) Subtotal [Annual Cost]***						**$17,320**				**$13,960**				**$12,920**	2
0025	Care of Water	HR	10	(8 hrs per week)		416	4,160	(6 hrs per week)		300	3,000	(6 hrs per week)		300	3,000	
0026	Miscellaneous parts and supplies	EA	1,480			1	1,480			1	1,480			1	1,480	
0027	Care of Aquatic Vegetation	HR	10	(10 hrs per week)		520	5,200	(6 hrs per week)		312	3,120	(6 hrs per week)		312	3,120	
0028	Care of Terrestrial Vegetation	HR	10	(10 hrs per week)		520	5,200	(10 hrs per week)		520	5,200	(8 hrs per week)		416	4,160	
0029	Care of Recreational Amenities	HR	10	(8 hrs per month)		96	960	(7 hrs per month)		84	840	(7 hrs per month)		84	840	
0030	Care of Duck/Bird Boxes (4 days per year)	HR	10			32	320			32	320			32	320	
	Reforestation Operation and Maintenance [Annual Cost]						**$10,480**				**$10,480**				**$8,380**	
	Care of saplings	HR	10	(10 hrs per week)		1,048	10,480	(10 hrs per week)		1048	10,480	(8 hrs per week)		838	8,380	
0031	**Recreation (Park and Wetland)** Subtotal						**$21,857**				**$29,981**				**$45,883**	
0032	***Recreation Wetland Subtotal***						**$11,916**				**$11,916**				**$6,243**	
0033	Trail 4' Stone Dust 4" thick	SY	8	(2450' x 4')		1088	8,421	(2450' x 4')		1088	8,421	(800' x 4')		355	2,748	2
0034	Parking Area Aggregate	CY	5	(150' x 150' x 0.4')		333	1,815	(150' x 150' x 0.4')		333	1,815	(150' x 150' x 0.4')		333	1,815	2
0035	Trash Bins	EA	300	(Circular, 2' diameter, 2'-6" high)		2	600	(Circular, 2' diameter, 2'-6" high)		2	600	(Circular, 2' diameter, 2'-6" high)		2	600	2
0036	Benches	EA	540			2	1,080			2	1,080			2	1,080	2
0037	***Recreation Park Subtotal***						**$9,941**				**$18,065**				**$39,640**	
0038	4' Trail	SY	8	(500' x 4' x 0.4') [Asphalt Repair Only]		223	1,751	(2830' x 4' x 0.4') Asphalt Sidewalk, 2" thick		1258	9,875	Asphalt Running Track, incl base, 3" thick	25	1258	31,450	2
0039	Trash Bins	EA	300	(Circular, 2' diameter, 2'-6" high)		9	2,700	(Circular, 2' diameter, 2'-6" high)		9	2,700	(Circular, 2' diameter, 2'-6" high)		9	2,700	2
0040	Cable Guide Rail w/ Wooden Posts	LF	9	[Repair Only]		100	930	[Repair Only]		100	930	[Repair Only]		100	930	2
0041	Benches	EA	540			7	3,780			7	3,780			7	3,780	2
0042	Stairs	LF	26			30	780			30	780			30	780	2
0043	**In-Stream Habitat (Park)** Subtotal			**2 Ponds 5 riffles**			**$102,336**	**2 Ponds 7 riffles**			**$103,824**	**2 Ponds 6 riffles**			**$102,254**	
0044	***General Subtotal***						**$75,076**				**$76,564**				**$74,994**	
0045	Temporary Access Roads	SY	12	(4" gravel fill)		75	900	(4" gravel fill)		75	900	(4" gravel fill)		75	900	1
0046	Light Clearing & Grubbing	AC	790			2	1,185			2	1,185			2	1,185	1
0047	Grading (steep slope)	SY	2			4840	9,680			4840	9,680			4840	9,680	1
0048	Crew B-1 (1 foreman, 2 laborers)	DAY	883			14	12,365			14	12,365			14	12,365	1
0049	Debris Removal	HR	155			40	6,200			40	6,200			40	6,200	1
0050	Cross Vanes	EA	1,300			2	2,600			2	2,600			2	2,600	1
0051	Natural stone rip-rap under 18" thick, machine placed	TON	31	18" thick / 5 riffles		1166	36,146	18" thick / 7 riffles		1311	40,634	18" thick / 6 riffles		1260	39,064	1
0052	Rootwads	EA	1,500			4	6,000			2	3,000			2	3,000	1
0053	***Stream Diversion (Dewatering) Subtotal***						**$23,640**				**$23,640**				**$23,640**	
0054	Stream Diversion										-				-	
0055	Excavate Drainage Trench with Backhoe Loader	CY	9			100	945			100	945			100	945	1
0056	4" Diaphram Pump, Attended 2Hrs/day for 8 Hrs	DAY	157			30	4,710			30	4,710			30	4,710	1
0057	CMP incl. excavation 3' deep, 18" diameter	LF	20	18" diameter		200	4,000	18" diameter		200	4,000	18" diameter		200	4,000	1
0058	Sandbag Material (dam materials) 30mi haul	CY	19.85			100	1,985			100	1,985			100	1,985	1
0059	Channel Excavation	CY	8			1500	12,000			1500	12,000			1500	12,000	1
0060	***Operation and Maintenance (In-stream structures) Subtotal [Annual Cost]***						**$3,620**				**$3,620**				**$3,620**	
0061	Care of Structures (4 hrs per week)	HR	10			208	2,080			208	2,080			208	2,080	
0062	Miscellaneous parts and supplies	EA	500			1	500			1	500			1	500	

Section 206 - Ecosystem Restoration Project				Scale 1				Scale 2				Scale 3				
Line Number	Description	Unit	Unit Price	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Construction Year
0063	Care of Aquatic Vegetation (2 hrs per week)	HR	10			104	1,040			104	1,040			104	1,040	

Stephenville, Texas
North Bosque River, Erath County, Texas
COE Contract No. DACA63-97-D-0030
Task Order No. 0038

Tetra Tech NUS
Houston, TX

Section 206 - Ecosystem Restoration Project					Scale 1				Scale 2				Scale 3				
Line Number	Description		Unit	Unit Price	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Comment	Unit Price (if Changed)	Estimated Quantity	Estimated Amount	Construction Year
0064	**Bank Stabilization (Park)**	**Subtotal**						**$103,779**				**$50,228**				**$97,171**	
0065	***General Subtotal***							**$99,419**				**$47,948**				**$93,331**	
0066	Light Clearing & Grubbing		AC	790			10	7,900			10	7,900			10	7,900	1
0067	Chainsaw/Chipping (not incl. stump)		EA	291			16	4,656			16	4,656			16	4,656	1
0068	Stump Removal by Backhoe		EA	112			16	1,792			16	1,792			16	1,792	1
0069	Grading (steep slope)		SY	2			1681	3,362			1681	3,362			1681	3,362	1
0070	Grading (gentle slope)		SY	2			500	1,000			500	1,000			500	1,000	1
0071	Brush Mattress		SF	34	(25% of slope area) B1-B and C1-C		1988	66,611	(25% of slope area) B1-B Only		664	22,241	(25% of slope area) B1-B and C1-C		1988	66,611	1
0072	Toe Protection		LF	61	Fiber Roll @ A, B & C		195	11,895	Fiber Roll @ B Only		100	6,100	Riffle Toe Protection		120	7,320	1
0073	Planting	Zone 3 Mast Prod Plants	AC	10,088	15' spacing B and C		0.2	2,018	[20' spacing] B Only	5044	0.1	504	[25' spacing] B and C	2522	0.2	504	2
0074	Planting	Zone 4 Native Grasses	AC	1,700	Channel Bank Turf A1-A		0.11	185	Channel Bank Turf A & C	1,700	0.23	393	Channel Bank Turf A Only	1,700	0.11	185	2
0075	***Operation and Maintenance (Bank Stabilization) Subtotal [Annual Cost]***							**$4,360**				**$2,280**				**$3,840**	
0076	Care of Banks		HR	10	(4 hrs per week)		208	2,080	(2 hrs per week)		104	1,040	(3 hrs per week)		156	1,560	
0077	Miscellaneous parts and supplies		EA	200			1	200			1	200			1	200	
0078	Care of Bank Vegetation		HR	10	(4 hrs per week)		208	2,080	(2 hrs per week)		104	1,040	(4 hrs per week)		208	2,080	
0079	**Planting (Park)**	**Subtotal**						**$101,441**				**$70,847**				**$57,291**	
0080	***General Subtotal***							**$29,907**				**$29,407**				**$29,407**	
0081	Light Clearing/Grubbing		AC	790			16	12,640			16	12,640			16	12,640	1
0082	Grading (gentle slope)		SY	0.13			77440	10,067			77440	10,067			77440	10,067	1
0083	Debris Removal		HR	155			40	6,200			40	6,200			40	6,200	1
0084	Wood Duck Boxes		EA	100			10	1,000	50% (Half)		5	500	50% (Half)		5	500	2
0085	***Planting Park Subtotal***							**$63,874**				**$35,860**				**$23,824**	
0086	Planting (Park Area)	Zone 1 Wetland Emerg	AC	27,770	2' spacing		0.1	2,777	3' spacing	7849	0.1	785	4' spacing	6944	0.1	694	2
0087	Planting (Park Area)	Zone 2 Perm Sat Trees & Shrubs	AC	9,680	3' spacing		0.3	2,904	4' spacing	5446	0.3	1,634	5' spacing	3484	0.3	1,045	2
0088	Planting (Park Area)	Zone 3 Mast Prod Trees	AC	10,088	15' spacing		5.6	56,493	20' spacing	5668	5.6	31,741	25' spacing	3640	5.6	20,384	2
0089	Planting (Park Area)	Zone 4 Native Grasses	AC	1,700	seeding		1.0	1,700	seeding	1700	1.0	1,700	seeding	1700	1.0	1,700	2
0090	***Operation and Maintenance (Planting) Subtotal [Annual Cost]***							**$7,660**				**$5,580**				**$4,060**	
0091	Miscellaneous parts and supplies		EA	300			1	300			1	300			1	300	
0092	Care of Aquatic Vegetation		HR	10	(4 hrs per week)		208	2080	(2 hrs per week)		104	1,040	(2 hrs per week)		104	1,040	
0093	Care of Terrestrial Vegetation		HR	10	(8 hrs per week)		416	4160	(6 hrs per week)		312	3,120	(4 hrs per week)		208	2,080	
0094	Care of Recreational Amenities		HR	10	(8 hrs per month)		96	960	(8 hrs per month)		96	960	(4 hrs per month)		48	480	
0095	Care of Duck/Bird Boxes		HR	10	(2 days per year)		16	160	(2 days per year)		16	160	(2 days per year)		16	160	
0096	**Land Acquisition (LERRD's)**	**Subtotal**						**$565,409**				**$565,409**				**$565,409**	
0097	***Wetland Complex***							**$493,099**				**$493,099**				**$493,099**	
0098	Total Area		AC	8,712			56.6	493,099			56.6	493,099			56.6	493,099	1
0099	***City Park Stream Restoration***							**$72,310**				**$72,310**				**$72,310**	
0100	Total Area		AC	8,712			8.3	72,310			8.3	72,310			8.3	72,310	2
0101																	
0102	**Total Construction Cost (+/- 30%)**							**$1,829,863**				**$1,286,794**				**$1,332,895**	

Notes: Contingency includes unforeseen or unanticipated design requirements or alterations.

APPENDIX G

HYDROLOGIC AND HYDRAULIC STUDIES

HYDROLOGY STUDY

FOR

NORTH BOSQUE RIVER STUDY AREA

In the City of Stephenville
Erath County, Texas

July 2003

Prepared for:

United States Army Corps of Engineers
Fort Worth District

Prepared by:

Tetra Tech, NUS, Inc.
Houston, Texas

Contract No. DAA63-97-D-0030
Delivery Order No. 0038

This document is for Interim Review Purpose Only and Not Intended for Bidding, Permit or Construction

HYDROLOGIC STUDYREPORT

North Bosque River Study Area, Erath County, Texas

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ABBREVIATIONS AND ACRONYMS

cfs	cubic feet per second
C_p	Snyder Peaking Coefficient
C_t	catchment shape factor
CWA	Clean Water Act
ft	feet
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
hr	hour
L_{ca}	length from subarea centroid to stream location nearest centroid
mi	mile
mi^2	square mile
min	minutes
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDA	Planning Design Analysis
Q	Total Flow
RAS	River Analysis System
SCS	Soil Conservation Service
sq ft.	square feet
t_p	Snyder's basin lag time factor (in hours)
TP	Technical Paper
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

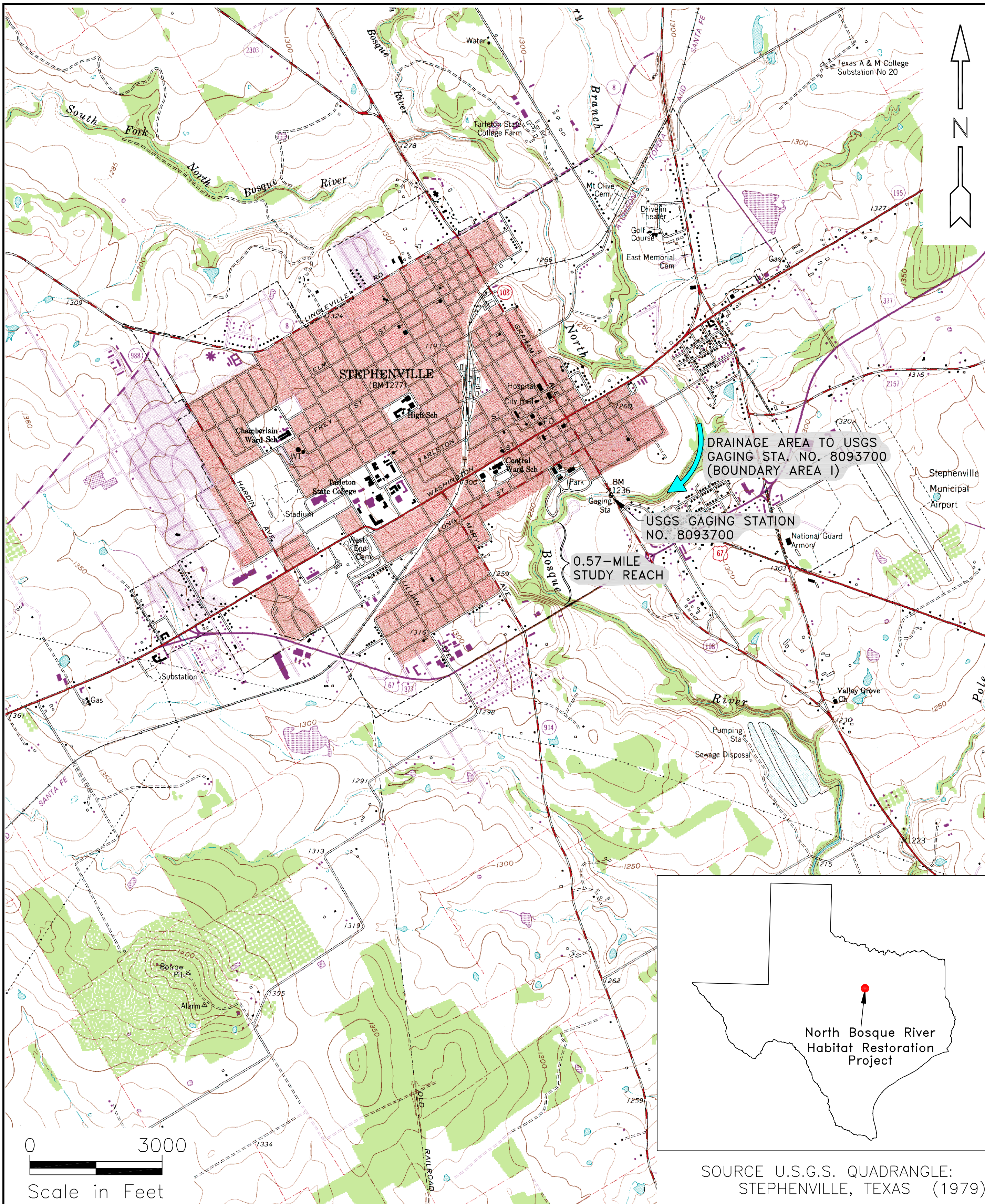
The purpose of this hydrologic study is to support the Planning Design Analysis (PDA) for an aquatic restoration project on the North Bosque River in Stephenville, Texas. This project is authorized by Section 206 of the Clean Water Act (CWA). The information herein will be used to assist in the formulation of the appropriate project alternative, while meeting overall project goals.

