APPENDIX B

CIVIL DESIGN

INTRODUCTION

The Oxbow area extends approximately 5000 linear feet between Riverside Drive and Beach Street along the West Fork of the Trinity River. The original river in the oxbow area was realigned by the construction of the existing improved channel. This left the original river oxbow without a source of low flow recharge. The improved channel bottom is approximately 15 feet lower than the original river bottom. The improved channel is approximately 350 feet wide. The old original river was approximately 150 feet wide. Restoration of the old river oxbow will include construction of drainage structures to allow water from the improved channel to recharge the oxbow. In addition, construction of several wetland areas in and around the oxbow area is proposed, with lift stations to provide a constant water supply. Access facilities will be provided for both public and maintenance purposes, including parking areas and comfort stations. The proposed recreation features include hard and soft surfaced trails and overlook areas. The existing channel will be widened to provide hydraulic mitigation for the proposed tree plantings.

DESIGN ASSUMPTIONS

In order to compute quantity takeoffs for the various plan alternatives in the Riverside Oxbow project area, the existing topographical maps completed by Greenehorne and O'Mara were used to create triangulated surfaces that could be used to determine volume quantities. These existing maps were created from aerial photography flown in 1991 and the CADD maps completed in 1993. The maps consist of two-foot contours with various spot elevations, which were used to create a triangulated model. Since the completion of these maps the existing conditions within this project area have changed along the flood control channel banks and levees. The remaining areas have also been altered to some degree; however, the mapping is adequate for providing estimated quantities for cost estimating purposes.

ENVIRONMENTAL RESTORATION FEATURES

Existing Conditions

The old oxbow river channel is currently cut off from the improved river channel and has no source of water recharge. The only known existing wetland features in the area are northeast of the oxbow and east of Gateway Park around the old water treatment plant. To the south of the river channel is an environmentally unique area known as Tandy Hills, which has been degraded through erosion and introduction of invading species of vegetation.

Proposed Improvements

Both the locally preferred plan (LPP) and the NER plan would provide for excavation to reconnect the old oxbow and the existing channel to allow recharging of the old oxbow riverbed. Both plans would include a low water dam in the downstream end of the old oxbow. The proposed plan includes construction of three wetland facilities. A wetland complex will be constructed within the interior of the oxbow, including a lift station for water supply, which will cover approximately 19 acres. The existing wetland on the northeast side of the oxbow will be expanded an additional 2.4 acres. A wetland complex, with lift station, approximately 25 acres in size will be created at the site of the old water treatment plant to the east of Gateway Park. Building a depressed benched area into the channel excavation for the hydraulic mitigation will create approximately 1 acre of wetland area. Approximately 115 acres of the Tandy Hills area will receive selective clearing of invading species of vegetation and will be fenced to discourage vehicular access.

RECREATION FEATURES

Existing Conditions

The existing recreation feature within the project site consists of Gateway Park, which is located to the east of the old oxbow riverbed. The park contains typical features, such as access roads, parking areas, ball fields, picnic tables and an overlook area by the existing channel.

Proposed Improvements

The proposed recreation features include the parking and access roads described above, comfort stations at two of the parking areas, and three overlook areas (for the LPP only) at the proposed wetlands. In addition, the recommended plan contains 8,967 linear feet of 10-foot wide concrete trail. Approximately 7,667 linear feet of the concrete trail would double as maintenance access. The access roads described above are also bordered with concrete sidewalks. Approximately 10,781 linear feet of gravel nature trail and 7,519 linear feet of equestrian trail are included in the recommended plan.

MAINTENANCE FEATURES

Existing Conditions

The existing oxbow region is primarily undeveloped with limited access along the channel.

Proposed Improvements

The proposed plan includes construction of approximately 10,781 linear feet of gravel maintenance access road along the old riverbank. A portion of the concrete trail will also serve to provide maintenance access. Concrete access ramps are proposed at the upstream end and the midpoint of the oxbow. Lift stations and outlet control structures on the wetlands will allow for control of the water levels to promote management of wetland vegetation. Post and cable fencing is proposed around the Tandy Hills area to discourage vehicular traffic from entering the area.

ROADS AND BRIDGES

Existing Conditions

The existing channel crosses two roads within the project area. Beginning on the upstream end, the channel crosses the southbound and northbound bridges for Riverside Drive, and then crosses the Beach Street Bridge on the downstream end of the oxbow area (see STRUCTURAL section for a more detailed description).

Southbound Riverside Drive Bridge – This concrete bridge is 292' -5" long, 40' wide and has a 30-degree skew. The bridge is approximately 50' high at center.

Northbound Riverside Drive Bridge – This concrete bridge is 338'-10" long and 45'-8" wide, with no skew. The bridge is approximately 50' high at center and has two horizontal, to one vertical, paved header slopes.

Beach Street Bridge – This concrete bridge is located just south of I-30 and is approximately 475' long, 41'-4" wide and has an approximate 25-degree skew. The bridge is approximately 50' high.