The hydrologic study for this section of the North Bosque River was divided into two geographic boundary areas. The first boundary, involving the upper river reach area, is represented by historical US Geological Service (USGS) flow rate data collected at a gage station located upstream of the PDA restoration study reach area. The second boundary represents the lower PDA study area. Both boundary areas were modeled using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) Hydrologic Modeling System (HMS) computer program (version 2.1.3, Oct 2001) to evaluate the peak discharge from the combined watershed. The information gathered from the USGS gage station was used to verify the model discharge results prior to using the results in hydraulic river analysis scenarios of the study area. The hydraulic study is discussed under separate cover.

2.0 BACKGROUND INFORMATION

The project study area is located along the North Bosque River within the City of Stephenville, Erath County, Texas. Stephenville is a livestock and farming community located approximately 80 miles southwest of Fort Worth Texas (Figure 1). Urban development and agricultural activities have encroached along both sides of the river causing some bank erosion and wildlife habitat fragmentation.

The project study area is located in the Grand Prairie sub-region of the North Central Plains geographic region of Texas. The North Bosque River is a tributary of the Brazos River. Erath County elevations range from 900 to 1,750 feet with gently rolling to nearly level slopes ranging from 0 to two percent. Generally, the Erath County is dry and warm with average temperatures ranging from a low of 34 degrees Fahrenheit (ºF) in January to a high of 96 ºF in July. The average rainfall in Erath County is approximately 29 inches per year. Climax vegetation is composed primarily of big bluestem, little bluestem, Indian grass, switch grass, Canada wild rye, and minor amounts of side oats grama, blue grama, hairy grama, Texas winter grass, and buffalo grass. The uplands show similarities with vegetation of the Edwards Plateau to the south and west, supporting Ashe juniper, live oak, Texas red oak, Texas ash, post oak, and mesquite. Trees in the bottomland areas are mainly American elm, cedar elm, Texas sugarberry, burr oak, and green ash. In well-watered bottomland zones the woodlands are comprised of pecan, walnut, cottonwood, sycamore, black willow, and several kinds of shrubs, and vines.



SOURCE U.S.G.S. QUADRANGLE: STEPHENVILLE, TEXAS (1979)

SITE MANAGER: D. LINDSAY		FIGURE 1
CHECKED BY: D. LINDSAY	TETRA TECH NUS, INC. Houston, Texas	PROJECT VICINITY MAP
DRAWN BY: J. FLESCH		FORT WORTH DISTRICT CORPS OF ENGINEERS
DATE: 07-03-03	SCALE: 1"=3000'	HYDROLOGIC STUDY NORTH BOSQUE RIVER
DWG. NO.: STEPH_SV2	PROJ. NO.: N7551.347D	STEPHENVILLE, TEXAS

3.0 GENERAL STUDY INFORMATION

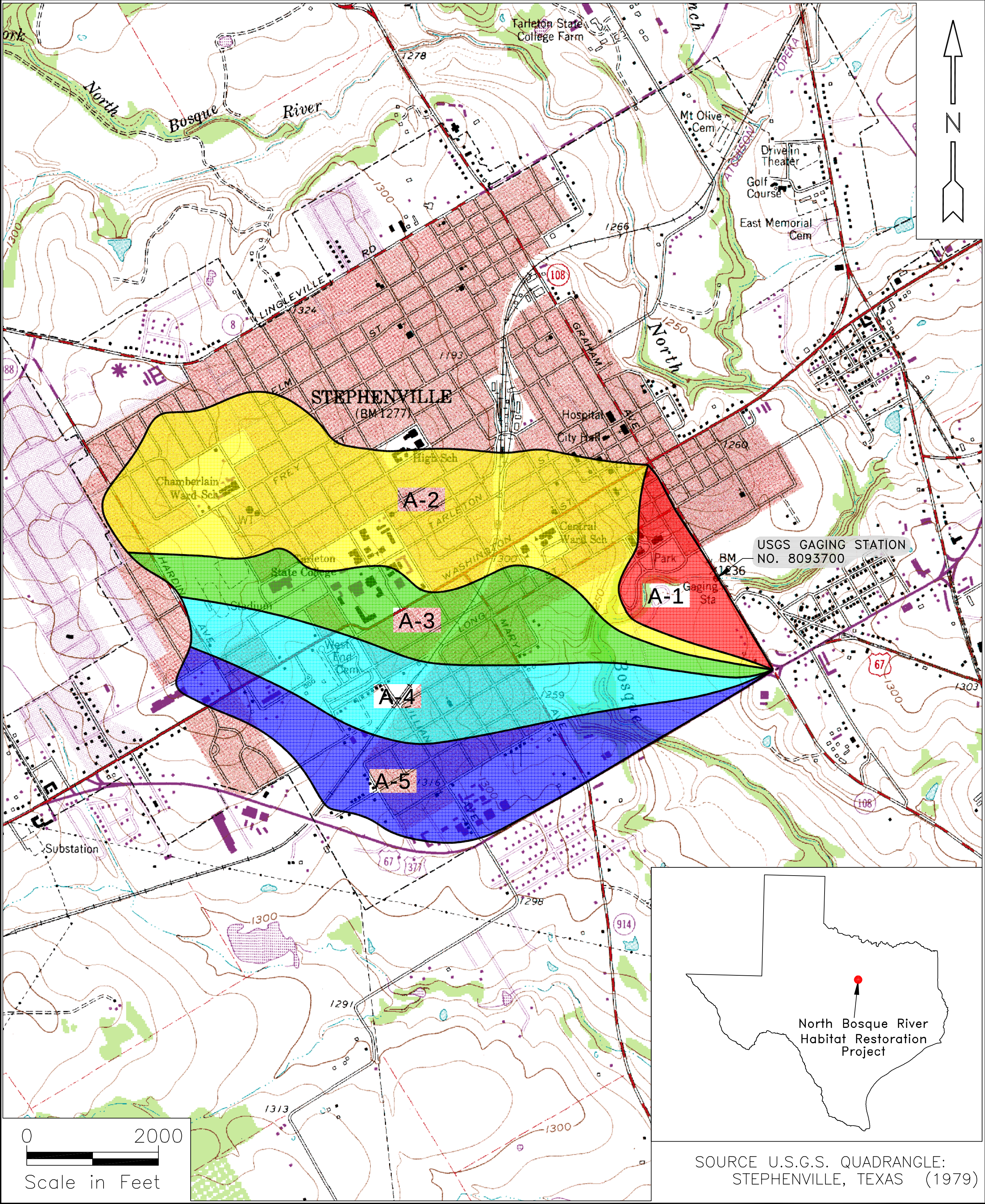
The hydrologic study area consists of 0.57 miles of the North Bosque River within Stephenville City Park (see Figure 1), beginning at the low-water crossing near the Centennial Park Gazebo and extending to just upstream of the South Loop roadway (U.S. 67 and U.S. 377). Water flow in the North Bosque River within the Stephenville City Park is augmented by treated effluent flow from the Stephenville Wastewater Treatment Plant (WWTP). Treated effluent is pumped from the Stephenville WWTP and introduced to the North Bosque River upstream of the study area. This additional flow has created a sustained source of flowing water to the river in the park area, however, the lack of stream bank vegetation has allowed erosion to occur. The majority of the bottomland plant community within the park area is disturbed and fragmented mainly due to park expansion and stream bank erosion. On average, approximately 0.3 million gallons per day (MGD) (0.5 cfs) of treated effluent flow is routed from the WWTP to the park area. However, the permit held by the City of Stephenville allows for a total discharge of 0.5 MGD (0.77 cfs).

4.0 METHODS

For the purposes of the hydrologic study, the watershed area contributing to flow within the study reach was divided into two boundary areas. The first boundary area (Boundary Area I, Figure 1), involving the upper river reach, is represented by flow data collected at USGS Gage Station Number 8093700 (N Bosque Rv at Stephenville, TX, Latitude 32°12'56", Longitude 98°11'55" NAD27, USGS Online, 2003). This gage station, shown in Figures 1 and 2, is located upstream of the PDA restoration study reach area near the river crossing at South Graham Ave. and represents a watershed area of 95.9 square miles (mi^2). The second boundary area (Boundary Area II) includes the catchment area associated with the portion of the river between the gage station and the PDA study area (A-1, Figure 1) as well as the 0.57 mile study reach area (A-2 through A-5, Figure 1), beginning at the low-water crossing (Figure 2). The catchment area associated with the Boundary Area II is 1.97 mi^2, and is mostly comprised of surface water runoff from the City of Stephenville. Both boundary areas were modeled using the USACE HEC-HMS computer program to evaluate the basin peak area discharge for several storm events. The total watershed area associated with the flow within the North Bosque River at the Stephenville City Park is approximately 97.9 mi^2.

<u>Boundary Area I – Upper Watershed above GS No. 8093700</u>

The discharge from Boundary Area I, as represented by field observed data collected at USGS Gage Station Number 8093700 (Figure 1), was evaluated and used to establish initial HEC-HMS parameters such as time to peak (Tc) and discharge characteristics. The watershed area associated with this gage station is 95.9 mi^2 (USGS Online, 2003) with data collected from May 1952 to May 1979. Of these data, annual peak stream flow, average monthly stream flow, and daily average stream flow values and trends were reviewed to estimate seasonal and monthly fluctuations (peak, average, minimum) and estimate the approximate distribution of flows over time. Graphical representations of these analyses are included in Appendix A.



SITE MANAGER: D. LINDSAY		TETRA TECH NUS, INC. Houston, Texas	FIGURE 2
CHECKED BY: D. LINDSAY			SUBBASIN DELINEATION – BOUNDARY AREA II
DRAWN BY: J. FLESCH			FORT WORTH DISTRICT CORPS OF ENGINEERS HYDROLOGIC STUDY
DATE: 07-03-03	SCALE: 1"=2000'		NORTH BOSQUE RIVER
DWG. NO.: STEPH_SV3	PROJ. NO.: N7551.347D		STEPHENVILLE, TEXAS

In general, the highest average monthly flows are present during month of May (37.6 cubic-feet-per-second, cfs) and the lowest average monthly flows are observed during August and December (3.69 and 3.99 cfs, respectively). The maximum instantaneous peak flow (49,000 cfs, a historic peak) was recorded at the station in 1955, while the lowest monthly peak flow of 299 cfs was observed in 1978. However, from 1961 to 1979, the average annual peak value was approximately 2,910 cfs, and the median annual peak value of approximately 2,430 cfs. Regulation and diversion activities within the watershed may have contributed to the fluctuation and possible reduction of observed peak streamflows. A discharge versus percent exceedance curve was generated from the available daily mean flow values for the period of record from March 1, 1958 to September 30, 1979 (see Appendix A). From this curve, approximate peak flow relationships were estimated, as shown in Table 1. These estimated flow relationships were then used to evaluate the results obtained from the HEC-HMS modeling efforts. The values on Table 1 were not used in any modeling studies.

Table 1

ESTIMATED DAILY AVERAGE AND PEAK FLOW VALUES
Hydrologic Study of North Bosque River Study Area

Exceedance Probability	Daily Average Flow (cfs)[1]	Peak Flow (cfs)[2]
100%	1100	3300
50%	1700	5100
20%	2750	8250
10%	3600	10800
4%	4750	14250
2%	5800	17400
1%	5900	17700
0.2%	6000	18000

Note: 1. Probability of Exceedance was based upon the occurrence of a flow.
2. Daily average flow graphically estimated from observed gage data collected March 1, 1958 through September 30, 1979 at USGS Gage Station No. 8093700.
3. Peak flow estimated as three times daily average flow.

Physical characteristics of the watershed (estimated reach length, elevations, etc.) were based upon 10-foot contour intervals from U.S. Geological Survey (USGS) quadrangle maps. This data was compiled and included with Boundary Area II in the HEC-HMS model developed for the PDA study area.

Boundary Area II – Lower Study Reach Area

The HEC-HMS computer program was used to establish the discharge for Boundary Area II. The 1.97 square-mile drainage area was divided into five (A-1 through A-5) subbasins as shown in Figure 2. The delineation of the watershed and subbasin boundaries was based upon 10-foot contour intervals from U.S. Geological Survey (USGS) quadrangle maps.

Criteria such as land-use, soil type, and rainfall data were used to generate peak discharge for boundary areas I and II using HEC-HMS. Preliminary hydraulic models were used to produce storage characteristics in the five stream subbasins and the watershed represented by USGS gage station 8093700 based upon the "typical" river geometric data obtained from a topographic survey collected within the PDA Study Area.

For both boundary areas, the HEC-HMS program utilized three models: basin, meteorologic, and control specification, as components in the computation of peak discharge. Within these modules the following methods were used to evaluate the North Bosque River:

- **Meteorologic Model:** Frequency Storm Method
- **Basin Model:**
  - Loss Method: Initial/Constant Method
  - Rainfall-Runoff Transform Model: Snyder
  - Channel Routing: Muskingum-Cunge 8-Point
  - Constant Monthly Base Flow Method (Subbasin A-1), No baseflow was considered for all other subbasin areas
- **Control Specification Model:** 24-hour precipitation duration with 5 minutes computation time interval

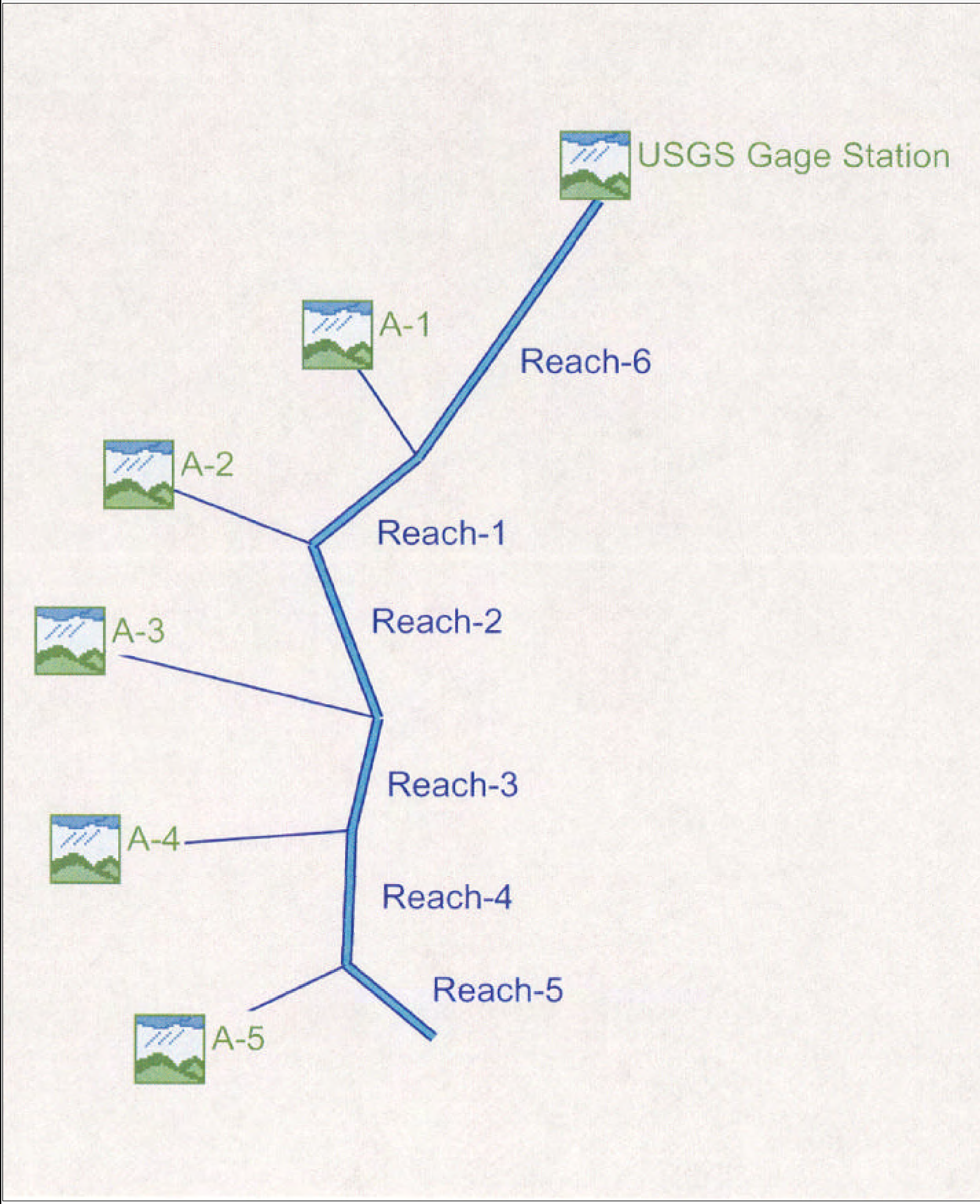
The delineation of the boundary area (I and II) catchments was developed based upon USGS mapping 10-foot contour intervals. The graphical schematic of the drainage areas, as represented in the HEC-HMS model, is shown in Figure 3.

4.1 Topographic and Field Surveys

Digital topography of PDA study area was collected to verify existing contour topography (2-foot) and used to generate typical cross-section information for the model. Site visits and field survey data were used to develop land-use, and other physical characteristics of the PDA study area.

4.2 Rainfall Data

The Technical Paper (TP) No. (U.S. Weather Bureau, 1961) and the National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum National Weather Service (NWS) Hydro-35 (NOAA, 1977) were used to develop the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year frequency rainfalls for the study area. Points not reported in these documents were interpolated to complete the frequency rainfall curves. The 500-year frequency rainfall curve was generated based upon extrapolated data from these sources. Table 2 lists relation of storm duration, depth, and frequency for the study area.



SITE MANAGER: D. LINDSAY		TETRA TECH NUS, INC. Houston, Texas	FIGURE 3 HYDROLOGIC MODEL SCHEMATIC FORT WORTH DISTRICT CORPS OF ENGINEERS HYDROLOGIC STUDY NORTH BOSQUE RIVER STEPHENVILLE, TEXAS
CHECKED BY: D. LINDSAY			
DRAWN BY: J. FLESCH			
DATE: 07-03-03	SCALE: NONE		
DWG. NO.: STEPH_HS	PROJ. NO.: N7551.347D		

Table 2

ERATH COUNTY AREA RAINFALL DEPTH - DURATION – FREQUENCY
Hydrologic Study of North Bosque River Study Area

Rainfall Frequency	Exceedance Probability	Storm Duration							
		5 Min.	15 Min.	60 Min.	2 Hr.	3 Hr.	6 Hr.	12 Hr.	24 Hr.
1 Year	**100**	0.05 in.	0.70 in.	1.38 in.	1.71 in.	1.93 in.	2.26 in.	2.59 in.	2.96 in.
2 Year	**50**	0.10 in.	0.87 in.	1.77 in.	2.23 in.	2.50 in.	2.95 in.	3.40 in.	3.87 in.
5 Year	**20**	0.16 in.	1.09 in.	2.30 in.	2.91 in.	3.27 in.	3.86 in.	4.47 in.	5.06 in.
10 Year	**10**	0.21 in.	1.25 in.	2.70 in.	3.43 in.	3.85 in.	4.55 in.	5.28 in.	5.97 in.
25 Year	**4**	0.28 in.	1.47 in.	3.22 in.	4.11 in.	4.61 in.	5.46 in.	6.35 in.	7.17 in.
50 Year	**2**	0.33 in.	1.64 in.	3.62 in.	4.63 in.	5.19 in.	6.15 in.	7.16 in.	8.07 in.
100 Year	**1**	0.37 in.	1.81 in.	4.02 in.	5.15 in.	5.77 in.	6.84 in.	7.97 in.	8.98 in.
500 Year	**0.2**	0.49 in.	2.19 in.	4.94 in.	6.35 in.	7.11 in.	8.44 in.	9.85 in.	11.09 in.

Note: Data based upon HEC-HMS - 35 and TP40

4.3 Baseflow Data

The Constant Monthly Baseflow Method was used in HEC-HMS to represent the effluent wastewater flow from the City of Stephenville WWTP to the park area. Table 3 lists the monthly flow values (in cfs) of wastewater pumped from the WWTP to the park area, and which were used in the HEC-HMS model as baseflow. The data is based upon 2002 data recorded by OMI, Inc. The baseflow data was added only to sub-basin A-1, as it represents the river area location at which the outlet for the wastewater flow is located within the model. Baseflow was not included within the HEC-HMS model for the remaining subbasin areas.

Table 3

MONTHLY BASEFLOW VALUES FOR SUBBASIN A-1
Hydrologic Study of North Bosque River Study Area

Month	WWTP Flow to Park Area[1] (cfs)
January	0.475
February	0.463
March	0.497
April	0.460
May	0.492
June	0.326
July	0.455
August	0.446
September	0.469
October	0.487
November	0.489
December	0.486

Note: 2001 WWTP effluent values (J. Davis, OMI, Inc., 2002)

4.3.1 Unit Hydrograph Computations

The Snyder Unit Hydrograph method was used to generate a flood hydrograph for each subbasin within HEC-HMS. A Snyder Peaking Coefficient (C_p) of 0.72 was applied to the model as it is similar to the use of a Cp640 coefficient of 460, and has been used regionally in hydrologic modeling (USACE, 1982). The Snyder's basin lag time factor (t_p, in hours) was calculated using basin topographic features, soil information and drainage information.

Snyder related unit hydrograph lag, t_p, to a catchment shape factor (C_t) or through the equation,

$$t_p = C_t (L * L_{ca})^{0.3}$$

where, C_t is the is a predictive equation parameter that does not vary greatly within a region, L is the length of the overall stream within the basin (in miles), and L_{ca} is the length from the centroid of the area or subarea to a point along the stream nearest the centroid (in miles) (USACE, 1994). The calculation of the Snyder Method Parameters is shown in Table 4.

Table 4

SNYDER METHOD PARAMETERS
Hydrologic Study of North Bosque River Study Area

		Subbasin/Catchment Identifier					
		Upper Watershed (USGS Gage 093700)	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**
Area	*sqft*	2,673,538,560	2,899,354	24,979,046	8,976,845	8,976,845	8,976,845
Area	*sq mi*	95.90	0.10	0.90	0.32	0.32	0.32
Ct	*coeff*	2	2	2	2	2	2
L	*mi*	15.5	0.44	1.55	1.34	1.19	1.19
L	*ft*	81,840	2,336	8,178	7,100	6,300	6,300
Lca	*mi*	3.1	0.1	0.78	0.47	0.53	0.71
Lca	*ft*	16,368	545	4,128	2,500	2,800	3,750
tp(1)	*hrs*	**6.39**	**0.79**	**2.12**	**1.75**	**1.74**	**1.9**
Cp	*coeff*	0.72	0.72	0.72	0.72	0.72	0.72

1. $t_p = C_t (L * L_{ca})^{0.3}$

4.3.2 Soil Information

According to the USDA's Soil Survey of Erath County, Texas, the soil association in the bottomlands of the project area is the Maloterre-Purves-Dugout, which is shallow to very shallow, stoney and gravelly soils over limestone (USGS, 1973). This soil type is in the Bunyan Series, a fine sandy loam that is deep, nearly level, moderately permeable, well, drained, and occasionally floods. Table 5 lists the soils found within the North Bosque River Study Area.

Table 5

NORTH BOSQUE RIVER STUDY AREA SOIL TYPES
Hydrologic Study of North Bosque River Study Area

Soil Name	Available Water Capacity (in/in)	Permeability (in/hr)	Estimated % of Watershed Area	Soil Description
Bunyan	0.13 - 0.15	0.63 - 2.0	90	Silt loam/loam
Duffau	0.10 - 0.14	2.0 - 6.3	10	Silt loam/loam
Purves	0.15 - 0.18	0.63 - 2.0	10	calcareous clayey soils
Bosque	0.15 - 0.17	0.63 - 2.0	10	Silt loam/loam
Bunyan	0.13 - 0.15	0.63 - 2.0	80	Silt loam/loam

4.3.3 Rainfall Loss

Rainfall losses occur within a watershed due to such factors as vegetation, landuse and soil–types, and are a function of rainfall frequency. Standardized loss rates for initial abstractions and hourly loss rates have been developed for clay and sand within the Dallas-Fort Worth area, by the USACE. Because the soils associated with the drainage area are mostly comprised of Frio silty clay loam and Bosque loam, the values for sand soil were applied to the North Bosque River Study Area HEC-HMS model and are listed in Table 6.

Table 6

STANDARDIZED LOSS RATES FOR SAND[1]
Hydrologic Study of North Bosque River Study Area

Annual Exceedance Probability	Initial Abstraction[2] (in)	Infiltration Rate[3] (in/hr)
100	1.75	0.23
50	1.95	0.27
20	2.10	0.30
10	2.10	0.30
4	1.65	0.21
2	1.25	0.14
1	0.90	0.10
0.2	0.60	0.08

Note: 1. Calibrated values were used (USACE, 2003)
2. HEC-HMS initial loss value.
3. HEC-HMS constant loss rate value.

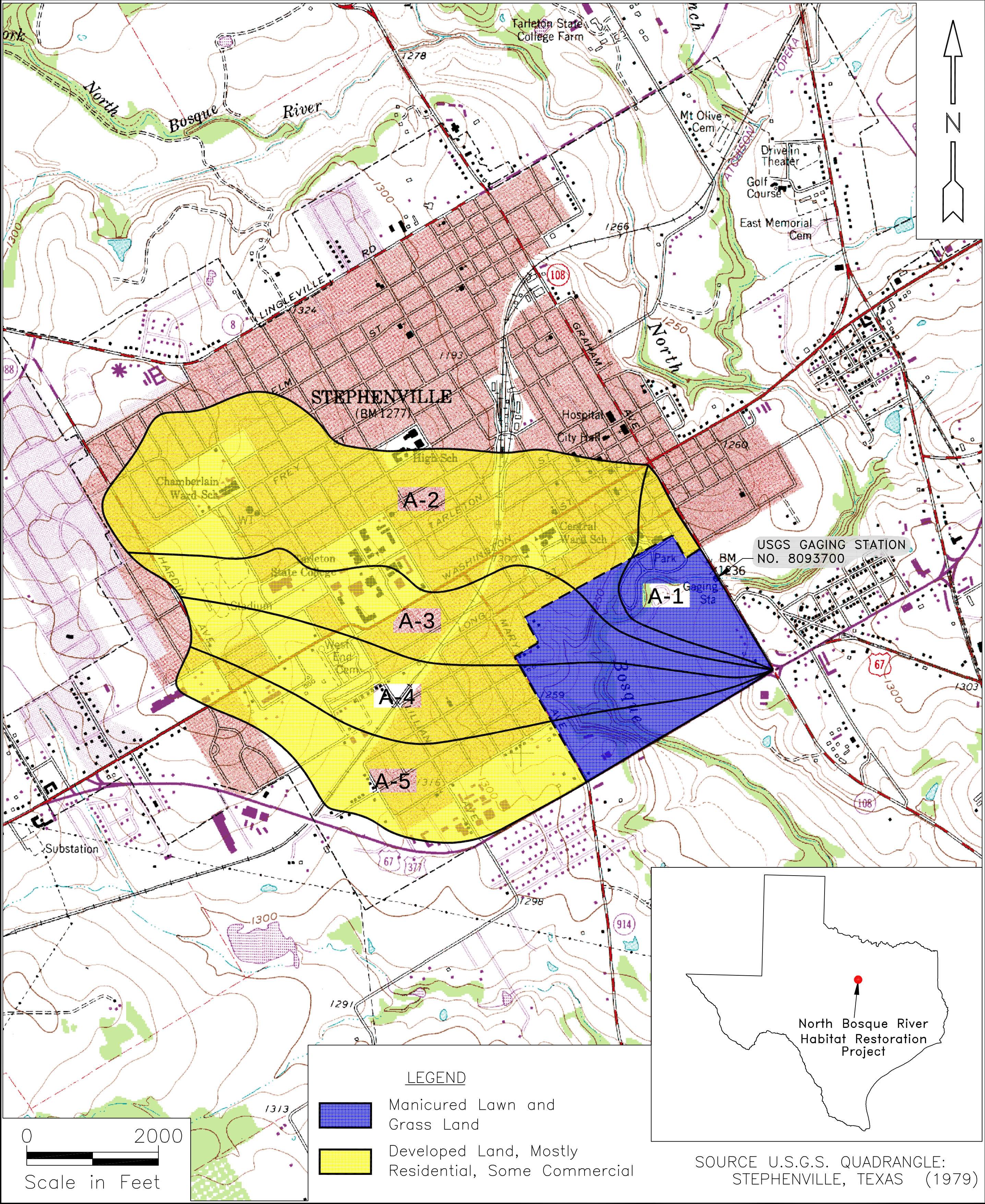
4.3.4 Imperviousness

Determination of imperviousness within the watershed was based upon field observation, aerial photographs, U.S. quadrangle maps and area land-use. Land-use types are outlined in Figure 4. Table 7 lists the percent imperviousness values, by subbasin area, used in the HEC-HMS model. Percent imperviousness values were modified during verification of the modeling results.