Beach Street Culvert Crossing - The concrete culvert, located where the old channel in the oxbow crosses Beach Street, is approximately 12' in diameter and 245' long.

Proposed Improvements

A new access road and parking facility is proposed off of Riverside Drive into an area just west of the old oxbow. A new access road and parking facility is proposed off of Beach Street into the interior of the old oxbow area. The proposed plan will include replacing the existing Beach Street culvert crossing with a new 115-foot long concrete bridge. A new access road is proposed off of Beach Street into Gateway Park (LPP only). A new parking facility is proposed in the Tandy Hills area (LPP only). A new 103-foot long concrete bridge is proposed where the new Gateway Park entrance will cross the oxbow (LPP only). One new concrete bridge, 113-foot long, is proposed to span the improved oxbow connection to the existing channel.

UTILITIES

Existing Conditions

Water: Existing water lines on the project include a 48-inch concrete water line and a 42-inch concrete water line on Beach Street. A 12-inch concrete water pipe is located on Riverside Drive.

Sanitary Sewer: Existing sanitary sewer lines include a 72-inch sewer line on the north side of the old river channel and an 84- and 60-inch sewer line along the

improved channel. The 84-inch sewer line extends along the north side of the channel and the 72-inch sewer line extends along the south side. In addition, an inverted siphon consisting of a 39- and 54-inch pipe, and a 48-inch inverted siphon crosses the channel. An 84-inch aerial sewer line crosses the old river channel.

Storm Drains: There are no known storm drains in the area.

Natural Gas: There are no known gas lines in the area.

Electric: A large TXU electrical transmission line crosses the southeast quadrant of the oxbow area with four-legged steel support towers spaced approximately 500' apart. In addition, aerial electric distribution lines parallel the Riverside and Beach right of ways. The distribution lines are 3-phase, 12.5 kv and single-phase 12.5 kv, respectively.

Fiber Optic: No existing fiber optic lines are known to exist in the area.

Telephone: Existing telephone facilities are assumed to follow the existing roads in this area.

Petroleum: A 14-inch diameter carbon steel Koch Petroleum pipeline parallels Sycamore Creek, then runs east along the south side of the West Fork past Beach Street then turns north, crossing the improved river channel and the old river channel, then turns east and follows the TXU electric transmission alignment described above. The pipeline carries jet fuel, gasoline, etc.

Proposed Improvements

A length of 1100 linear feet of 60-inch diameter sanitary sewer is proposed for relocation where the existing channel will be widened for hydraulic mitigation. New buried power lines will be provided to the light poles in the proposed parking facilities. The comfort stations will also receive power for lights.

STRUCTURAL DESIGN

EXISTING CONDITIONS

General – There are three bridges, one culvert and a low water dam located in the study area. One of the bridges is for the southbound lane of Riverside Drive where it crosses over the main channel and the second one is for the northbound lane of Riverside Drive. The third bridge is at Beach Street where it crosses over the main channel. There is a culvert where Beach Street crosses over the old channel in the oxbow. The low water dam is located downstream of Beach Street.

Southbound Riverside Drive Bridge – This is the old original bridge over the main channel that consists of five spans totaling 292 feet with a 40-foot wide concrete deck. The concrete abutments for the two end spans are parallel to the channel and are supported by pre-cast concrete piles that extend down to elevation 486. The concrete piers that support the end spans and the three interior spans are supported on timber piles that extend down to elevation 460 and are skewed 30-degrees to the channel. The end spans are concrete pan girders with an average length on the centerline of 33.5 feet. The three interior spans are continuous steel plate girders of 64.5, 96 and 64.5 feet long. The bridge is approximately 50-feet high at the center.

Northbound Riverside Drive Bridge – This is a newer bridge, that was added later, that consists of three spans totaling 333-feet with a 36-foot wide concrete deck. This bridge is not skewed with respect to the channel. The concrete abutments supported by drilled shafts are founded at elevation 425 on the north end and elevation 443 on the south end. Drilled shafts, founded at elevation 425, support the two concrete interior bents. The three spans are continuous steel plate girders 89.75, 153.5 and 89.75 feet long. The bridge is approximately 50-feet high at the center.

Beach Street Bridge – This bridge consists of seven steel beam spans totaling approximately 475-feet long and has a concrete deck that is approximately 50-feet wide. The concrete bents each have four circular columns. The bridge is approximately 50-feet high at the center.

Beach Street Culvert – The concrete culvert located where the old channel in the oxbow crosses Beach Street is approximately 12-feet in diameter and 245 feet long.

Beach Street Low Water Dam – The Low Water Dam consists of a roller compacted concrete weir with the top of the weir at Elev. 494.5 and the bottom at Elev. 475. The top of the weir is 17.7' x 244' with an upstream slope of 1.5:1 and a downstream slope of 3:1. There are fifty 24" x 18 " oval shaped corrugated metal spillway pipes that are uncontrolled through the weir with their inverts at Elev. 492. There are three, 36-inch diameter pipes with invert at Elev. 480 controlled by three, 36" butterfly valves in a valve house within the

weir with top at Elev. 492. There is a plunge pool on the on the downstream side that is 32' x 143' with the floor at Elev. 476. and end sill at Elev. 480.