Table 7

SUBBASIN AREA IMPERVIOUSNESS VALUES
Hydrologic Study of North Bosque River Study Area

Subbasin Area	Imperviousness
Upper Watershed (USGS Gage 093700)	1 %
A-1	1 %
A-2	50 %
A-3 through A-5	10 %



SITE MANAGER: D. LINDSAY		TETRA TECH NUS, INC. Houston, Texas	FIGURE 4
CHECKED BY: D. LINDSAY			LAND USE MAP
DRAWN BY: J. FLESCH			FORT WORTH DISTRICT CORPS OF ENGINEERS
DATE: 07-03-03	SCALE: 1"=2000'		HYDROLOGIC STUDY NORTH BOSQUE RIVER
DWG. NO.: STEPH_SV4	PROJ. NO.: N7551.347D		STEPHENVILLE, TEXAS

4.4 Assumptions

Engineering judgement and various assumptions were used in the final determination and construction of the hydrologic model. These assumptions included:

1. Baseflow (influence of groundwater) was not included in the HEC-HMS model.
2. Watershed characteristics for the 95.9 mi^2 watershed above the study area were estimated from existing gage data and topographic mapping (e.g., reach length, gradient, land-use, etc.).
3. Topographic survey data were augmented with aerial photography and available information to obtain and/or estimate physical elements (i.e., land-use, elevations, etc.) within the model, and were assumed to be correct.
4. Imperviousness estimates and land-use types were based upon USGS topographic mapping and visual field observations.
5. General Manning roughness values were chosen based upon field observations, material and soil types, and noted vegetation types. In cases where information was not available, typical Manning values were used.

4.5 Sensitivity Analysis

A sensitivity analysis of the model was performed to evaluate the effect of altering various parameters within the model on the peak flow (Q) output. While holding all other parameters constant, maximum and minimum individual parameters were initially evaluated. Later, variations close to the expected and calculated site-specific values were also studied. The basin and reach parameters evaluated included: Snyder standard lag (tp), Snyder peaking coefficient (C_p), Muskingum-Cunge 8-Point Method energy slope, imperviousness associated with loss rate, abstraction and loss, infiltration, etc.

The parameter that most effected the resulting flow from the model was the standard lag (tp), and to a lesser degree, the parameters for peaking coefficient (C_p), abstraction and loss, Mannings number, and imperviousness. The variation of the Muskingum-Cunge 8 Point energy slope had a minimal effect on the model output results.

5.0 CONCLUSIONS

Results of the HEC-HMS hydrologic modeling for the North Bosque River at the Stephenville City Park are shown in Table 8. Detailed modeling output results are provided in Appendix B. The information from this modeling study will be used in further hydraulic analysis of the study area.

Table 8

SUMMARY OF HYDROLOGIC RESULTS
Hydrologic Study of North Bosque River Study Area

River	Location (River Station)	Subbasin Area	Drainage Area (mi^2)	Peak Discharge (cfs)[1]						
				2-year	5-year	10-year	25-year	50-year	100-year	500-year
North Bosque River	Upper Watershed above GS No. 8093700	Above Study Area	95.9	1,721	7,324	12,408	22,844	31,103	38,095	49,897
North Bosque River Study Area	Downstream of low-water road crossing (Sta. 2830)	A-1[2]	0.104	1,721	7,324	12,408	22,845	31,104	38,100	49,907
North Bosque River Study Area	At Stormwater Canal (Sta. 2529)	A-2	0.896	1,751	7,376	12,477	22,941	31,233	38,261	50,124
North Bosque River Study Area	Top of Reach, Inside Park, DS of Stormwater Canal (Sta. 1917)	A-4	0.322	1,753	7,381	12,484	22,953	31,256	38,298	50,179
North Bosque River Study Area	Midway of Reach, inside Park area (Sta. 998)	A-6	0.322	1,755	7,385	12,490	22,964	31,279	38,335	50,233
North Bosque River Study Area	Bottom of Study Reach, inside Park area (Sta. 345)	A-8	0.322	1,758	7,391	12,498	22,979	31,306	38,377	50,295

Note: 1. The Peak Discharge values include runoff from the individual subbasin drainage area and all upstream contributing areas.
2. Baseflow representing wastewater pumped from the WWTP (average of 0.3 cfs per day) to the Stephenville City Park is included in this value.

Although the resulting peak discharge values appear to be elevated, as compared to initial estimates (shown in Table 1), the results compare well with observed historical peak values and adequately represent the floodplain characteristics within the Stephenville City Park area.

6.0 REFERENCES

Engineering and Design, Flood-Runoff Analysis, US ACE, Engineering Manual,(EM) 1110-2-1417, 13 Aug 1994.

Five- to 60-Minute Precipitation Frequency for the Eastern and Central United States, NOAA Technical Memorandum NWS HYDRO-35, NOAA and NWS, Silver Spring, MD, June 1977.

Hydrologic Engineering Center, Hydrologic Modeling System (HEC-HMS) Computer Program, USACE, Hydrologic Engineering Center, version 2.1.3, Oct 2001.

Personal communication with City of Stephenville Waste Water Treatment Plant Operator, Johnny L. Davis, Project Manager, OMI, Inc., 2003.

Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Paper No. 40, D.M. Hershfeld, Cooperative Studies Section, U.S. Weather Bureau, Washington, DC, May 1961.

Site-Specific Estimation of Peak-Streamflow Frequency Using Generalized Least-Squares Regression for Natural Basins in Texas, U.S. Geological Survey Water Resources Investigations, Report 99-4172, Asquith, W.H., and Slade, R.M., 1999.

Soil Survey of Erath County, Texas, Soil Conservation Service (SCS), USDA, May 1980.

Standardized Loss Rates Table developed for NUDALLAS and SWFHYD programs, provided to TtNUS by USACE (Craig Lofton, 817-886-1683), 2003.

APPENDIX A

HEC-HMS SUPPORTING CALCULATIONS

Data Evaluation, North Bosque Watershed above USGS Gage Station No. 8093700

Figure A-1

ANNUAL PEAK STREAM FLOW DATA - USGS GAGE STATION NUMBER 8093700
Hydrologic Study of North Bosque River Study Area

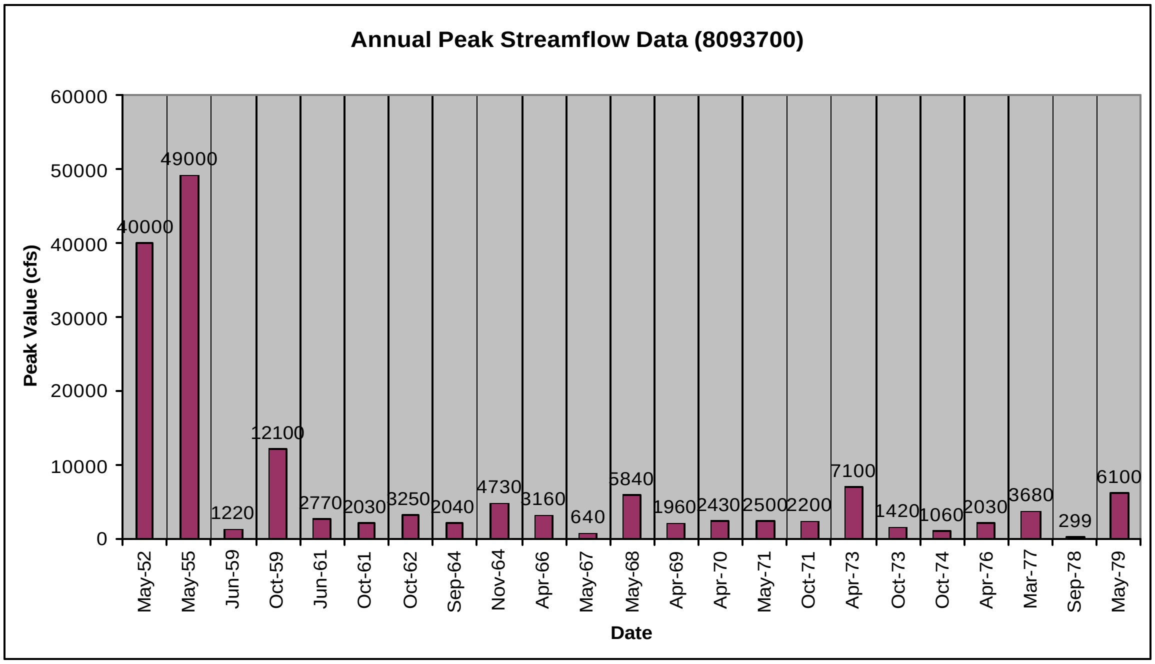


Figure A-2

AVERAGE MONTHLY FLOWS (CFS) - USGS GAGE STATION NUMBER 8093700
Hydrologic Study of North Bosque River Study Area

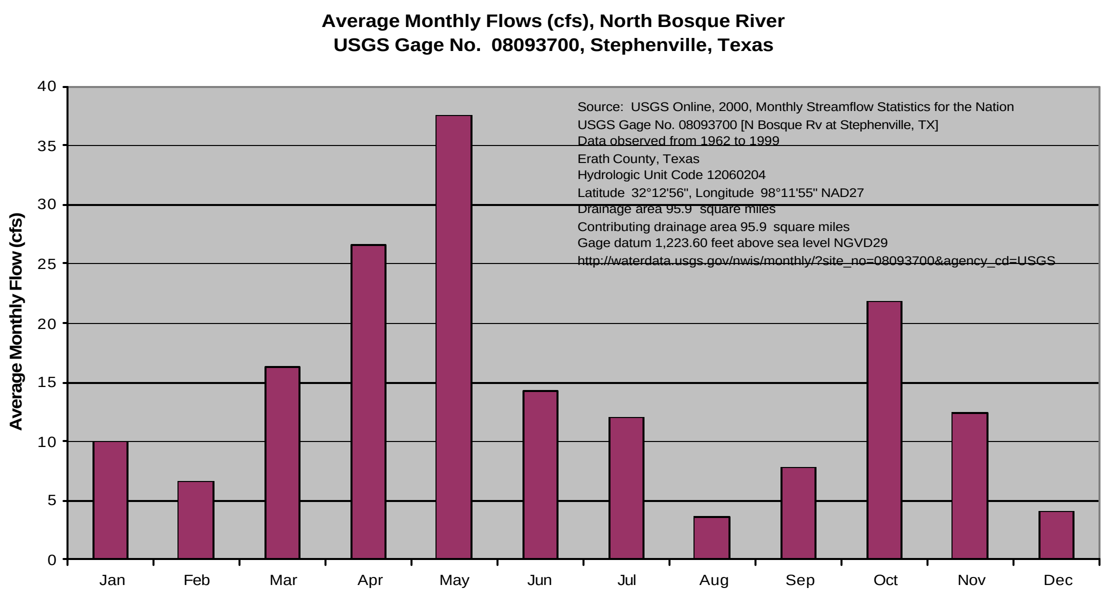
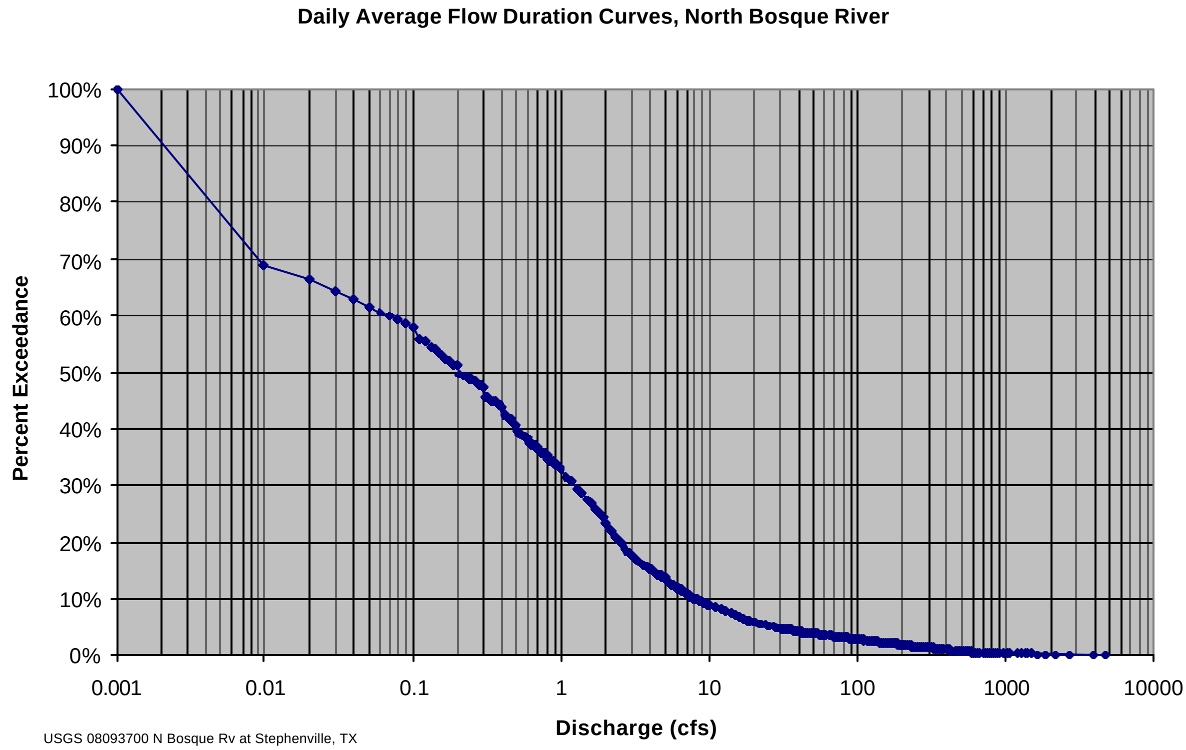


Figure A-3

DAILY AVERAGE FLOW DURATION CURVE - USGS GAGE STATION NUMBER 8093700
Hydrologic Study of North Bosque River Study Area



APPENDIX B

HYDROLOGIC COMPUTER RESULTS: HEC-HMS OUTPUT

APPENDIX C

DIGITAL HEC-HMS MODEL FILE

HYDRAULIC STUDY

FOR

NORTH BOSQUE RIVER STUDY AREA

In the City of Stephenville
Erath County, Texas

July 2003

Prepared for:

United States Army Corps of Engineers
Fort Worth District

Prepared by:

Tetra Tech, NUS, Inc.
Houston, Texas

Contract No. DAA63-97-D-0030
Delivery Order No. 0038

This document is for Interim Review Purpose only and not intended for Bidding, Permit or Construction

HYDRAULIC STUDY REPORT

North Bosque River Study Area, Erath County, Texas

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North Bosque River Study Area, Erath County, Texas

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ACRONYMS AND ABBREVIATIONS

cfs	cubic feet per second
ft	feet
HEC	Hydrologic Engineering Center
hr	hour
mi	mile
mi^2	square mile
min	minutes
PDA	Planning Design Analysis
Q	Total Flow
RAS	River Analysis System
sq ft.	square feet
sq mi.	square mile
USACE	United States Army Corps of Engineers

1.0 INTRODUCTION AND OBJECTIVES

The purpose of this hydraulic analysis is to support the Planning Design Analysis (PDA) level Section 206 Aquatic Restoration Project for Stephenville, Texas. The information herein will be used to assist in the formulation of the appropriate project alternative, while meeting overall project goals. This hydraulic analysis report describes the existing conditions of the North Bosque Creek stream reach within the Stephenville City Park, and evaluates the selected alternative to allow for stream restoration in the floodplain. The study reach area was modeled using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) River Analysis System (RAS) computer program (version 3.0.1, March 2001.

2.0 OBJECTIVES

The primary objectives of the hydraulic study are to provide a description of the existing conditions and the proposed project restoration plan alternative within the hydraulic study. The study goal is to provide a hydraulic design of the recommended restoration plan that does not negatively impact the Federal Emergency Management Administration (FEMA) National Flood Insurance Program (NFIP) base flood elevations, or any adjacent, non-project-area, floodplain property.

3.0 BACKGROUND INFORMATION

The project study area is located along the North Bosque River within the City of Stephenville, Erath County, Texas. Stephenville is located approximately 80 miles southwest of Fort Worth Texas. Stephenville is a livestock and farming community. Urban development and agricultural activities have encroached along both sides of the river causing some bank erosion and wildlife habitat fragmentation. The project study area is located in the Grand Prairie sub region of the North Central Plains geographic region of Texas. The North Bosque River is a tributary of the Brazos River. Erath County elevations range from 900 to 1,750 feet with gently rolling to nearly level slopes ranging from 0 to 2 percent. Generally, the Erath County is dry and warm with average temperatures ranging from a low of 34 degrees Fahrenheit (ºF) during January to 96 ºF in July. The average rainfall in Erath County is approximately 29 inches per year.

4.0 EXISTING CONDITIONS AND GENERAL STUDY INFORMATION

The project study area is located along the North Bosque River within the City of Stephenville, Erath County, Texas. Stephenville is a livestock and farming community located approximately 80 miles southwest of Fort Worth Texas (Figure 1). Figure 1 depicts the general project area, existing conditions and 100-year flood plain. Urban development and agricultural activities have encroached along both sides of the river causing some bank erosion and wildlife habitat fragmentation.

The proposed restoration area includes approximately 0.98 miles of the river within Stephenville City Park and 0.8 miles within the Stephenville Wastewater Treatment Plant (WWTP) area. This hydraulic study evaluated peak stream flow only within the 0.98 mile study area of the North Bosque River within the Stephenville City Park.

The water flow in the North Bosque River at the Stephenville City Park is augmented by water from the Stephenville WWTP. Treated effluent water is pumped from the Stephenville WWTP and introduced to the North Bosque River upstream on the study area. This additional flow has created a permanent source of flowing water to the river in the park area, however, the lack of stream bank vegetation has allowed erosion to occur. The majority of the bottomland plant community within the park area is disturbed and fragmented due primarily to park expansion and stream bank erosion. On average, approximately 0.3 million gallons per day (MGD) (0.47 cfs) if treated effluent is routed from the WWTP to the park. However, the permit held by the City allows for a total of 0.5 MGD (0.77 cfs), therefore, for hydrologic and hydraulic evaluation purposes the greater value (0.77 cfs) was used.

Existing modeling information was not available to define existing conditions, therefore, a model was developed using the USACE HEC-RAS modeling program. The model was based upon cross-section data taken from the topographic survey conducted at the site. The existing condition model extends from just downstream of the low water crossing in the Stephenville City Park to just upstream of the sanitary sewer pipeline crossing, north of Highway 67. Mannings roughness values were based upon field observations. The channel was well defined within the study area, although overbank erosion and undercutting was observed. Roughness values of 0.035 for the left and right overbanks and 0.030 for the channel were used in the model.

Existing condition flows were developed using the USACE HEC - Hydrologic Modeling System (HMS) computer program, version 2.1.3 (Oct 2001). Peak discharges for the 2-, 5-, 10-, 50-, 100-, and 500-year flood events were generated and are detailed under separate cover. Table 1 outlines the hydrologic study developed discharges used in this hydraulic study.

Table 1

NORTH BOSQUE RIVER PEAK DISCHARGES
Hydraulic Study of North Bosque River Study Area

River	Location (River Station)	Subbasin Area	Drainage Area (mi^2)	Peak Discharge (cfs)[1]						
				2-year	5-year	10-year	25-year	50-year	100-year	500-year
North Bosque River	Upper Watershed above GS No. 8093700	Above Study Area	95.9	1,721	7,324	12,408	22,844	31,103	38,095	49,897
North Bosque River Study Area	Downstream of low-water road crossing (Sta. 2830)	A-1[2]	0.104	1,721	7,324	12,408	22,845	31,104	38,100	49,907
North Bosque River Study Area	At Stormwater Canal (Sta. 2529)	A-2	0.896	1,751	7,376	12,477	22,941	31,233	38,261	50,124
North Bosque River Study Area	Top of Reach, Inside Park, DS of Stormwater Canal (Sta. 1917)	A-4	0.322	1,753	7,381	12,484	22,953	31,256	38,298	50,179
North Bosque River Study Area	Midway of Reach, inside Park area (Sta. 998)	A-6	0.322	1,755	7,385	12,490	22,964	31,279	38,335	50,233
North Bosque River Study Area	Bottom of Study Reach, inside Park area (Sta. 345)	A-8	0.322	1,758	7,391	12,498	22,979	31,306	38,377	50,295

Note: 1. The Peak Discharge value includes runoff from the individual subbasin drainage area and all upstream contributing areas.
2. Baseflow representing wastewater pumped from the WWTP (average of 0.3 cfs per day) to the Stephenville City Park is included in this value.

5.0 ALTERNATIVES

Two areas were analyzed as potential future pool locations. The pools include the addition of cross vane structures. In addition, various riffle areas were also evaluated. The pool area excavations were modeled in such a way as to add or maintain storage area in the flood plain (e.g., maintain water surface profile as close to existing as possible), and offset loss of flood plain area due to the cross vane and riffle placement. In addition slope stabilization (in the form of cutting back of the overbanks) in two locations was evaluated and included in the model. Placement of energy dissipating structures (root wads) at the juncture of the storm water canal and the North Bosque River in the northern end of the study area was also evaluated.

5.1 North Bosque River Recommended Alternative

The recommended alternative incorporates the construction of two ponds and multiple riffle sequences within the reach study area. Table 2, below, lists the effects on the water surface profile of the recommended alternative compared to of the existing condition water surface elevations. The proposed project features have no significant impact on the Federal Emergency Management Administration's (FEMA's) National Flood Insurance Program base flood elevations, or on adjacent, non-project-area, floodplain properties. Additional flood studies, including the City of Stephenville Stormwater Master Plan, was not available at the time of this study, therefore, a zero rise in the water surface profile within the model area was adopted as the goal in determining the success of the proposed alternative.

In this alternative, cross vanes will be installed to help in the formation of scour pools over a period of time. These pools are referred to as Ponds P-1 and P-2 (at proposed station locations of 2013 and 587, respectively) in Figure 2. Excess soil excavated during the installation of cross vanes and from slope stabilization activities will be recycled in backfill areas (i.e. banks)

Table 2
North Bosque River Recommended Alternative Water Surface Comparison Table

Reach	River Station	Profile	Q Total (cfs)	Existing W.S. Elev (ft)	Recommended Alternative W.S. Elev (ft)	Difference W.S. Elev (ft)
Upper	3001	1 Percent	38095	1245.63	1245.68	0.050
Upper	2869	1 Percent	38100	1245.6	1245.66	0.060
Upper	2764.87*	1 Percent	38100	1245.05	1245.15	0.100
Upper	2700	1 Percent	38100	1242.73	1242.73	0.000
Upper	2633	1 Percent	38100	1242.93	1243.15	0.220
Upper	2489	1 Percent	38261	1243.95	1244.01	0.060
Upper	2088	1 Percent	38298	1243.79	1243.82	0.030
	2012.79				1243.73	
Upper	1944	1 Percent	38298	1243.62	1243.64	0.020
Upper	1936	1 Percent	38298	1243.61	1243.63	0.020
Upper	1704	1 Percent	38298	1243.3	1243.32	0.020
Upper	1509	1 Percent	38298	1243.62	1243.63	0.010
Upper	1169	1 Percent	38335	1243.38	1243.43	0.050
Upper	814	1 Percent	38335	1242.67	1242.79	0.120
					1242.55	
Upper	572	1 Percent	38335	1242.53	1242.53	0.000
Upper	516	1 Percent	38377	1242.84	1242.84	0.000
Upper	493	1 Percent	38377	1242.79	1242.79	0.000
Upper	269	1 Percent	38377	1241.82	1241.82	0.000
Upper	171	1 Percent	38377	1242.2	1242.2	0.000

Figure 2 also outlines the locations of each of the new elements, as well as the proposed location of the new riffle areas (at proposed station locations 2800, 2677, 1380, 1204, 924, and 706) along the study reach, and are listed in Table 3.

Variations of the recommended alternative were modeled result in a zero rise in the water surface profile over the entire reach length. Small rises were noted in localized areas near the energy dissipation structures and cross vane structures, however, overall a zero elevation in water surface was achieved.

Table 3
Existing Conditions and Proposed Structures

Proposed River Station Location	Structure	Existing Condition	Status
2800	Riffle	Veg & Stone	Existing
2677	BR + Riffle	Veg & Stone	Existing
2589	Root Wad	Veg & Stone	Proposed
2549	Root Wad	Logs	Proposed
2509	Root Wad	Logs	Proposed
2479	Root Wad	Logs	Proposed
2013	CV - Pool	Stones	Proposed
1380	Riffle	Vegetation	Proposed
1204	Riffle	Vegetation	Proposed
924	Riffle	Vegetation	Proposed
706	Riffle	Vegetation	Proposed
587	CV - Pool	Vegetation	Proposed

6.0 CONCLUSIONS

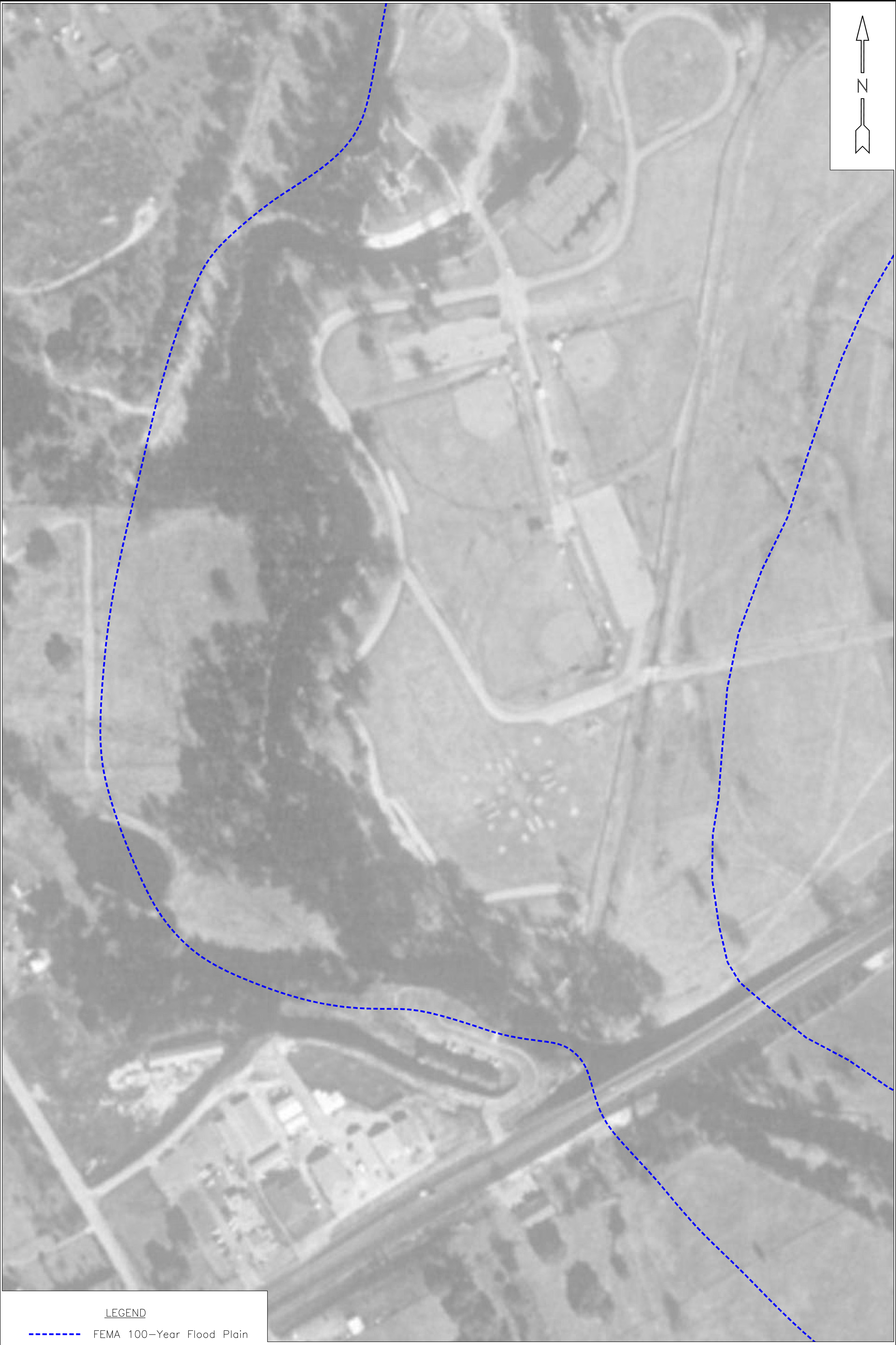
The recommended plan succeeds in producing a feasible restoration option within the study reach length without causing adverse effects to the water surface profile, outside of the Stephenville City Park area. The proposed project features have no significant impact on the FEMA National Flood Insurance Program base flood elevations, or on adjacent, non-project-area, floodplain properties. Reassessment of this study may become necessary should additional flood plain information become available (i.e., City of Stephenville Stormwater Master Plan or other flood plain studies).

7. REFERENCES

U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) River Analysis System (RAS) computer program (version 3.0.1, March 2001)

Engineering and Design, Flood-Runoff Analysis, USACE, Engineering Manual,(EM) 1110-2-1417, 13 Aug 1994.

Hydrologic Engineering Center, River Analysis System (HEC-RAS) Computer Program, USACE, Hydrologic Engineering Center.



Source: 1991 FEMA Insurance Rate Maps.

0 200
Scale in Feet

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 11-11-04	SCALE: 1"=200'
DWG. NO.: Park_aerial3	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 1
100-YEAR FLOOD BOUNDARY
CITY PARK
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 11-11-04	SCALE: 1"=200'
DWG. NO.: Park_aerial4	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 2
RECOMMENDED RESTORATION PLAN
CITY PARK
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

Source: 1991 FEMA Insurance Rate Maps.

0 300
Scale in Feet

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 11-11-04	SCALE: 1"=300'
DWG. NO.: WWTP_aerial3	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 3
100-YEAR FLOOD BOUNDARY
WWTP
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 - HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 11-11-04	SCALE: 1"=300'
DWG. NO.: WWTP_aerial4	PROJ. NO.: N7551.347D

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 4
RECOMMENDED RESTORATION PLAN
WWTP
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 – HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

APPENDIX A

HYDRAULIC COMPUTER MODELING RESULTS

COMPARISON TABLE

EXISTING STORAGE RATING CURVE

EXISTING STANDARD TABLE 1

PROPOSED STORAGE RATING CURVE

PROPOSED STANDARD TABLE 1

APPENDIX H

REAL ESTATE PLAN

REAL ESTATE PLAN

NORTH BOSQUE RIVER AQUATIC ECOSYSTEM RESTORATION PROJECT
STEPHENVILLE, ERATH COUNTY, TEXAS

DATE OF REPORT

JUNE 10, 2005

PREPARED BY

U.S. ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

This Real Estate Plan has been prepared in accordance with ER 405-1-12 dated 1 May 1998.