DESCRIPTION OF PROPOSED STRUCTURES

Beach Street Bridge – The bridge for Beach Street over the Oxbow will replace the existing 245' long by 12' diameter conduit. The bridge will be 80' wide, having five traffic lanes and one 5' wide pedestrian walk on the East side and 10'wide hike and bike trail on the West side. The bridge will have a single span with a total length of 115' consisting of Type IV prestressed concrete beams supported on concrete abutments that have 36-inch diameter drilled shafts founded at elevation 452. The bridge is designed for an AASHTO HS 20-44 Loading. (Both NER and LLP Plans)

Levee Bridge at Upstream End of Oxbow – This bridge will have a 24' roadway and will be 113'-3" long with a single span consisting of prestressed concrete type IV beams supported on concrete abutments that have 36-inch diameter drilled shafts The bridge is designed for an AASHTO HS 20-44 loading. (Both NER and LPP Plans)

Gateway Park Entrance Bridge - This bridge will have a 24' roadway and a 5' wide sidewalk on one side and a 10' wide hike and bike trail on the other side. The bridge will be 103'-4" long with a single span consisting of prestressed concrete type IV beams supported on concrete abutments that have 36-inch diameter drilled shafts. The bridge is designed for an AASHTO HS 20-44 loading. (LPP Plan only)

Wetland Pump Stations –There are three wetland pump structures. The concrete sump for the pump systems will consists of 10'x 10' reinforced pre-cast concrete box culvert sections with pre-cast reinforced concrete tops. The pre-cast box culvert sections and pre-cast tops will be designed for an AASHTO HS 20-44 load and applicable soil and water loads. (Both NER and LPP plans)

DESIGN CRITERIA REFERENCES

General

Allowable stresses, loading conditions, design assumptions and other criteria were based on applicable parts of the following references unless otherwise noted.

1 Engineering and Design; Strength Design for Reinforced Concrete Structures, EM 1110-2-2104, June 30, 1992.

2 Building Code Requirements for Reinforced Concrete, ACI 318-02.

3 Engineering and Design; Retaining and Flood Walls, EM 1110-2-2502, September 29, 1989.

4 Engineering and Design; Retaining and Flood Walls, ETL 1110-2-322, October 15, 1990.

5 Engineering and Design; Structural Design of Concrete Lined Flood Control Channels, EM 1110-2-2007, April 30, 1995.

6 American Association of State Highway and Transportation Officials – Standard
Specifications for Highway Bridges.

DESIGN DATA

Unit Loads

Concrete	150 PCF
Water	62.5 PCF

Reinforced Concrete Properties

Concrete	f 'c = 3000 PSI
	3600 psi (bridge abutments)
	4000 psi (bridge slabs)
Reinforcing Steel	fy = 60000 PSI

Uplift

Hydrostatic uplift pressure is assumed to act over 100 % of the base of the structures. The drainage system is assumed to be effective in reducing the hydrostatic head by 50%.

Bridge Design Loads

Vehicular bridges will be designed for an HS 20-44 live load in accordance with AASHTO.

Pedestrian bridges will be designed for 85-psf live load in accordance with AASHTO.

Geotechnical Data for Structures

Bridges - The proposed bridge structures should be supported on reinforced concrete straight-shaft drilled piers. Based on preliminary subsurface information, the piers should be founded 60 or 70 feet below ground surface depending on location. At this time, an allowable end bearing capacity of 30,000 psf (net) should not be exceeded when sizing the pier shafts. The piers can be sized for both end bearing and skin friction if additional load-carrying capacity is required. For this phase of design, an allowable side

shear value of 650 psf can be used over the effective embedment length of the pier. The effective length (L_{eff}) starts 10 feet below ground surface and extends to within one shaft diameter of the final bearing depth. All pier shafts should be a minimum of 18 inches in diameter and reinforced with a minimum of 1% reinforcing steel. The load used to size the piers should consist of full dead load plus that portion of the live load that acts more or less continuously, usually 50%.

Small Support-type Structures - Small support-type structures can be supported on reinforced concrete slabs-on-grade with turned-down edge beams. The turned-down edge beam should extend a minimum of 12 inches below outside finished grade, and can be sized for a safe bearing pressure of 2,000 psf (net). Interior beams should be spaced on (maximum) 15-foot centers. Subgrade preparation should consist of providing a minimum of 36 inches of compacted nonexpansive fill below the soil-supported slab.

Below-Grade Structures. The following information is provided for the design of all below-grade structures, if applicable. All structures should be designed for at-rest conditions using a lateral earth pressure coefficient (k_o) equal to 0.7. In addition, an allowable bearing capacity of 1,500 psf and a cohesion value (c) of 100 psf should be used. All backfill should be nonexpansive material and can be assumed to have a moist unit weight of 125 pcf.