PREPARED BY:

____

Thurman A. Schweitzer
Realty Specialist
Fort Worth District, Corps of Engineers
Real Estate Division, Technical Resources Branch

RECOMMENDED BY:

____

Rocky D. Lee, MAI, SRA
Lead Realty Specialist
Fort Worth District, Corps of Engineers
Real Estate Division, Technical Resources Branch

TABLE OF CONTENTS

Real Estate Plan: North Bosque River Aquatic Ecosystem Restoration Project, Stephenville, Erath County, Texas

1. PURPOSE

This Real Estate Plan has been prepared in support of the feasibility study and describes the lands, easements, and right of way (LER) required for the aquatic ecosystem restoration of the North Bosque River in the City of Stephenville, Texas. All project lands will be acquired by the sponsor, the City of Stephenville, Texas. Authority for the project is Section 206 of the Water Resources Development Act of 1996, as amended, which authorizes the Secretary of the Army to carry out projects for aquatic ecosystem restoration and protection.

The project is located within the City of Stephenville along the North Bosque River in the Stephenville City Park and the Stephenville Wastewater Treatment Plant. Federal interest in this project involves approximately 0.9 miles within the park and 0.8 miles within the Wastewater Treatment area.

The benefits of this project would include, but not be limited to:

- re-establishment of the riparian corridor
- restoration of in-stream habitat
- creation of emergent wetland habitat
- installation of recreational facilities
- water quality improvement
- possible ecological learning opportunities

2. LAND, EASEMENT, AND RIGHT-OF-WAY FOR THE RECOMMENDED PLAN

Fee Land	66.04 acres

The 66.04 acres required for the project belongs to the City of Stephenville.

3. COST SHARE OF PROJECT

ESTATE	ESTIMATED VALUE
Fee Land	$ 300,000
Relocation of Facilities	$ - 0 -
Minerals	$ - 0 -
Severance Damage	$ - 0 -
Contingencies @ 10%	$ 30,000
Total	$ 330,000

The cost-share for this restoration project is: Federal 65% and Local Sponsor 35%.

4. NON-STANDARD ESTATES

There are no non-standard estates associated with this project.

5. EXISTING FEDERAL PROJECT

There is no existing Federal project that lies fully or partially within the project area.

6. FEDERALLY OWNED LAND

There is no federally owned land associated with this project.

7. NAVIGATIONAL SERVITUDE

The North Bosque River is not a navigational stream/river. Therefore, navigation servitude is not applicable.

8. PROJECT AREA

The project area consists of approximately 66.04 acres located along the North Bosque River in Stephenville, Texas. The project is located entirely within the 100-year floodplain.

9. FLOODING OF PROJECT AREA

There will be no flooding to private property caused by the construction and maintenance of the aquatic restoration project.

10. BASELINE COST ESTIMATE FOR REAL ESTATE

Property values included in the cost estimate are based on a Gross Appraisal, dated October 29, 2004, prepared by Randy Roberts, and approved by Rocky Lee, MAI, SRA, of the Real Estate Division of the Fort Worth District. The Fort Worth District, Technical Resources Branch, staff estimated administrative cost. Contingencies have been added to the estimates as follows:

01.23.03.01 Real Estate Payment Documents, 10% based on reasonable certainty of costs.

01.23.03.02 RE Acquisition Documents, 10% based on reasonable certainty of contract costs.

01.23.03.15 RE Payment Documents, 10% based on reasonable certainty of costs.

01.23.03.16 Real Estate LERRD Accounting Documents, 10% based on reasonable certainty regarding accounting requirements.

Estimates are presented in the standard Code of Accounts from MCACES Model Database, October 1994. Costs are presented as follows:

Account	Description	Estimate	Contingency
01.23.03.01	RE Payment Documents	$ 2,500	$ 250
01.23.03.02	RE Acquisition Documents		
	City Prepared Documents	$ 5,000	$ 500
	Corps Review	$ 1,000	$ 100
01.23.03.15	RE Payment Documents		
	Credit for Land	$300,000	$30,000
01.23.03.17	RE LERRD Accounting Documents		
	Appraisal by Sponsor	$ 5,000	$ 500
	Review of Sponsor	$ 3,000	$ 300
	TOTAL ADMIN & PAYMENT	$316,500	
	TOTAL CONTINGENCY		$31,650
	GRAND TOTAL	**$348,150**	

11. RELOCATION ASSISTANCE PROGRAM P.L. 91-646

There are no individuals, farms, or businesses to be relocated in conjunction with this project.

12. MINERAL AND TIMBER ACTIVITY

There is no evidence of mineral exploration or production activity on the project site. The City of Stephenville Zoning Ordinance will not allow mineral exploration or timber activity within the city limits.

13. COST SHARED PROJECT

The City of Stephenville owns the land in fee, and there is no requirement for condemnation authority or quick-take capability.

14. ENACTMENT OF ZONING ORDINANCES

There are no special Zoning Ordinances proposed for enactment with the project.

15. LAND ACQUISITION

There is no additional land that will be acquired for the project. The land is owned by the City of Stephenville in fee, therefore inclusion of a detailed acquisition schedule isn't deemed necessary. Approximately 60 days will be required from the date the PCA is executed to the advertisement of a construction contract. The 60 day period will allow the City to provide proof of title and grant the government right of entry for construction, as well as afford Corps legal counsel to prepare an Opinion of Compensability.

16. FACILITY OR UTILITY RELOCATIONS

There are no, known facility or utility relocations associated with this project.

17. CONTAMINANTS ON REAL ESTATE ACQUISITIONS

The Planning, Environmental, and Regulatory Division of the Fort Worth District have verified that there are no known HTRW lands in the project area or adjacent areas.

18. OPPOSITION BY LANDOWNERS IN PROJECT AREA

As the soul land owner and proposed Non-Federal Cost Share Partner, the City of Stephenville has been completely supportive of the project. No landowners in the surrounding area have come forward to give positive or negative responses concerning this project.

19. LAND ACQUISITION PRIOR TO PCA

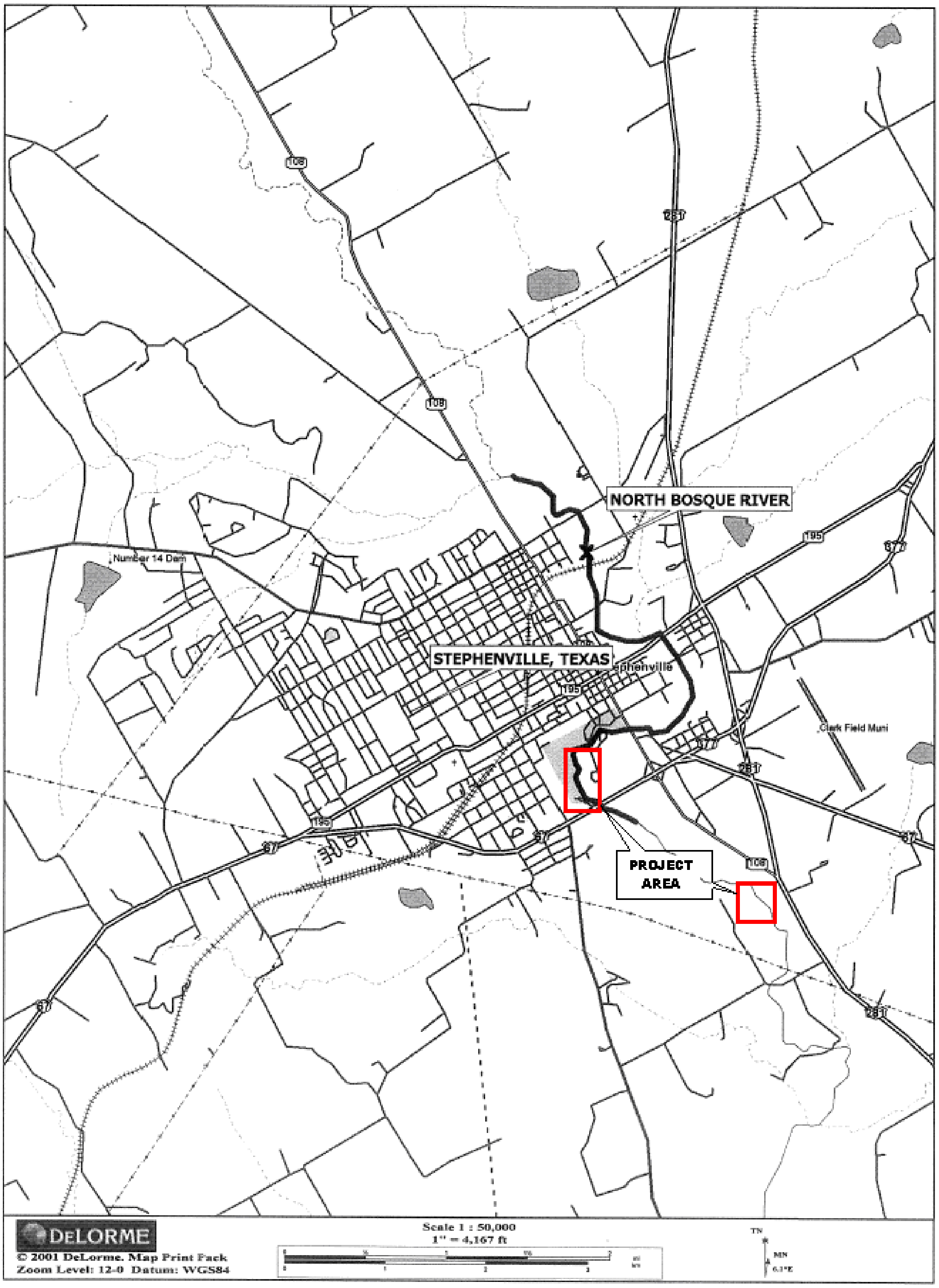
There are no lands to be acquired for this project. Should additional land be necessary for the project, the sponsor will be notified in writing to not acquire the land prior to signing the PCA.

20. RELEVANT ISSUES

There are no real estate issues relevant to planning, designing, or implementing this project. Since there will be no acquisition of land for the project, the

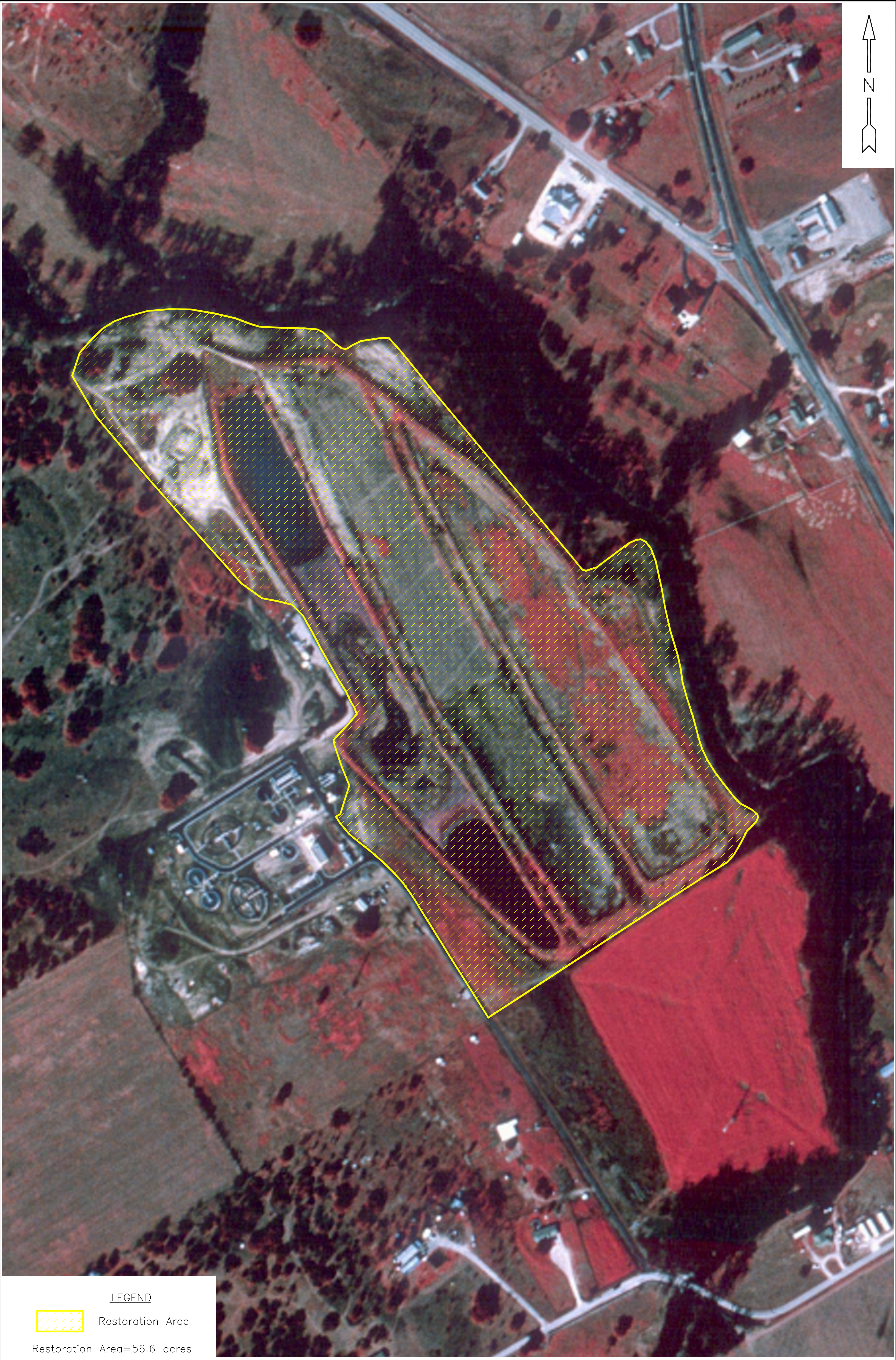
Assessment of Non-Federal Sponsor’s Real Estate Acquisition capability will be accomplished.

Real Estate Plan: North Bosque River Aquatic Ecosystem Restoration Project, Stephenville, Erath County, Texas



Map of Project Area

SITE MANAGER: D. LINDSAY		TETRA TECH NUS, INC. Houston, Texas	FIGURE 1 REAL ESTATE MAP CITY PARK FORT WORTH DISTRICT CORPS OF ENGINEERS SECTION 206 – HABITAT RESTORATION PROJECT NORTH BOSQUE RIVER STEPHENVILLE, TEXAS
CHECKED BY: L. BOWIE			
DRAWN BY: J. FLESCH			
DATE: 07-26-05	SCALE: 1"=200'		
DWG. NO.: Park_aerial2	PROJ. NO.: 112GN2196		



LEGEND

Restoration Area

Restoration Area=56.6 acres

0 300

Scale in Feet

SITE MANAGER: D. LINDSAY	
CHECKED BY: L. BOWIE	
DRAWN BY: J. FLESCH	
DATE: 07-26-05	SCALE: 1"=300'
DWG. NO.: WWTP_aerial2	PROJ. NO.: 112GN2196

TETRA TECH NUS, INC.
Houston, Texas

FIGURE 2
REAL ESTATE MAP
WWTP
FORT WORTH DISTRICT CORPS OF ENGINEERS
SECTION 206 - HABITAT RESTORATION PROJECT
NORTH BOSQUE RIVER
STEPHENVILLE, TEXAS

APPENDIX I

PROJECT COOPERATION AGREEMENT
AND
LETTER OF INTENT

PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
CITY OF STEPHENVILLE, TEXAS
FOR THE
STEPHENVILLE SECTION 206
AQUATIC ECOSYSTEM RESTORATION PROJECT

THIS AGREEMENT is entered into this _________ day of ______________, 20__, by and between the Department of the Army (hereinafter the "Government"), represented by the U.S. Army Engineer for the Fort Worth District (hereinafter the "District Engineer") and the City of Stephenville, Texas (hereinafter the "Non-Federal Sponsor"), represented by the Mayor, City of Stephenville.

WITNESSETH, THAT:

WHEREAS, this Project is authorized by Section 206 of the Water Resources Development Act of 1996, Public Law 104-303, as amended;

WHEREAS, Section 206 of the Water Resources Development Act of 1996, Public Law 104-303, as amended, authorizes the Secretary of the Army to carry out an aquatic ecosystem restoration and protection project if the Secretary determines that the project will improve the quality of the environment, is in the public interest, and is cost-effective;

WHEREAS, the Government and the Non-Federal Sponsor desire to enter into a Project Cooperation Agreement for implementation of the Stephenville Section 206 Restoration (hereinafter the "Project", as defined in Article I.A. of this Agreement);

WHEREAS, Section 206(b) of the Water Resources Development Act of 1996, Public Law 104-303, as amended, specifies the cost-sharing requirements applicable to this Project;

WHEREAS, Section 206(c) of the Water Resources Development Act of 1996, Public Law 104-303, as amended, provides that the Secretary of the Army shall not commence construction of any project, or separable element thereof, under the Section 206 authority, until each non-Federal sponsor has entered into a binding agreement to pay the non-Federal share of the costs of construction required by Section 206(b) and to pay 100 percent of any operation, maintenance, replacement, and rehabilitation costs with respect to the project in accordance with regulations prescribed by the Secretary;

WHEREAS, the Non-Federal Sponsor desires to perform certain work (hereinafter the "work-in-kind", as defined in Article I.L. of this Agreement) which is a part of the Project;

WHEREAS, the Government and Non-Federal Sponsor have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the implementation of the Project in accordance with the terms of this Agreement.

NOW, THEREFORE, the Government and the Non-Federal Sponsor agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Project" shall mean in-stream aquatic, wetland, and riparian corridor restoration measures within the Stephenville City Park and Waste Water Treatment Plant study areas located along the North Bosque River; specific restoration activities within the Stephenville City Park study area include the planting of high quality native terrestrial and aquatic vegetation, installation of native stone weirs and river substrate to create pool and riffle complexes, and river bank stabilization along the North Bosque River; specific restoration activities within the Stephenville Waste Water Treatment Plant study area include conversion of a sludge drying bed complex to high quality emergent wetland habitat, construction of an operations and maintenance access trail adjacent to the emergent wetland complex, and planting of high quality native terrestrial and aquatic vegetation within and adjacent to the wetland complex. The project when completed would create approximately 45.1 acres of emergent wetland complex, provide 5.8 acres of water quality and in-stream aquatic habitat benefits and reforest approximately 18.4 acres of riparian woodland habitat as generally described in **[the final DPR report; expect signature by SWF-DE in approx September 2005]**, dated ______________, 20___, and approved by the District Engineer, on ______________, 20___. The Project includes the work-in-kind described in Article I.L. of this Agreement.

B. The term "total project costs" shall mean all costs incurred by the Non-Federal Sponsor and the Government in accordance with the terms of this Agreement directly related to implementation of the Project. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to, feasibility phase planning costs; all engineering and design costs, including those incurred in the feasibility phase; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; the costs incurred by the Government for clean-up and response in accordance with Article XV.C. of this Agreement; costs of historic preservation activities in accordance with Article XVIII.A. of this Agreement; actual implementation costs; the credit amount for the work-in-kind performed by the Non-Federal Sponsor in accordance with Article II.D.4. of this Agreement; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; and costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

C. The term "financial obligation for implementation" shall mean a financial obligation of the Government or a financial obligation of the Non-Federal Sponsor for work-in-kind, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project costs.

D. The term "implementation" shall mean all actions required to carry out the Project.

E. The term "non-Federal proportionate share" shall mean the ratio of the Non-Federal Sponsor's total cash contribution required in accordance with Article II.D.2. of this Agreement to total financial obligations for implementation as projected by the Government.

F. The term "period of implementation" shall mean the time from the effective date of this Agreement to the date that the District Engineer notifies the Non-Federal Sponsor in writing of the Government's determination that implementation of the Project is complete.

G. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

H. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

I. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

J. The term "functional portion of the Project" shall mean a portion of the Project that is suitable for tender to the Non-Federal Sponsor to operate and maintain in advance of completion of the entire Project. For a portion of the Project to be suitable for tender, the District Engineer must notify the Non-Federal Sponsor in writing of the Government's determination that the portion of the Project is complete and can function independently and for a useful purpose, although the balance of the Project is not complete.

K. The term "betterment" shall mean a change in the design and construction of an element of the Project resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

L. The term "work-in-kind" shall mean light clearing and grubbing of existing vegetation within the existing sludge drying lagoon complex prior to soil excavation work; removal of miscellaneous debris and existing concrete gates/water control structures within the sludge drying lagoon complex; stripping of approximately six inches of the existing organic soil layer within the sludge drying lagoon complex and stockpiling on site; and excavation and placement of soil within the sludge drying lagoon complex to design specifications for wetland slope, islands, berms, and scour holes, as approved by the District Engineer in **[the final DPR report; expect signature in approx September 2005 by SWF-DE]** dated ___________, 20__. The work-in-kind includes implementation of the authorized improvements as well as planning, engineering, design, supervision and administration, and other activities associated with implementation, but does not include the implementation of betterments or the provision of lands, easements, rights-of-way, relocations, or suitable borrow and dredged or excavated material disposal areas associated with the work-in-kind.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSOR

A. The Government, subject to the availability of funds and using those funds and funds provided by the Non-Federal Sponsor, shall expeditiously implement the Project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the Non-Federal Sponsor the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. The Government shall not issue the solicitation for the first contract for implementation until the Non-Federal Sponsor has confirmed in writing its willingness to proceed with the Project. To the extent possible, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsor with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsor, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. Throughout the period of implementation, the District Engineer shall furnish the Non-Federal Sponsor with a copy of the Government's Written Notice of Acceptance of Completed Work for each contract for the Project.

B. The Non-Federal Sponsor may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

C. When the District Engineer determines that the entire Project is complete or that a portion of the Project has become a functional portion of the Project, the District Engineer shall so notify the Non-Federal Sponsor in writing and furnish the Non-Federal Sponsor with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") and with copies of all of the Government's Written Notices of Acceptance of Completed Work for all contracts for the Project or the functional portion of the Project that have not been provided previously. Upon such notification, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project in accordance with Article VIII of this Agreement.

D. The Non-Federal Sponsor shall contribute 35 percent of total project costs in accordance with the provisions of this paragraph.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsor shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsor must provide for the implementation, operation, and maintenance of the Project, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the implementation, operation, and maintenance of the Project.

2. If the Government projects that the value of the Non-Federal Sponsor's contributions under paragraph D.1. of this Article and Articles V, X, and XV.A. of this Agreement will be less than 35 percent of total project costs, the Non-Federal Sponsor shall provide an additional cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsor's total contribution equal to 35 percent of total project costs.

3. If the Government determines that the value of the Non-Federal Sponsor's contributions provided under paragraphs D.1. and D.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 35 percent of total project costs, the Government, subject

to the availability of funds, shall reimburse the Non-Federal Sponsor for any such value in excess of 35 percent of total project costs. After such a determination, the Government, in its sole discretion, may provide any remaining Project lands, easements, rights-of-way, and suitable borrow and dredged excavated material disposal areas and perform any remaining Project relocations on behalf of the Non-Federal Sponsor. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

4. The Government has determined that the work-in-kind is compatible with the Project and has approved a credit in the estimated amount of $487,253 for implementation of such work by the Non-Federal Sponsor. The affording of such credit shall be subject to an on-site inspection by the Government to verify that the work was accomplished in a satisfactory manner and is suitable for inclusion in the Project. The actual amount of credit shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. To afford such credit, the Government shall apply the credit amount toward any additional cash contribution required under paragraph D.2. of this Article. The Non-Federal Sponsor shall not receive credit for any amount in excess of such additional cash contribution, nor shall the Non-Federal Sponsor be entitled to any reimbursement for any excess credit amount. In no event shall the Non-Federal Sponsor perform work-in-kind that would result in either the credit afforded under this paragraph exceeding 100 percent of the Non-Federal Sponsor’s share of total project costs or the credit afforded under this paragraph, plus the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement, exceeding 35 percent of total project costs.

E. The Non-Federal Sponsor may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the Non-Federal Sponsor. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

F. The Government shall perform a final accounting in accordance with Article VI.D. of this Agreement to determine the contributions provided by the Non-Federal Sponsor in accordance with paragraphs B., D., and E. of this Article and Articles V, X, and XV.A. of this Agreement and to determine whether the Non-Federal Sponsor has met its obligations under paragraphs B., D., and E. of this Article.

G. The Non-Federal Sponsor shall not use Federal funds to meet its share of total project costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

H. Crediting and/or reimbursement is subject to satisfactory compliance with applicable Federal labor laws covering non-Federal construction, including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq*.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq*.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)). Crediting and/or reimbursement may be withheld, in whole or in part, as a result of the Non-Federal Sponsor's failure to comply with its obligations under these laws.

ARTICLE III - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, after consultation with the Non-Federal Sponsor, shall determine the lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsor must provide, in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. Prior to the end of the period of implementation, the Non-Federal Sponsor shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the Non-Federal Sponsor shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsor must provide for that contract. The Non-Federal Sponsor shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project and that were provided by the Non-Federal Sponsor are retained in public ownership for uses compatible with the authorized purposes of the Project.

B. The Government, after consultation with the Non-Federal Sponsor, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the implementation, operation, and maintenance of the Project. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with construction of such improvements. Prior to the end of the period of implementation, the Non-Federal Sponsor shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsor, shall determine the relocations necessary for the implementation, operation, and maintenance of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with such relocations. Prior to the end of the period of implementation, the Non-Federal Sponsor shall perform or ensure the performance of all relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsor in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs, and afford credit for such value toward the Non-Federal Sponsor's share of total project costs.

E. The Non-Federal Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsor shall receive credit toward its share of total project costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article III of this Agreement, and for the value of the relocations that the Non-Federal Sponsor must perform or for which it must ensure performance pursuant to Article III of this Agreement. However, the Non-Federal Sponsor shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project. The Non-Federal Sponsor also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsor provides the Government with authorization for entry thereto. However, for lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement that are required for the construction of the work-in-kind, fair market value shall be the value of such real property interests as of the date the Non-Federal Sponsor awards the first construction contract for the work-in-kind, or, if the Non-Federal Sponsor performs the implementation with its own labor, the date that the Non-Federal Sponsor begins implementation of the work-in-kind. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsor shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal

Sponsor and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsor's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's appraisal, the Non-Federal Sponsor may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsor's second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's second appraisal, or the Non-Federal Sponsor chooses not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsor. In the event the Non-Federal Sponsor does not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsor, shall consider the Government's and the Non-Federal Sponsor's appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsor for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsor, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsor, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsor, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsor shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsor shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsor shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsor agree as to an appropriate amount, then the Non-Federal Sponsor shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsor cannot agree as to an appropriate amount, then the Non-Federal Sponsor may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the implementation, operation, and maintenance of the Project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsor within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. After consultation with the Non-Federal Sponsor, the Government shall determine the value of relocations in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard that the State of Texas would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

4. Any credit afforded for the value of relocations performed within the Project boundaries is subject to satisfactory compliance with applicable Federal labor laws covering non-Federal construction, including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq*.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq*.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)). Crediting may be withheld, in whole or in part, as a result of the Non-Federal Sponsor's failure to comply with its obligations under these laws.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsor and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of implementation. The Government's Project Manager and a counterpart named by the Non-Federal Sponsor shall co-chair the Project Coordination Team.

B. The Government's Project Manager and the Non-Federal Sponsor's counterpart shall keep the Project Coordination Team informed of the progress of implementation and of significant pending issues and actions, and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of implementation, the Project Coordination Team shall generally oversee the Project, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; contract costs; the application of and compliance with 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq*.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq*.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)) for relocations and the construction portion of the non-Federal work-in-kind; the Government's cost projections; final inspection of the entire Project or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters.

D. The Project Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Coordination Team. The Government, having the legal authority and responsibility for implementation of the Project, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations.

E. The costs of participation in the Project Coordination Team shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs and costs due to betterments. At least quarterly, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project costs, of total costs due to betterments, of the components of total project costs, of each party's share of total project costs, of the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, and of the non-Federal proportionate share. On the effective date of this Agreement, total project costs are projected to be $2,378,295, and the Non-Federal Sponsor's cash contribution required under Article II.D. of this Agreement is projected to be $832,403. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor.

B. The Non-Federal Sponsor shall provide the cash contribution required under Article II.D.2. of this Agreement in accordance with the following provisions: Not less than 30 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and the funds the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, determines to be required from the Non-Federal Sponsor to meet its projected cash contribution under Article II.D.2. of this Agreement. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED FORT WORTH" to the District Engineer, or verifying to the satisfaction of the Government that the Non-Federal Sponsor has deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsor, or presenting the Government with an irrevocable letter of credit acceptable to the Government for the required funds, or providing an Electronic Funds Transfer of the required funds in accordance with procedures established by the Government. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for implementation incurred prior to commencement of the period of implementation; and (b) the non-Federal proportionate share of financial obligations for implementation as they are incurred during the period of implementation. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet the Non-Federal Sponsor's cash contribution, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required and provide an explanation of why additional funds are required. Within 60 calendar days after receipt of such notice, the Non-Federal Sponsor shall provide the Government with the full amount of the additional required funds through any of the payment mechanisms specified above.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.B. or II.E. of this Agreement, the Non-Federal Sponsor shall provide the Government with the full amount of the funds required to pay for such additional work through any of the payment mechanisms specified in B. of this Article. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet its cash contribution, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required and provide an explanation of why additional funds are required. Within 30 calendar days from receipt of such notice, the Non-Federal Sponsor shall provide the Government with the full amount of the additional required funds through any of the payment mechanisms specified in B. of this Article.

D. Upon completion of the Project or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the Non-Federal Sponsor with the results of the final accounting. The final accounting shall determine total project costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to betterments and the Non-Federal Sponsor's cash contribution provided pursuant to Article II.B. of this Agreement.

1. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor is less than its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the Non-Federal Sponsor shall, no later than 90 calendar days after receipt of written notice, make a payment to the Government of whatever sum is required to meet the Non-Federal Sponsor's required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement by delivering a check payable to "FAO, USAED, FORT WORTH" to the District Engineer or providing an Electronic Funds Transfer in accordance with procedures established by the Government.

2. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor exceeds its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsor no later than 90 calendar days after the final accounting is complete. In the event existing funds are not available to refund the excess to the Non-Federal Sponsor, the Government shall seek such appropriations as are necessary to make the refund.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

A. Upon notification in accordance with Article II.C. of this Agreement and for so long as the Project remains authorized, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XI of this Agreement and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto.

B. The Non-Federal Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Non-Federal Sponsor for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsor. If, after 30 calendar days from receipt of the notice, the Non-Federal Sponsor continues to fail to perform, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property the Non-Federal Sponsor owns or controls for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsor's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX – HOLD AND SAVE

The Non-Federal Sponsor shall hold and save the Government free from all damages arising from the implementation, operation, maintenance, repair, replacement and rehabilitation of the Project, and any Project related betterments, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 60 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of implementation and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsor is responsible for complying with the Single Audit Act Amendments of 1996, 31 USC Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-133 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsor and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsor and independent auditors any information necessary to enable an audit of the Non-Federal Sponsor's activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-133, and such costs as are allocated to the Project shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsor is required to conduct under the Single Audit

Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq*.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq*.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsor fails to fulfill its obligations under Article II.B., II.D., II.E., VI, or XVIII.C. of this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If appropriations are not available in amounts sufficient to meet the Government's share of Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsor in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsor elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of any obligation previously incurred. Any delinquent payment owed by the Non-Federal Sponsor shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsor shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsor determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project, except for any such lands that the Government determines to be subject to the navigation servitude. For lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsor or the Government for such investigations for hazardous substances shall be included in total project costs and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way, that the Government determines, pursuant to Article III of this Agreement, the Non-Federal Sponsor must provide for the implementation, operation, and maintenance of the Project, the Non-Federal Sponsor and the Government shall provide prompt written notice to each other, and the Non-Federal Sponsor shall not proceed with the acquisition of the real property interests until both parties agree that the Non-Federal Sponsor should proceed.

C. The Government and the Non-Federal Sponsor shall determine whether to initiate implementation of the Project, or, if already in implementation, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project. Should the Government and the Non-Federal Sponsor determine to initiate or continue with implementation after considering any liability that may arise under CERCLA, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination on lands, easements or rights of way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project, except for any such lands, easements, or rights-of-way owned by the United States and administered by the Government. Such costs shall not be considered a part of total project costs. In the event the Non-Federal Sponsor fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsor's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project. The Government shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination on lands, easements, or rights of way owned by the United States and administered by the Government. All costs incurred by the Government shall be included in total project costs and cost shared in accordance with the terms of this Agreement.

D. The Non-Federal Sponsor and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary cleanup and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally, or by telegram, or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsor:

City of Stephenville
298 West Washington
Stephenville, Texas 76401-4257

If to the Government:

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

B. Pursuant to Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project costs, up to the statutory limit of one percent of the total amount the Government is authorized to expend for the Project.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs and shall be cost shared in accordance with the provisions of this Agreement.

ARTICLE XIX - LIMITATION ON GOVERNMENT EXPENDITURES

Notwithstanding any other provisions of this Agreement, the Government's financial participation in the Project is limited to $5,000,000. The Non-Federal Sponsor shall be responsible for all total project costs that exceed this amount. In lieu of further construction of the Project at the Non-Federal Sponsor's expense, the Government shall, at the request of the Non-Federal Sponsor suspend construction or terminate this Agreement in accordance with Article XIV.B. of this Agreement. To provide for this eventuality, the Government may reserve a percentage of total Federal funds available for the Project and an equal percentage of the total funds contributed by the Non-Federal Sponsor in accordance with Article II.D. of this Agreement as a contingency to pay costs of termination, including any costs of contract claims and contract modifications.

DEPARTMENT OF THE ARMY	CITY OF STEPHENVILLE, TEXAS
BY:____________________________	BY:____________________________
JOHN R. MINAHAN Colonel, Corps of Engineers District Engineer Fort Worth District	RUSSELL E. JERGINS Mayor, City of Stephenville, Texas
DATE:__________________________	DATE:__________________________

CERTIFICATE OF AUTHORITY

I, ___________________, do hereby certify that I am the principal legal officer of the City of Stephenville, Texas, that the City of Stephenville, Texas is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Stephenville, Texas in connection with the Stephenville Section 206 Aquatic Ecosystem Restoration, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, and that the persons who have executed this Agreement on behalf of the City of Stephenville, Texas have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this _______ day of _______, 20__.

____
Randy Thomas
City Attorney

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

____

Russell E. Jergins,
Mayor

DATE: ______________________________

LIST OF DEVIATIONS
TO
STEPHENVILLE SECTION 206
AQUATIC ECOSYSTEM RESTORATION
PCA MODEL
ERATH COUNTY, TEXAS

1. None

CERTIFICATION OF LEGAL REVIEW

The Project Cooperation Agreement (PCA) for the Stephenville Section 206 Restoration Project has been fully reviewed by the Office of Counsel, USAED, Fort Worth District, Fort Worth, Texas, and contains no deviations from the PCA model agreement.

____
Office of Counsel

DATE:_____________________

APPENDIX J

PERTINENT CORRESPONDENCE

Brazos River Authority

QUALITY • CONSERVATION • SERVICE

September 28, 2001

Mr. William Fickel, Jr.
Chief, CESWF-PER
U.S. Army Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Mr. Fickel:

Per your request the Brazos River Authority has reviewed the U.S Army Corps of Engineers' Preliminary Restoration Plan (PRP) for the North Bosque River Aquatic Ecosystem Restoration project located in Stephenville, Texas. The Authority supports the Corp of Engineers and City of Stephenville in the development and completion of this project.

The proposed aquatic restoration project will provide improved habitats for a diverse assemblage of aquatic and terrestrial species through the creation of a wetland complex and reforestation of erosion prone riparian corridors, promote environmental learning opportunities for local students and citizens, and will work to improve water quality in the North Bosque River and Lake Waco.

The Authority appreciates the opportunity to review the project proposal and look forward to assisting the Corps of Engineers during the project planning process. If you have any questions feel free to contact David Collinsworth, Central Basin Environmental Planner, of my staff at (254) 776-9648, extension 238.

Sincerely,

JOHN BAKER
Central Basin Manager

JB:dc
:x:\david\stehenville_ltr..doc

4400 Cobbs Drive • P.O. Box 7555 • Waco, Texas 76714-7555
254-776-1441 • FAX 254-772-5780

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF:

July 20, 2000

Environmental, Planning, and Regulatory Division

Ms. Gayle Haecker
Brazos River Authority
6600 Sanger Avenue, Suite 11
P.O. Box 7555
Waco, TX 76714-7555

Dear Ms. Haecker:

The Fort Worth District, U.S. Army Corps of Engineers (USACE) is proposing an aquatic ecosystem restoration project along the North Bosque River located in Stephenville, Texas. Wetland, grassland, and high quality bottomland hardwoods have steadily declined due primarily to continued development along the North Bosque River. The majority of the grassland and bottomland plant communities within the study area are highly disturbed and fragmented due primarily to agricultural and urban development. Likewise, nutrient and sediment loads from dairy operation run-off, clearing of floodways, and alterations to natural water flow have caused in-stream aquatic habitat and water quality to decline in the North Bosque River.

The proposed aquatic restoration project would involve restoration/creation of 41.0 acres of emergent wetland habitat, 6.0 acres of in-stream aquatic habitat, and 41.0 acres of riparian corridor habitat that have degraded along the North Bosque River. The first restoration measure would consist of converting a sludge drying bed complex, located at the Stephenville Wastewater Treatment Plant (WWTP), into an emergent wetland complex that would directly benefit resident wildlife, waterfowl, a migratory bird species. A gravity-flow water reuse system would be used to provide a permanent water supply to the wetland complex. Following construction, communities of emergent and submersed native aquatic plants would be established throughout the wetland complex. Wood duck boxes would also be placed throughout the wetland and within the adjacent riparian corridor. The second restoration measure would include the installation of native stone weirs and substrate to create pool-riffle-run complexes along the North Bosque River within the Stephenville City Park. Restoration would also involve the use a stream bank stabilization measures at various locations within the park to reduce erosion and bank sloughing along the river. The third restoration measure would include the planting of high quality native trees, shrubs, and grasses in the riparian corridor of the North Bosque River at both the city park and WWTP sites. Plantings would consist of bare root seedlings and/or container trees that include bur oak and pecan. Fruit-bearing shrubs and trees would also be planted and include

Chickasaw plum, sand plum, and red mulberry. Plant species that can remain permanently saturated in water, such as the water willow, southern wild rice, and common reedgrass would also be planted along riverbank and wetland shoreline areas.

Enclosed is a copy of the draft Preliminary Restoration Plan (PRP) for your review and comment. The draft PRP is currently undergoing an internal technical review within the District as well as review by the City of Meridian and U.S. Fish and Wildlife Service. The USACE would appreciate a letter of support from the Brazos River Authority to accompany the PRP prior to Division review. Following acceptance of the PRP by our higher authority, and based upon availability of funds, a Planning and Design Analysis (PDA) study will be initiated in the next phase of the project. The purpose of the PDA will be to further refine the costs, benefits, and plans for the proposed project. Any questions can be directed to Mr. Jeff Tripe at (817) 978-6392 or Jeffry.A.Tripe@SWF.USACE.Army.mil.

Sincerely,

William Fickel, Jr.
Chief, Environmental, Planning, and Regulatory Division

Enclosures

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF:

July 20, 2000

Environmental, Planning, and Regulatory Division

Ms. Carol Hale
U.S. Fish and Wildlife Service
Ecological Services
711 Stadium Drive, Suite 252
Arlington, TX 76011

Dear Ms. Hale:

The Fort Worth District, U.S. Army Corps of Engineers (USACE) is proposing an aquatic ecosystem restoration project along the North Bosque River located in Stephenville, Texas. Wetland, grassland, and high quality bottomland hardwoods have steadily declined due primarily to continued development along the North Bosque River. The majority of the grassland and bottomland plant communities within the study area are highly disturbed and fragmented due primarily to agricultural and urban development. Likewise, nutrient and sediment loads from dairy operation run-off, clearing of floodways, and alterations to natural water flow have caused in-stream aquatic habitat and water quality to decline in the North Bosque River.

The proposed aquatic restoration project would involve restoration/creation of 41.0 acres of emergent wetland habitat, 6.0 acres of in-stream aquatic habitat, and 41.0 acres of riparian corridor habitat that have degraded along the North Bosque River. The first restoration measure would consist of converting a sludge drying bed complex, located at the Stephenville Wastewater Treatment Plant (WWTP), into an emergent wetland complex that would directly benefit resident wildlife, waterfowl, a migratory bird species. A gravity-flow water reuse system would be used to provide a permanent water supply to the wetland complex. Following construction, communities of emergent and submersed native aquatic plants would be established throughout the wetland complex. Wood duck boxes would also be placed throughout the wetland and within the adjacent riparian corridor. The second restoration measure would include the installation of native stone weirs and substrate to create pool-riffle-run complexes along the North Bosque River at the Stephenville City Park site. Restoration would also involve the use a stream bank stabilization measures at various locations along the river to reduce erosion and bank sloughing. The third restoration measure would include the planting of high quality native trees, shrubs, and grasses in the riparian corridor of the North Bosque River at both the city park and WWTP sites. Plantings would consist of bare root seedlings and/or container trees that include bur oak and pecan. Fruit-bearing shrubs and trees would also be planted and include Chickasaw plum, sand plum, and red mulberry. Plant species that can remain permanently saturated in water, such as the water willow, southern wild rice, and common reedgrass would also be planted along riverbank and wetland shoreline areas.

Enclosed is a copy of the draft Preliminary Restoration Plan (PRP) for your review and comment. The draft PRP is currently undergoing an internal technical review within the District as well as review by the City of Meridian and Brazos River Authority. The USACE would appreciate a letter of support from the U.S. Fish and Wildlife Service to accompany the PRP prior to Division review. Following acceptance of the PRP by our higher authority, and based upon availability of funds, a Planning and Design Analysis (PDA) study will be initiated in the next phase of the project. The purpose of the PDA will be to further refine the costs, benefits, and plans for the proposed project. Any questions can be directed to Mr. Jeff Tripe at (817) 978-6392 or Jeffry.A.Tripe@SWF.USACE.Army.mil.

Sincerely,

William Fickel, Jr.

William Fickel, Jr.
Chief, Environmental, Planning, and Regulatory Division

Enclosures

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF

July 20, 2001

Planning, Environmental, and Regulatory Division

Mr. Mark Kizer
City of Stephenville
298 W. Washington
Stephenville, TX 76401-4257

Dear Mr. Kizer:

The Fort Worth District, U.S. Army Corps of Engineers has completed the draft Preliminary Restoration Plan (PRP) for the North Bosque River Aquatic Ecosystem Restoration project located in Stephenville, Texas. The proposed project would restore approximately 41.0 acres of natural riparian corridor habitat, 41.0 acres of emergent wetland habitat, and 6.0 acres of in-stream aquatic habitat along the North Bosque River. Specific restoration activities would include the planting of high quality native terrestrial and aquatic vegetation, installation of native stone weirs and river substrate to create pool and riffle complexes, river bank stabilization within the Stephenville City Park, conversion of a sludge drying bed complex to high quality emergent wetland habitat, and construction of a hike and bike trail adjacent to the emergent wetland complex. Enclosed are three copies of the draft PRP for your review and comment. The draft PRP is currently undergoing an internal technical review within the District as well as review by the U.S. Fish and Wildlife Service and Brazos River Authority.

In order to proceed with the feasibility study, a letter of intent must be received from the City of Stephenville. The letter should state that the draft PRP has been reviewed and that the City of Stephenville supports the recommended plan. Further, it should state that the City of Stephenville intends to fulfill the responsibilities of the non-Federal sponsor during project implementation, including project cost sharing. For your convenience I have included a draft example of a letter of intent. I request a letter stating your position on the PRP by August 1, 2001.

Following acceptance of the letter of intent and PRP by our higher authority, and based upon availability of funds, a Planning and Design Analysis (PDA) phase will be initiated at full Federal expense. The purpose of the PDA will be to further refine the costs, benefits, and plans for the proposed project. Upon the initiation of the final phase of the PDA study, the City of Stephenville will be asked to sign a Project Cooperation Agreement (PCA). The project sponsor is at no obligation to cost share funds until the PCA is signed. Once the PCA is signed, the project sponsor is obligated to cost share project PDA and implementation costs. A copy of a model PCA for the Section 206 Program is included for your review.

Members of the study team are available to meet with you at any time to discuss the PRP and the recommended plan. On behalf of the Fort Worth District, I look forward to working with the City of Stephenville on the development and implementation of the North Bosque River Aquatic Ecosystem Restoration project. If you have any questions, please contact the technical manager, Mr. Jeff Tripe at (817) 978-6392, or Jeffry.A.Tripe@swf.usace.army.mil.

Sincerely,

William Fickel, Jr.
Chief, Environmental Planning and Regulatory Division

Enclosures